KOPPERS

Interoffice Correspondence

To Mr. Paul Guth

Location Northwest Plant

Subject Samples

From Environmental Health & Safety Section

Location Monroeville Research Center

Date April 23, 1971

As per letter of K. Caldwell to you, dated April 22, re samples - the two boxes of four bottles each have been sent to you by Air Freight.

The dilute samples, from the water in wells at irrigation and water from sump in tank farm, one bottle from each sampling point must be preserved with copper sulfate for phenol analysis. Please add the copper sulfate at the start of the sampling period and shake after each addition. An additional composited sample from each site will not be preserved and these samples will be used for other analyses. It is believed that there are two locations for water in the wells at the irrigation area. Thus, the two sets of samples taken here and the one site at the sump in tank farm bottle should have copper sulfate.

The water to the irrigation area should be taken but with no preservative added.

Please label all bottles as to time of sampling, etc. and send back by Air Freight. Air Express is on strike.

C. W. Fisher

CWF:jd

cc: Mr. K. R. Caldwell, J. Little, D. L. O'Dell, C. Pratt, B. K. Pospishil

10000

NW-S-1

Sent 12-18

DEC 17 1987

cc: MRN
BSN

Environmental Resources JW 3 12/18

KOPPERS

Interoffice Correspondence

To Jordan Dern

Location K-901

Subject Pencil Pitch & Oregon D.E.Q

From John Offord

Location N.W. Plant

Date 12-11-87

Dear Jordan,

Thought you should know that Oregon D.E.Q took a sample of Pencil Pitch from our October ship that was unloaded at the Port of Portland. They ran a Bio-assay for Salmon and other fish mortalities.

We are told that the results were favorable - there were no mortalities of any fish subjected to the test.

Regards,
John

CC: S. Flaherty K-1750
J. Butala K-1201

K43-REV. 5 100M 9-80

KOPPERS

Interoffice Correspondence

To	John W. Kunkle	From	D. N. Sweet
Location	K - 1750	Location	K - 1750
Subject	Portland Terminal Pitch Melter	Date	May 6, 1987

I have reviewed the Portland Pitch Melter preliminary request and have talked with a few of the individuals involved. At this time, I would not recommend proceeding any further with this request.

The primary reason for this capital is to satisfy additional business at Columbia Falls. It is my understanding that Walt Turner is currently attempting to sell them 100% of their requirements from Chicago. The only reason we would need to ship "melted" Chinese pitch would be that Columbia Falls insisted on a second supplier and agreed that the Chinese pitch would satisfy this requirement. Should this latter case exist, we should then only proceed if a long term contract (5 years or longer) is obtained from Columbia Falls.

Should the marketing situation indicate that we proceed, the following would still require completion or investigation:

1. Engineer and estimate total scope and cost of installation through Pittsburgh Engineering.
2. Are operating permits required at Portland?
3. Long terms lease on Portland property should be obtained.
4. Is the installation environmentally acceptable?
5. Provide calculations for operating costs.
6. Have all safety aspects of the operation been explored and will properly trained operators run the unit?

I am sure there are other questions, but the main one is the marketing which needs to be addressed before we proceed any further.

D. N. Sweet

DNS:rs

CC: L. F. Flaherty
J. Oxford
J. M. Dern
R. L. Shannon
W. W. Turner
E. A. Clendaniel
A. I. Domanico

RECEIVED
MAY 7 1987
Environmental Resources

K-5 REV. 2

File: NW. general

TO T. M. LEAKE - FONTANA
J. DERN - PITTSBURGH

FROM John O'Hard
N.W. Terminal

RECEIVED
MAY 23 1983
ENVIRONMENTAL RESOURCES
OMG

SUBJECT Visit from Ore. D.E.Q

DATE 5-19-83

FOLD— MESSAGE For your records, Dept of Environmental Quality inspector came in today. He asked for Vapor Pressures and Storage tank temp's on our Creo tanks. Gave him copies of the Creosote - Material Safety Data sheets per his request, and informed him average temp was 140°F. Informed Caldwell of Visit. Thank you,

ORIGINATOR-DO NOT WRITE BELOW THIS LINE REPLY TO ⟶ SIGNED John O'Hard

REPLY

DATE

SIGNED

SEND WHITE AND PINK COPIES WITH CARBONS INTACT. PINK COPY IS RETURNED WITH REPLY.

FINAL REPORT OF THE

ENVIRONMENTAL REVIEW OF

NORTHWEST TERMINAL, PORTLAND, OR

Submitted by:

Robert Anderson
Gary Edwards

February 12, 1986

PORTLAND, OREGON

AIR

No pending issues

WATER

The plant has a stormwater discharge. If this discharge is determined to be covered by the Organic Chemical Effluent Limitation Guidelines, some treatment or other handling of the stormwater will be required.

SOLID WASTES

U. S. EPA has taken the position that Koppers is a PRP with respect to groundwater contamination at the Gould Superfund site which is near the plant. Koppers is contesting this determination.

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ENVIRONMENTAL REVIEW

NORTHWEST TERMINAL

PORTLAND, OREGON

INTRODUCTION

In keeping with Koppers' corporate policy of assessing the environmental status of all operating Chemical and Allied Products (CAP) plants, an environmental assessment of the Northwest Terminal in Portland, Oregon, was performed on December 6, 1985. This report contains an appraisal of the plant's compliance with environmental regulations as well as recommendations for future environmentally related work. Because the Portland facility is a transfer terminal for pencil pitch and some creosote products, no process summary is included. Based on the results of this review, a plan of action to correct any non-compliance situations will be developed by the production management, environmental coordinator and plant personnel.

The assessment includes an interview with the environmental coordinator for the plant, a review of all environmental files in Pittsburgh and an environmental questionnaire answered by plant personnel. The plant was toured on December 17, 1985. Preliminary information, requested from the plant prior to the review, is included in Appendix A. The environmental coordinator interview is in Appendix B, the review questionnaire is in Appendix C and field notes are in Appendix D.

NWT 002429

SITE DESCRIPTION

The Northwest Terminal is located on approximately 26 acres of level land at 7540 NW St. Helens Road in Portland, Oregon. It is bounded on the northeast by Wacker Siltronic Company, on the east by a vacant lot owned by Gould Corporation, on the south by NW St. Helens Road, and on the west and north by Northwest Natural Gas Company. The Willamette River lies north of the gas company.

Figure 1 shows the plant layout. The lower tank farm is situated just northeast of St. Helens Road at the southern boundary of the plant. It is approximately ten feet below grade and has cement block retaining walls. Twenty tanks are located in this tank farm: four are waste water storage tanks; six are creosote or tar blending tanks; five are creosote or heavy oil storage tanks; four are not in use; one is a boiler fuel oil tank. A Southern Pacific and Southern Railroad spur line lies between St. Helens Road and the lower tank farm.

The upper tank farm is northeast of the lower tank farm and is at ground level. It consists of two large tanks not in use, a creosote storage tank and a creosote shipping tank. A new pencil pitch storage building is being built northeast of the creosote shipping tank. Another S.P. & S. Railroad spur runs from the main plant entrance to the area between the upper tank farm and the new pitch storage building.

NWT 002430

L-7106-14
Koppers N.W. Terminal - Portland Ore.
EFFLUENT TREATMENT AREA
L-7274
Settling Pond that was used by Koppers. Last used in 1978 I think. D.E.Q and Northwest Natural Gas have already taken core samples of this area.
FENCE
OLD AGEN FUN
OLD BOILER FUN
N. W. FRONT AVENUE
ROADWAY
M & R BUILDING
STOREROOM
SERVICE BLDG.
PRESENT TRACK
TRACK (NEW)
PITCH PAN 60'-4" X 88'-0"
PITCH PAN 54'-5½" X 88'-0"
L-7263
L-7272
L-7275
SWITCH HOUSE
SUB-STA.
LEASE LINE
N.S. BASE LINE
15' ROADWAY N.S PLANT BASE LINE
OFFICE & LABORATORY
L-7269
OFFICE PARKING
SERVICE ALLEY
MAIN ROAD
BOILER BLDG.
L-7271
150 H.P. N. American Atlas Steam Generator
Air Compressor House
GASCO REGULATOR STATION
CONTROL HOUSE
PROPANE TANKS
PLANT ENTRANCE ROAD FROM N.W. ST. HELEN'S ROAD
T-2
78' x 29'-9
1,000,000 GAL
T-11
40' x 25'
225,000 GAL
T-1
650,000 GAL
FOAMITE BLDG.
T-65
80'-6" x 41'-8"
850,000 GAL
T-20
T-42
LEASED TO HERCULES POWDER
750,000 GAL
LEASED TO HERCULES
RxR Track where creosote is unloaded
The reportable agency is Dept. of Environmental Quality State of Oregon - N.W. Industrial Region
Stubbed Pipe that shows Oil seeping all around it through Concrete Wall
Drain pipes from main Road that carries surface water from road and hillside into our Plant. Then water travels over ground surface to our Sump.
an underground spring that in heavy rains brings water & Oil to surface of ground
Due to recent violation of Oil & Grease permit on our affluent water, we are presently piping our wash water to the above marked tanks. Then we can sample the tanks have the results from Coffey Lab then we will pump the tank empty to the Willamette River.
Sample Point for waste water
REVISED
DESTROY ALL PREVIOUS ISSUES
NOMINAL YARD EL. +32'-6"
ELEVATIONS SHOWN ARE FROM FIELD DATA BASED ON +33'-0" AT REF PT. ON TOP OF FOUNDATION OF T-1 TANK
GEN. ARR. LEASE AGREEMENT L-7238
ELEVATIONS L-7265
RELOCATED LEASE LINES
ADDED SERVICE BLDG.
REFERENCE DATA REVISED TO DATE
ADDED ELEVATION DATA SUPPLIED BY FIELD
REVISED TO DATE
KOPPERS COMPANY, INC.
TAR PRODUCTS DIVISION
PITTSBURGH, PA.
NORTH WEST 300-1
TAR PLANT LAYOUT
L-7106-14

NWT 002431

The north central portion of the plant was formerly an effluent settling pond which was last used in 1978. It has since been filled with layers of soil, sand, and sludge and is now vacant ground.

Surface water from St. Helens Road drains to the lower tank farm while surface water from the rest of the plant either infiltrates the ground or drains toward the Willamette River.

The property is completely fenced and has four gates. The main gate, located in the southeast portion of the plant, accesses St. Helens Road. There are secondary gates on the remaining three sides.

HISTORY

The property is owned by the Northwest Natural Gas Company, who operated a coke plant and coke oven gas plant on the site until Koppers leased the land in 1969. Koppers has used the property primarily as a pencil pitch storage and distribution terminal. Additionally, creosote is blended to produce specialty tar products. A large pitch storage building is currently being erected. This will ensure that pitch will be stored on a concrete pad and out of the weather. There are eight employees at the terminal.

ENVIRONMENTAL STATUS

AIR QUALITY

Air emission sources at the terminal include the boiler, storage tank vents and ~~vapors from loading and unloading trucks and~~

tank vents and vapors from loading and unloading trucks and railcars. A permit to operate the boiler has been filed with the City of Portland. No other air permits exist for the plant.

The boiler burns natural gas and has the capability to burn fuel oil as backup fuel. Emissions testing and monitoring are not required for boilers which burn natural gas as a primary fuel.

Organic vapor emissions from the tank vents have not been estimated. Permits are not needed for these tanks because the vapor pressure of creosote is less than that required for VOC storage tank permitting.

During railcar unloading, the hatches are open and a visible steam and vapor cloud is released. No testing of this source has been performed to determine the need for a vapor control system for railcar unloading.

CONFIDENTIAL

ASBESTOS

The plant has stripped asbestos insulation from piping. The Director of Oregon's Department of Environmental Quality and the Administrator of EPA were not notified of the intent to dismantle asbestos containing structures as required. The notification must include the description of items to be dismantled, including their age and prior use, an estimate of the amount of asbestos present on the structure, the scheduled starting and completion dates of renovation, the procedures to be used to handle asbestos during demolition and the name of the site where the asbestos will be disposed.

Presently, there are 15 drums of asbestos being stored at the plant. This material is double bagged in leak tight, double lined bags which are stored in drums. The drums are not labeled with asbestos caution labels as required.

CONFIDENTIAL

WATER QUALITY

Sanitary wastewater from Northwest Terminal is discharged to the City of Portland POTW. No permit for this discharge exists. Storm water runoff flows toward the Willamette River.

Tank farm runoff and boiler blowdown are discharged through a culvert which leads to an unnamed creek south of Saint Helens Road before flowing to the Willamette River. A NPDES permit was issued for this discharge. A renewal application for the NPDES permit was submitted to DER on June 28, 1984; however, a renewed permit is not on file at the plant or in Pittsburgh. Despite the possibility that a permit for this discharge may not exist, the plant monitors the discharge and submits monthly monitoring reports to the state. The method of handling water from this discharge has changed since the NPDES permit was issued. The plant now collects water in four storage tanks and has it tested to ensure no parameters exceed NPDES limits before discharging wastewater to the outfall. This may violate the sampling schedule established in the permit.

According to the Oregon regulations, the plant could eliminate its NPDES by discharging all wastewater to the Portland POTW if the POTW has a NPDES or WPCF (water pollution control facility) permit.

The drain from the sink in the laboratory empties directly into the tank farm sump before being pumped into one of the water holding tanks. This does not appear to affect the quality of water being discharged to the NPDES outfall.

SOLID WASTE

CONFIDENTIAL

Northwest Terminal does not generate any wastes on a regular basis. Because of this, the Part A permit for the plant was withdrawn ~~from regulators~~ LK on April 25, 1984. Wastes are generated as the result of spill cleanup on a sporadic basis. Four drums of contaminated soil were collected as the result of a spill involving a Koppers transporter in Washington state. Plant personnel cleaned up the spill and shipped the drums of contaminated soil to the plant in a rented truck. The drums have been in storage at the plant for an unknown period of time. Labeling, storage, inspection and permitting requirements have been violated as a result of the drums not having been disposed properly. The drums are currently housed in a maintenance building, and are surrounded by bags of sodium sulfite so that they are not easily accessible for inspection.

Several rusted drums of pitch or sludge are being stored alongside a building west of the new pitch building. These drums are not labeled. If they contain wastes, they must have secured lids, be stored on an impervious pad surrounded by diking and have labels which include the contents and the accumulation date. The plant is not in compliance with waste accumulation regulations.

LEGACIES

Many of the areas at the plant are not covered by environmental regulations, or may have the potential to affect the environment because of past operating and disposal practices. These situations are known as environmental legacies.

There are several unused tanks at the plant which contain sludges. These include:
1000 gallons of tar sludge in the old distillation column;
anthracene and creosote sludge in a 77000 gallon tank;
30000 gallons of sludge in #1 tank;
9000 gallons of crystalline creosote sludge in #66 tank;
78000 gallons of crystalline creosote sludge in #101 tank;
700 gallons of tar and water in #19 tank;
19000 gallons of tar, water and creosote sludge in #2 tank;
an unnumbered tank is empty and unused.
The contents of two tanks in the southeast corner of the plant are unknown.

CONFIDENTIAL

A former leach field is north of the new pitch building. This reportedly consists of several layers of gravel and sludges. Observation pipes are still in place around the leach field. Sludges in the field have the potential to contribute to soil and groundwater contamination.

Another area north of the new pitch storage building and adjacent to the north fence line was used in the past to dump spill cleanup and off-spec product. Thin layers of soil were placed

over each layer of waste disposed in this area. This may also contribute to soil and groundwater contamination.

Many creosote spills have occurred throughout the years at the railcar unloading area along the south edge of the plant. Much of the spilled material was allowed to infiltrate the ground. Creosote seeping into the lower tank farm through the southern tank farm wall, and creosote which filled a pump foundation excavation, show evidence that these spilled materials are mounding to the south of the tank farm dike.

A diesel fuel line outside the plant site was ruptured by contractors off of the plant site. However, spillage and underground seepage along the pipe line contaminated a portion of the plant area with diesel fuel.

Plant personnel indicted that there has been spillage at most of the areas at the plant at some time during Koppers' operation.

CONFIDENTIAL

RECOMMENDATIONS

o Estimate or test emissions from railcar unloading. If missions are found to be in excess of 25 tons per year, apply for a permit to operate an air emissions source.

o Label all drums containing asbestos.

o Dispose of all asbestos stored at the plant as soon as possible.

o Before demolishing any other asbestos containing structures, notify the Director of DER and the Administrator of EPA of the start and finish dates of the project,as well as the amount of asbestos to be removed.

o Apply for a permit to discharge wastewater to the City of Portland POTW.

o Obtain a copy of the renewed NPDES permit from the DER.

o Notify the DER of the changes made to the wastewater handling system.

o Check to see if the Portland POTW has a NPDES or WPCF permit. If so, determine if the plant's NPDES discharge can be converted to a POTW discharge.

o Collect laboratory solvents instead of putting them in the sink drain. If necessary, dispose of these through a registered laboratory waste disposal company.

o Label the four drums of hazardous waste.

o Dispose of the drums of waste immediately.

o Sample the contents of all stray drums at the plant and dispose of them properly.

o Clean sludges out of all unused tanks and dispose of the sludges properly. Dismantle any tanks which will not be used in the future.

o Initiate a hydrogeologic investigation of the plant site to determine the amount and extent of subsurface contamination. In particular, scrutinize the former dump area, the former leach field, the area around the railcar unloading tracks, the tank farms and the area affected by the diesel line rupture. Make a determination of the source of any contamination, and whether it was introduced by Koppers.

CONFIDENTIAL

NWT 002439

SUMMARY

Koppers' Northwest Terminal plant is in compliance with most environmental regulations. There are no significant air emissions sources, although some testing or calculations may be necessary to determine the need for an air emissions permit for the railcar loading/unloading process. Asbestos regulations have not been observed by the plant during the removal of insulations from pipes.

The plant's NPDES discharge is in compliance with limitations stipulated in the permit, even though the plant does not have a copy of the current permit. The wastewater handling system has been changed since the permit was issued, and this may affect the status of any permit renewals. It may be possible to eliminate the NPDES permit by obtaining a permit to discharge to the Portland POTW.

Spill clean up constitutes the bulk of hazardous wastes generated by the plant. Several drums of waste are improperly stored at the plant. Because of this, nearly all requirements regarding the storage of wastes are being violated.

Although there are some non-compliance situations at the Northwest Terminal, they can probably be cleared up with little effort.

CONFIDENTIAL

APPENDIX A

Information requested from the plant before the review.

RECEIVED
NOV 19 1984
ENVIRONMENTAL RESOURCES

This is the plot Plans with explanations on the N.W. Plant in Portland Ore. Also you will find one of the Original Gasco. Plot maps. Our plant is on the Property owned by N.W. Natural Gas Co. This was the sight of a Coke Gas Plant.

John A. Offord
11/15/84
Plant Mgr.

P.S. - Beth & Mark.
I apologize for the delay in this report but with the running around over the Oil & Grease Violation. and now I am sitting in the Kaiser Hospital in Fontana Cal. awaiting news of my mothers Kidney surgery Again I apologize

John

APPENDIX B

Interview: Jordan Dern, Environmental Coordinator

KOPPERS COMPANY ENVIRONMENTAL REVIEW

INTERVIEW OF

Jordan M. Dern

FACILITY NAME

Northwest Terminal

INTERVIEWED BY

~~Robert Anderson~~

~~Gary Edwards~~

DATE December 13, 1985

ENVIRONMENTAL REVIEW

AIR

1.	permits	See below
2.	consent orders	
3.	ongoing negotiations	
4.	3rd party complaints	
5.	lawsuits	
6.	residues disposal	
7.	planned expansion	
8.	odors	
9.	hazardous air pollutants	

1. A permit to operate the boiler and boiler house compressor is on file with the City of Portland.
2. No.
3. None.
4. None.
5. None.
6. None .
7. A pencil pitch storage building is being constructed.
8. Some creosote odors are evident.
9. None.

ENVIRONMENTAL REVIEW

WASTEWATER

1.	permits	See below
2.	consent orders	
3.	ongoing negotiations	
4.	3rd party complaints	
5.	lawsuits	
6.	BAT	
7.	residues disposal	
8.	spill prevention	
9.	storm runoff	
10.	sanitary wastewater	
11.	129 toxic pollutants	
12.	pretreatment (POTW)	

1. There is a NPDES permit to discharge tank farm water to a stream southeast of the plant.
2. None.
3. None.
4. None.
5. None.
6. No.
7. None
8. A spill prevention plan is on file.
9. Stormwater infiltrates the ground as flows toward the Williamette River. Tank farm runoff is collected and discharges through the NPDES.
10. Pumped to the City of Portland POTW.
11. Not done.
12. None.

ENVIRONMENTAL REVIEW

SOLID WASTES

	Non-Hazardous		Non-Hazardous
1.	quantity	_____	1. Unknown.
2.	quality	_____	2. Plant trash
3.	disposition	_____	3. Unknown
4.	issues	_____	4. None.
	Hazardous		
1.	RCRA A&B permit	See below	
2.	quantity	_____	**Hazardous**
3.	quality	_____	See below
4.	consent orders	_____	
5.	ongoing negotiation	_____	
6.	3rd party complaints	_____	
7.	lawsuits	_____	
8.	disposition	_____	
9.	monitor wells	_____	

1. The part A application was withdrawn.
2. Unknown - spill cleanup is the only hazardous waste generated.
3. Spill cleanup - U051.
4. None.
5. None.
6. None.
7. None.
8. Wastes are not disposed regularly.
9. None.

ENVIRONMENTAL REVIEW

ENVIRONMENTAL LEGACIES

1.	CWA spill reports	See below
2.	Superfund spill reports	
3.	Superfund sites on plant	
4.	gdwtr. contamination	
5.	consent orders	
6.	ongoing negotiations	
7.	3rd party complaints	
8.	lawsuits	
9.	plant history	
10.	stratigraphy	

1. None within the last two years.
2. None.
3. No.
4. Probably.
5. None.
6. None.
7. None.
8. None.
9. See report - history section.
10. Unknown.

ENVIRONMENTAL REVIEW

WATER SUPPLY

1.	source	1. City of Portland
2.	quantity	2. Unknown
3.	public supply	3. City of Portland.
4.	issues	4. None.
5.	fire protection	5. Unknown.

ENVIRONMENTAL MANAGEMENT

1.	responsibility	1. Jordan Dern.
2.	staff	2. John Oxford, plant manager
3.	reporting	3. Jordan Dern.

APPENDIX C

Questionnaire

CLEAN AIR ACT

NORTHWEST TERMINAL PLANT

Emissions Inventory

1. Have all the air emission points in the plant been and tabulated? If so, obtain a copy of the tabulation. If the information is available, but scattered, a reasonable attempt should be made to collect and tabulate as much as possible. No. The boiler, which burns natural gas, the storage tanks and railcar unloading are emission sources at the plant. A formal tabulation does not exist.

2. Has the following information on each point source been inventoried: No.

   - stack height?
   - stack diameter?
   - stack temperature?
   - stack velocity?
   - control equipment type?
   - control efficiency?

3. Have the emissions from each point been determined either by stack testing or calculation? If so, obtain a copy and determine how current the emission estimates are. No.

4. What are the annual fuel usages for the plant? Unknown. Natural gas is burned in the boiler. Oil is used as standby fuel for the boiler.

Type of Fuel	Annual Consumption	% Ash	% Sulfur

5. Have the annual plantwide emissions (including fugitive) for the following pollutants been estimated or calculated? If so, please provide:

Pollutant	Emission Rate (if known) Tons/Year
Carbon Monoxide	
Nitrogen Oxides	
Sulfur Oxides	
Lead	
Particulates	
Volatile Organic Compounds	

Emissions Sampling/Testing

11. Is any stack testing performed at the plant on a routine basis? If so, detail. No.

12. Is the fuel at the plant sampled and analyzed for any parameter on a routine basis? If so, detail. No. Natural gas is used. Fuel oil is dept in storage as backup fuel.

13. Have there been any emissions in excess of the allowable over the past year? If so, were they reported to any regulatory agency? Detail reporting procedures and record keeping. Unknown.

Special Regulatory Orders

14. Are any of the operations at the plant currently covered by any Consent or Administrative Orders or variances regarding air pollution issues? If so, detail each order or variance. No.

Ambient Monitoring

15. Has ambient monitoring for any air pollutant been performed? If so, detail. No.

Episode Plans

16. Does the plant have on file an episode action plan to be used in the event of air pollution episodes occurring in its area? If so, detail. No.

Miscellaneous

17. Are startup/shutdown reports submitted to any regulatory agency? If so, detail. No.

18. Does the plant employ a certified smoke reader? No.

19. Is any construction or plant modification planned in the near future? If so, detail. No.

20. Is the Bubble Policy applied to any of the sources at the plant? If so, explain. No.

21. Does the plant currently have any emission reduction credits? If so, explain. No.

22. Have there ever been any complaints from neighbors regarding odors or noise? Are the complaints of a relatively consistent frequency? Has any program been established to deal systematically with neighborhood complaints? What actions have been taken to eliminate the causes of the odors and/or noise leading to complaints? Yes. A neighbor (approximately five miles away) complained, and the Department of Environmental Quality engineer "traced" the odor to the Koppers plant by driving along the road until he no longer smelled the odor. The source may have been from a tank car heating during the weekend without a cover on the hatch.

23. Has there ever been a lawsuit filed against the plant by any regulatory agency or third party as a result of alleged problems with air emissions fromt he plant? Problems would include respiratory problems, clean-up costs, other health effects, etc. No.

ASBESTOS

NORTHWEST TERMINAL PLANT

1. List all structures at the facility that contain asbestos or insulation which could contain asbestos. Many of the pipes and lines in the plant are insulated with asbestos.

2. Has the amount of asbestos or insulation been calculated in any of these structures? No.

3. As a result of manufacturing, demolition, renovation or other facility operations, has any asbestos material been disposed? No. Approximately 15 drums of asbestos material is stored at the plant. This material is double-bagged in labeled bags, and these bags are in drums. The drums are not labeled.

   If so:

   - Was any regulatory agency notified?
   - Who was notified?
   - When were they notified?
   - How much asbestos-containing material was involved?
   - When was it disposed?
   - Where was it disposed?
   - How was it handled?
   - Were any labeling or warning signs used?
   - Has asbestos been transported off-site? If so, are manifests available?
   - Are asbestos handling training records maintained on file?
   - Were any renovation or demolition under order of a state or local agency because the structure was unsound?

IF ASBESTOS IS NOT USED IN MANUFACTURING, GO TO NEXT SECTION.

4. Has asbestos or asbestos material ever been used in any manufacturing operations at the facility? If so, please list.

5. Are there any visible emissions resulting from these operations?

6. Are there any collection devices at the facility to control asbestos emissions? If so, list them and their rated efficiencies.

7. Are there any measurements taken to monitor these collection devices (i.e., differential pressure, air flow, emissions, etc)?

8. Has the amount of asbestos sent to the control device ever been quantified?

9. Is the collection device permitted? If so, please include permitting agency, the permit or license number, and the expiration date(s).

Asbestos
Benzene
Coke Oven Emissions
Others

No.

6. Is an annual emissions report of any type submitted to a state or local agency? If so, describe the contents and to whom submitted. No.

Federal Permit Requirements

7. List all construction or modification which took place at the plant which resulted in either the addition of a new emission source or the increase in emission from an existing source. None.

8. For each of projects listed above, were any construction permits received? If so, please list and indicate either Prevention of Significant Deterioration (PSD) or non-attainment new source review. N/A.

Other Air Permits

9. Obtain a list of all the air construction or operating permits currently on file at the plant, including the permit numbers and expiration dates. A permit to operate exists for the air compressor in the boiler house. A permit to operate the boiler also has been filed. These are both filed with the City of Portland.

Continuous Emissions Monitoring

10. Are any of the emission sources at the plant equipped with continuous emissions monitoring systems? If so, detail each as to type, purpose, maintenance, calibration, and other pertinent data. No.

CLEAN WATER ACT

NORTHWEST TERMINAL PLANT

Identification of Discharges

1. List below all discharges of waters from the plant, whether clean or contaminated, and identify the receiver of each (surface water, storm sewer, POTW, spray field, etc):

Discharge Description	Receiving Entity
Surface water	Some to city sewer. Some to Willamette River.
Tank farm runoff and wastewater, boiler blowdown	Unnamed creek southeast of plant - flows to Willamette River
Sanitary wastewater	City of Portland POTW.
Lab sink drain	Tank farm sump - to southeast creek.

2. Which of the above are covered by permits relating to wastewater discharges? Identify permit number, issuing agency, and expiration date. Include surface water, storm sewer, POTW, spray field, etc.

Discharge Description	Permit Number	Agency	Expiration Date
Tank farm runoff	NPDES?	Oregon DEQ	?

IF NO SURFACE WATER DISCHARGE, GO TO QUESTION 18.

Discharges to Surface Waters

3. For any permit identified in Question 2 above, has any renewal permit application been filed with an environmental regulatory agency? If so, identify the permit number, agency to which the application was sent, and date of submittal. Renewal was applied for on June 28, 1984. No renewed permit is on file.

Permit Number	Agency	Submittal Date

4. Have any modifications or process changes taken place since the issuance of any wastewater discharge permits which may have changed either the quality or quantity of the discharges? If so, detail, including whether or not the environmental agency was notified and when. Yes. Wastewater is pumped into holding tanks. A sample is taken from the tanks and water is only discharged after the sample results are received and indicate that the water is within limits established in the original NPDES permit. Water is pumped from the holding tanks to discharge 001 (unnamed creek).

5. For each permitted discharge explain in detail the self-monitoring program used by the plant including date, time and exact location of sampling, sampling methods, sampling personnel, sample preservation, chain of custody, analytical laboratory used, date of analyses, name of analyst and lab report distribution. The plant does not self-monitor the discharge. Samples are sent to Coffey Labratories in Portland. They analyze the samples for pH, oil and grease, and phenols.

6. What analytical procedures are used for each parameter? Unknown.

7. Who is responsible for completing any standard "Discharge Monitoring Report" (DMR) or any other self-monitoring report to environmental agencies? John Oxford, plant manager.

8. Who signs the DMRs or other reports submitted? John Oxford, plant manager.

9. Is self-monitoring conducted more frequently than required by any permits? If so, what test methods are used for the extra analyses and are the results sent to the regulatory agency? Samples are not taken according to permit requirements. They are taken as grab samples when the plant needs to discharge water from the storage tanks.

10. If onsite laboratory facilities are used, explain in detail any Quality Assurance/Quality Control (QA/QC) procedures used. N/A.

11. Over the past two years have any analytical results indicated non-compliance with any permit limitation? If so, detail the actions taken in response to such information including: 1) whether it was noted on any self-monitoring form 2) whether the cause of non-compliance was noted 3) corrective action taken 4) whether the period of non-compliance was noted 5) how long it took (or will take) to come into compliance 6) any steps taken to avoid any recurrence. Yes. Oil and grease was out of compliance, and noted on the DMR. Since the system has been changed over, nothing has been out of compliance.

12. Is effluent quality for any discharge subject to non-compliance due to plant operations which are not reasonably controllable? If so, has the plant ever experienced such an "upset" condition? If so, what are the frequency of the "upset" conditions? Detail the procedures instituted in the event of an "upset" condition including: 1) any notification to environmental agencies 2) the cause of the "upset" 3) the content of any notification 4) when the notification was made 5) whether any written report was filed and when it was filed 6) remedial measures taken. No. However, runoff from the hillside and road south of the plant may be introducing oil and spetic tank effluent into the tank farm wastewater collection area.

13. Have any portions of wastewater treatment facilities ever been bypassed intentionally? If so, detail each bypass including: 1) whether or not an environmental agency was notified and when 2) what was the reason for the bypass

3) was the bypass the only alternative available to the plant 4) when did the plant become aware that the bypass was necessary. No. However, wastewater piping system shattered in a freeze and the system will be bypassed until the system can be repaired.

14. Has a Polynuclear Aromatic Hydrocarbon (PAH) scan been run on any of the plant discharges or the presence of the following specific pollutants? If so obtain a copy of the monitoring results. No.

Volatiles	Acid Compounds
Acrolein	2-chlorophenol
acrylonitrile	2,4-dichlorophenol
benzene	2,4-dimethylphenol
bromoform	4,6-dinitro-o-cresol
carbon tetrachloride	2,4-dinitrophenol
chlorobenzene	2-nitrophenol
chlorodibromomethane	p-chloro-m-cresol
chloroethane	pentachlorophenol
2-chloroethylvinyl ether	phenol
chloroform	2,4,6-trichlorophenol
dichlorobromomethane	
1,1-dichloroethane	
1,2-dichloroethane	
1,1-dichloropropylene	
1,2-dichloropropylene	
ethylbenzene	
methyl bromide	
methyl chloride	
methylene chloride	
1,1,2,2-tetrachloroethane	
tetrachloroethylene	
toluene	
1,2-trans-dichloroethylene	
1,1,1-trichloroethane	
1,1,2-trichloroethane	
trichloroethylene	
vinyl chloride	

Base/Neutral	Pesticides
acenaphthene	aldrin
acenaphthylene	alpha-BHC
anthracene	beta-BHC
benzidine	gamma-BHC
benzo(a)anthracene	delta-BHC
benzo(a)pyrene	chlordane
3,4-benzofluoranthene	4,4'-DDT
benzo(ghi)perylene	4,4'-DDE
benzo(k)fluoranthene	4,4'-DDD
bis(2-chloroethoxy)methane	dieldrin
bis(2-chloroethyl)ether	alpha-endosulfan

NWT 002460

bis(2-ethylhexyl)phthalate
bis(2-chloroisopropyl)ether
4-bromophenyl phenyl ether
butylbenzyl phthalate
2-chloronaphthalene
4-chlorophenyl phenyl ether
chrysene
dibenzo(a,h)anthracene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3`-dichlorobenzidine
diethyl phthalate
dimethyl phthalate
di-n-butyl phthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
di-n-octyl phthalate
1,2-diphenylhydrazine (as azobenzene)
fluroranthene
fluorene
hexachlorobenzene
hexachlorobutadiene
hexachlorocyclopentadiene
hexachloroethane
indeno (1,2,3-cd)pyrene
isophorone
napthalene
nitrobenzene
N-nitrosodimethylamine
N-nitrosodi-n-propylamine
N-nitrosodiphenylamine
phenanthrene
pyrene
1,2,4-trichlorobenzene

beta-endosulfan
endosulfan sulfate
endrin
endrin aldehyde
heptachlor
heptachlor epoxide
PCB-1242
PCB-1254
PCB-1221
PCB-1232
PCB-1248
PCB-1260
PCB-1016
toxaphene

Other Toxic Pollutants

Antimony, Total
Arsenic, Total
Beryllium, Total
Cadmium, Total
Chromium, Total
Copper, Total
Lead, Total
Mercury, Total
Nickel, Total
Selenium, Total
Silver, Total
Thallium, Total
Zinc, Total
Cyanide, Total
Phenols, Total

NWT 002461

15. Are records kept on: 1) all calibration and maintenance of equipment used to monitor 2) reports required by the permit 3) all information required for permit application completion? If so, detail. The only records kept are DMR's. These are kept at the plant.

16. How long are the records retained? Forever.

17. Are the following operation and maintenance conditions at wastewater treatment units met? The wastewater collection system at Northwest Terminal is not listed as a wastewater treatment system.

    a. Are standby power or equivalent provisions in place and available? Yes _____ No_____

    b. Are alarm systems in place in operational to alert personnel to power or equipemnt failure? Yes ___ No_____

    c. Are all wastewater treatment units currently in service? Yes_____ No_____

    d. Is the wastewater treatment operating staff trained, qualified, and if required by the total authority, certified? Yes_____ No_____

    e. Are procedures in place to train new operators? Yes_____ No_____

    f. Are files kept to document training of operators? Yes _____ No_____

    g. Is an O&M Manual kept? Yes_____ No_____

IF NO POTW DISCHARGE GO TO QUESTION 27.

18. For each discharge to a POTW, answer the following:

a. Does the discharge present a fire or explosion hazard? Yes ____ No X

b. Does the discharge present a corrosion or potential structural damage hazard? Yes____ No X

c. What is its pH range? unknown

d. Does the discharge contain solids or viscous materials such that sewer obstruction or treatment plant interference are possible? Yes____ No X

e. Does the discharge contain any pollutant of such strength and volume so as to interfere with the POTW treatment process? Yes____ No X

f. What is the temperature range of the discharge? ambient

19. For each discharge to a POTW explain in detail the monitoring program used by the plant including date, time and exact location of sampling, sampling methods, sampling personnel, sample preservation, chain of custody, analytical laboratory used, date of analyses, name of analyst, and lab report distribution. None.

20. What analytical procedures are used for each parameter? N/A.

21. Are monitoring reports sent to any environmental agency? If so, include the names of those responsible for preparing and signing the reports and the frequency of submittals. No.

22. If onsite laboratory facilities are used, explain in detail any QA/QC procedures used. N/A.

NWT 002463

23. Over the past two years, have any analytical results indicated non-compliance with any permit location? If so, detail actions taken in response to such information including: 1)whether it was noted on any monitoring report 2) whether the cause of the non-compliance was noted 3) corrective action taken 4) whether the period of non-compliance was noted 5) how long it took (or will take) to come into compliance 6) any steps taken to avoid any recurrence. N/A.

24. Has a Polynuclear Aromatic Hydrocarbon (PAH) scan been run on the discharge or does the plant have any monitoring data or knowledge of the presence of the following specific pollutants? If so obtain a copy of the monitoring results. No.

(See list on Page 3, #14 for list of chemicals).

25. Are records kept on: 1) all calibration and maintenance of equipment used to monitor 2) any required reports? If so, detail. N/A.

26. How long are all the records retained? N/A.

NWT 002464

LAND APPLICATIONS OF WASTEWATER (SPRAY FIELDS, EVAPORATION PONDS,) IF NO LAND APPLICATIONS, GO TO QUESTION 31.

27. For every land application of waste water explain any monitoring program used by the plant, including date, time and exact location of sampling, sampling methods, sampling personnel, sample preservation, chain of custody laboratory used, date of analyses, name of analyst, and lab report distribution. N/A.

28. If onsite laboratory facilities are used explain any QA/QC procedures used. N/A.

29. Has a Polynuclear Aromatic Hydrocarbon (PAH) scan been run on the discharge, or does the plant have any monitoring data or knowledge of, the presence of the following specific pollutants. If so obtain a copy of the monitoring results or a guestimate of the concentration. N/A.

(See list on Page 3, #14 for list of chemicals).

30. How long are all the records retained? N/A.

NWT 002465

Spill Prevention Control and Countermeasures (SPCC) Plans

31. Does the plant have a SPCC Plan on file? Obtain a copy. No.

Miscellaneous

32. Has a non-point source control plan been prepared for the site that identifies best management practices for control of non-point source pollution? If so, obtain a copy. No.

33. Are environmental baseline studies conducted or available on surrounding waters? If so, detail. No.

34. Obtain a list of chemicals used for boiler blowdown and cooling tower water. Sodium sulfite (Chemex 171), Sodium metaphosphate (Chemex 158) and Sodium Hydroxide (Chenex 193).

RESOURCE CONSERVATION AND RECOVERY ACT

NORTHWEST TERMINAL PLANT

Waste Identification and Notification

1. Please list all wastes generated and their source.

Waste	Source	Classification
Trash	office wastes	non-hazardous
Asbestos	piping demolition	non-hazardous
Sludges, contaminated soil	spill cleanup	hazardous (U051)

2. Has the U.S. EPA Regional Administrator been notified that the facility manages hazardous waste? The Part A Application has been withdrawn from regulatory agencies.

3. Has the EPA identification number been received? If so, indicate the number.

Hazardous Waste Generators

4. Are hazardous wastes isolated from other solid wastes? Yes.

5. Does the plant ship chemical waste off-site? If so, identify the primary off-site facility(s) for each waste. No.

6. Is a uniform manifest system being used for off-site shipment of non-hazardous chemical waste? No.

7. Is a uniform manifest system being used for off-site hazardous waste shipment? No wastes have been shipped.

8. Does the manifest include the following information? N/A.

   - Manifest document number.
   - Generators name, mailing address, and telephone number.
   - Generator EPA I.D. Number.
   - Transporter(s) name and EPA I.D. Number.
   - Disposal facility, name, address, and EPA I.D. Number.
   - Alternate TSD Facility name, address, and EPA I.D. Number.
   - If undeliverable, instructions to return to the generator.
   - Waste information required by DOT, such as shipping name, weight or volume, type and number

of containers.
- Emergency information such as special handling instructions, etc.
- DOT and EPA Certification.

Does the generator sign and date all manifests? Who signs for the generator?

Does the plant obtain a handwritten signature and date of manifest acceptance from the initial transporter? Who signs for the transporter?

Do returned copies of the manifest include the TSD Facility's owner/operator signature and date of acceptance?

9. Is an exception report policy in place in the event that a manifest copy is not returned from the designated facility? If so, please describe. No.

10. List any outstanding exception report cases. N/A.

Facility	Waste Type	Date Shipped

11. How long are the manifests, annual and exception reports, test results and analyses kept on file? N/A.

12. What labeling is placed on drums holding hazardous waste? (i.e., dated, type of waste, I.D.,etc). None.

13. Does the plant have the required placards to offer the transporters? No.

14. Describe any waste accumulation area. Include diking, sumps, fence, roofs, etc. What is the capacity of the diked area? Wastes are kept in drums in a metal building with a concrete floor. The drums are inaccessable...they are completely surrounded by bags of sodium sulfite.

15. What is the average time for storing any specific hazardous waste? Wastes have been stored for six to eight months because of a delay in finding a disposal location.

16. If you don't have a hazardous waste storage permit, is there a tracking mechanism to assure that wastes are accumulated on site for less than 90 days before shipment? No.

Transportation Requirements

17. List all transporters, including Koppers, and EPA I.D. numbers. None as of yet.

18. Are any hazardous wastes transported by water or rail? No.

19. How long are copies of the records kept? No records have been generated yet.

20. For accidental spills involving a Koppers transporter, what procedure has been established to report the incidents to regulatory agencies? None.

Treatment, Storage and Disposal (TSD) Facility Requirements

IF NOT A TSD FACILITY, GO TO QUESTION 28.

21. List all TSD facility operations at the plant. N/A.

Facility	Was it in Existence on 11/19/80?	Was a Regulatory Agency Notified by 8/19/80?	Did you have Interim Status (Part A by 11/19/80?

22. If there are any facilities listed which have not met all three requirements state why. N/A.

23. Do any of the TSD facilities have final permits? If so, please list. N/A.

NWT 002469

Facility	Agency	Permit Number	Expiration Date

24. Does the plant maintain a copy of waste analysis plan at the facility? If so, does it include: N/A.

    - Parameters for which each waste will be analyzed.
    - Test methods used to test for these parameters?
    - Sampling method used to obtain the sample.
    - Frequency with which the initial analyses will be reviewed or updated.

25. Has a RCRA Part B permit application been requested by any environmental regulatory agency? N/A.

26. Has a RCRA Part B permit application been submitted to any environmental regulatory agency? If so, to what agency(s) and on what dates? N/A.

27. Are there any outstanding permitting issues needing special attention? N/A.

28. When was the most recent EPA or DER inspection and what were the results? Explain any non-compliance situations, problems, or penalties arising from the inspection. In October, 1985, the DEQ/OSHA inspected the plant for safety. No violations were cited.

29. What actions were or are being taken to bring any non-complying facilities into compliance? N/A.

30. Does the facility provide adequate security through --

    - 24-hour surveillance system (e.g. television monitoring, guards). Yes.
    - Artificial or natural barrier around the facility. Yes.

NWT 002470

- Controlled entry. Yes.

- Warning signs. No.

31. Is a written procedure for inspecting plant operations maintained at the facility? If so, does it include inspection of: No.

    - Monitoring equipment?

    - Safety and emergency equipment?

    - Security devices?

    - Dikes, containers, tanks, emissions, impervious pad, etc?

32. Does a log documenting this plant inspection exist? Does it include: No.

    - Date and time of the inspection?

    - Name of inspector?

    - Notation of observations?

    - Date and nature of remedial action?

33. How long are plant inspection logs maintained on file? N/A.

34. Does the plant maintain personnel training records for each person working in hazardous material areas? How long are these records kept on file? No.

    Do these records include:

    - Who performed the inspection?

    - Job title and description of each position?

    - When each person began working in hazardous waste areas?

    - Description of type, date, and amount of training?

35. Is the personnel training annually updated? No.

Contingency Plan -- (Obtain a copy)

NWT 002471

36. Has a fire, explosion, or any unplanned release of hazardous waste ever occurred? If so, detail any actions taken in response, including clean-up and notification to environmental agencies. Was the incident documented? No.

37. Is there an emergency coordinator on site at all times? Who? Yes. John Oxford, plant manager, during business hours. Guard during off-hours.

38. Is the facility equipped with the following: No.

- An easily accessible internal communication or alarm system?
- Telephone or two-way radio?
- Portable fire extinguishers?

39. Has the facility made arrangements with the local authorities to familiarize them with characteristics of the facility including: No. There is a yearly inspection by the fire department.

- Facility layout?
- Properties of hazardous materials handled?
- Places where facility personnel would normally be working?
- Possible evacuation routes?

40. Is there a designated primary police and fire authority? Yes. Portland City Fire and Police departments.

41. Does the plant have agreements with state emergency response teams, emergency response contractors and/or equivalent suppliers? An on-call contract is maintained with Riedell.

42. Has the plant arranged to familiarize local hospitals with the properties of hazardous waste handled and type of injuries that could result from releases at the facility? No. MSDS for pencil pitch was supposedly channeled to the hospital through the union hygenist.

43. If the State or local authorities decline to enter into such an arrangement, is this entered in the operated record? No.

Operating Record

44. Does the plant keep a written operating record of hazardous waste areas at the facility? Review the record. Does it include: N/A.

- Description and quantity of each hazardous waste received or generated?
- Location and quantity of each hazardous waste at each location?
- Records and results of waste analyses?
- Report of incidents involving implementing the contingency plan?
- Records and results of required inspections?
- Monitoring, testing, or analytical data?
- Closure and post-closure plans?
- Closure cost estimates?
- Post-closure cost estimates?

Groundwater Monitoring

45. Does a groundwater monitoring system exist at the facility? No.

46. Is a groundwater sampling and analysis plan on file at the facility? Does it include procedures for sample collection, preservation, shipment, analysis, chain of custody control and quality assurance/quality control (QA/QC) procedures? No.

47. If a monitoring system does exist, please describe the location of the sampling points, frequency of sampling, and parameters to be analyzed. N/A.

48. Are annual reports of the groundwater sampling plan submitted to any environmental regulatory agency? If so, detail. N/A.

49. What are the results of the most recent groundwater monitoring tests? Have they been reported to the appropriate regulatory agency? N/A.

CONTAINERS CHECKLIST

NORTHWEST TERMINAL PLANT

1. Have any damaged or leaking containers ever been found at the storage or accumulation facility? If so, how is the waste managed? No.

2. What type of containers are used for holding corrosive wastes? N/A.

3. How often are the container storage or accumulation areas inspected? They are not inspected.

4. Does an inspection log exist indicating the frequency of inspection of the hazardous waste area? No.

5. How far from the plant property line is the storage or accumulation facility located? Approximately 50 feet.

6. Describe the procedures followed when a container is re-used with a different hazardous waste. Not done.

7. Describe how incompatible wastes are stored. N/A.

8. Describe how the containers are grouped and their maximum height. Are reactive or ignitable wastes stored in any of the containers? Four drums are on pallets and surrounded by sodium sulfite.

TANKS CHECKLIST

NORTHWEST TERMINAL PLANT

1. Are there any tanks which are not being used? Describe the contents. Are there any tanks which the plant no longer plans to use? If yes, has all material and residue been removed from these tanks, discharge control equipment and discharge confinement structures? Yes.

   77,000 gallon tank with anthracene and creosote sludge.
   #1 tank has 30,000 gallons of sludge.
   #66 tank has 9,000 gallons of crystalline creosote sludge.
   #101 tank has 78,000 gallons of crystalline creosote sludge.
   #19 tank has 700 gallons of tar and water.
   #2 tank has 19,000 gallons of tar, creosote and water.
   An unnumbered tank is empty and unused.
   Two tanks in the southeast corner of the plant are unidentified.
   There is about 1,000 gallons of sludge in the old distillation column.

2. List any tanks which are underground or partially buried at the plant and describe any monitoring system in place to detect leakage. There are none.

3. Are tanks presently used to treat or store hazardous waste? No.

4. For all above ground open top tanks answer the following: There are no open-top tanks.

   - Do they have 2 feet (60 cm) freeboard?
   - Are they within a containment structure (e.g. dike or trench)?
   - Are they equipped with a drainage control system?
   - Are they equipped with diversion structure? (e.g., feed cutoff or by-pass to a stand-by tank)?

5. Are any of the tanks continuous feed? No.

   If yes, is it equipped with a means to stop inflow (e.g., feed cutoff or by-pass to a stand-by tank)?

6. Is the tank used to store waste exclusively? No.

   - If no, list the various materials stored in the tank.
   - Are waste analyses available?

Inspections

7. How often does the plant inspect the following? Never.

   - Discharge control equipment (e.g. feed cut-off, by pass and/or drainage system)?
   - Monitoring equipment (e.g. pressure and temperature gases)?
   - Level of waste in each tank?

POLYCHLORINATED BIPHENYLS (PCB's)

NORTHWEST TERMINAL PLANT

1. Are PCB's processed or used in any of the plant's operations? How are they contained? No.

2. List any transformers which may contain PCB's. All transformers we owned by the utility company.

3. Are records of transformer inspections maintained? Review the records for the following information. N/A.

   - Transformer location.
   - Date of each transformer visual inspection and the date that a leak was discovered.
   - Person performing the inspection.
   - Leak location.
   - Estimate of the amount of dielectric fluid released from any leak.
   - Date and description of cleanup.

4. Do any of the heat transfer systems in the plant contain PCB's? Detail the PCB concentration and the frequency of testing. If the PCB concentration is greater than 50 ppm, detail the clean-up procedures. N/A.

5. Do any of the hydraulic systems in the plant contain PCB's? Detail the PCB concentration and the frequency of testing. If the PCB concentration is greater than 50 ppm, detail the clean-up procedures. N/A.

6. Do any of the electromagnets, switches, voltage regulators, and circuit breakers contain PCB's? Detail the PCB concentration and the frequency of visual inspection. N/A.

7. Are PCB containers, transformers, capacitors, hydraulic systems, heat transfer systems, and storage areas marked with an approved PCB label? Are poles or protected areas containing any of the above marked with an approved PCB label? N/A.

8. Are PCB's stored before disposal? Detail the type of PCB's and the dates of storage and disposal. Does the storage facility include: N/A.

- Adequate roof and walls?
- Adequate floor with a six-inch high continuous curb?
- No drain valves, floor drains, expansion joints,etc?
- Floors and curbing constructed of continuous smooth and impervious materials?
- Not located on the 100 year flood plain?

9. How often are PCB articles and containers in storage checked for leaks? Is a record kept of these inspections? N/A.

10. Have PCB's from the plant been disposed of or planned to be disposed of? What disposal method was used for each item containing PCB's? N/A.

11. What records are available at the plant which indicate where, how, and how much PCB's were disposed? N/A.

12. Are any reports submitted to a regulatory agency? N/A.

SUPERFUND

NORTHWEST TERMINAL PLANT

1. Is the plant currently involved with any Superfund litigation or negotiations?

   Detail, including environmental agency involved, Pittsburgh personnel involved, type of work already initiated, type of Superfund action, etc.

   No.

2. What procedures are used by the plant in procuring off-site chemical waste disposal services. Include Pittsburgh personnel involvement, whether a contract is signed, and whether this contract is handled on a case-by-case or yearly basis.

   John Oxford calls a hauler when he has wastes to dispose of (Rydell International). They are a licensed hauler and are hired on a case-by-case basis.

3. What records have been kept with respect to the chemical waste disposal practices in the past (weigh tickets, work orders, invoices, copies of checks, purchase orders, bills of lading, contracts, permits, manifests, etc)? Any records prior to December 31, 1981 are to be transported to Pittsburgh and maintained by the Law Department.

   Documents including manifests have been sent to the Law Department.

4. Does the plant have an established policy on the retention of records pertaining to chemical waste shipments? Detail.

   No. As manifests are returned, they are filed at the plant.

5. Have all the individual disposal areas used by the plant been identified in the "Eckhardt Study" (see attached tables)? Have all the haulers used by the plant been identified?

   If not, list and describe all others.

   Yes.

NWT 002480

7. Explain the procedures that are established at the plant to assure that any "release" to the environment of a "reportable quantity" of any material is reported to the National Response Center.

   No procedures are established. The wastes are drummed for disposal and hauled away.

8. Has the plant had any releases of chemicals over the past two years?

   Was the release of a chemical in the amount of a reportable quantity and was it reported to the National Response Center? Obtain a copy of the written report.

   No.

9. Do you pay a hazardous waste tax?

   Yes, for the state of Oregon.

NWT 002481

ECKHARDT DISPOSAL LOCATIONS

NORTHWEST TERMINAL

Dates	Site Name & Address	Materials Sent	Amount	Disposal Method	Other Users (Y & N)	Manifest Availabl
1967-1978	Gasco Property 7540 N.W. St.Helens Rd. Portland, OR. 97119	Coal tar, fungicides, oil sludges.	100 ton	Landfill	N	?

APPENDIX D

Plant tour field notes.

NORTHWEST TERMINAL PLANT

FIELD NOTES

G. EDWARDS

DECEMBER 17, 1985

1. Runoff collects in the tank farm which is below grade. It is presently pumped to one of four tanks, sampled and stored until the results of the sample are received. If the water is in compliance with NPDES requirement, it is then pumped to the sewer.

2. When a pump base near the railroad unloading area was being dug, black oil was observed seeping into the hole.

3. If the wastewater collecting tanks get too full, they overflow to the cement floor of the tank farm and the water flows back to the sump.

4. Outfall 001 goes to an unnamed creek. Outfall 002 is not identified.

5. Creosote unloading is done from tank cars at the south end of the property.

6. A former settling pond in the north central portion of the plant was last used in 1978.

7. The Burlington Northern rail line runs along the south end of the plant.

8. Creosote has been spilled from several tanks.

9. Tar tanks have been run over in the past.

10. A lot of waste has been buried throughout the plant over the years.

11. Four drums of hazardous waste are stored in the building. They are not labeled.

12. There are quite a few drums, some with material in, some empty throughout the plant -- especially in the abandoned buildings.

13. Some of the piping in the tank farm area has asbestos insulation.

NORTHWEST TERMINAL PLANT

FIELD NOTES

ROBERT ANDERSON

DECEMBER 17, 1985

The area north of the new pitch storage building and along the north fenceline was used in the past to dump spill cleanup and off spec material.

An old leach field is located northeast of the pitch building. Observation pipes are still in place in the field. The field is made up of layers of gravel, soil and sludge.

Pencil pitch is being stored on asphalt north of the office building until the storage building is finished.

Some of the tank farm piping has asbestos insulation on it. Some of the asbestos is flaking off of the lines.

Several drums of pitch are next to an old building west of the pitch building. These drums are unmarked and rusted.

The old tar still contains approximately 1,000 gallons of ola-based sludge.

An NPDES permit renewal application was filed in 1984. No permit is on file at the plant.

Many of the tanks at the plant still contain sludges.

Tank farm runoff is held in storage tanks before being discharged to outfall 001.

Four drums of spill cleanup from a transportation accident are stored in the maintenance building. The drums are on a pallet; they are not labeled, and are surrounded by bags of sodium sulite so that they cannot be seen or inspected. The drums have been accumulating for several years.

Eleven drums of double-bagged asbestos are stored on the maintenance building. Labels are on the bags in the drums. but no labels are on the drums.

ENVIRONMENTAL REVIEW
NORTHWEST TERMINAL
PORTLAND, OREGON

INTRODUCTION

In keeping with Koppers' corporate policy of assessing the environmental status of all operating Chemical and Allied Products (CAP) plants, an environmental assessment of the Northwest Terminal in Portland, Oregon, was performed on December 6, 1985. This report contains an appraisal of the plant's compliance with environmental regulations as well as recommendations for future environmentally related work. Because the Portland facility is a transfer terminal for pencil pitch and some creosote products, no process summary is included. Based on the results of this review, a plan of action to correct any non-compliance situations will be developed by the production management, environmental coordinator and plant personnel.

The assessment includes an interview with the environmental coordinator for the plant, a review of all environmental files in Pittsburgh and an environmental questionnaire answered by plant personnel. The plant was toured on December 17, 1985. Preliminary information, requested from the plant prior to the review, is included in Appendix A. The environmental coordinator interview is in Appendix B, the review questionnaire is in Appendix C and field notes are in Appendix D.

NWT 002486

SITE DESCRIPTION

The Northwest Terminal is located on approximately 26 acres of level land at 7540 NW St. Helens Road in Portland, Oregon. It is bounded on the northeast by Wacker Siltronic Company, on the east by a vacant lot owned by Gould Corporation, on the south by NW St. Helens Road, and on the west and north by Northwest Natural Gas Company. The Willamette River lies north of the gas company.

Figure 1 shows the plant layout. The lower tank farm is situated just northeast of St. Helens Road at the southern boundary of the plant. It is approximately ten feet below grade and has cement block retaining walls. Twenty tanks are located in this tank farm: four are waste water storage tanks; six are creosote or tar blending tanks; five are creosote or heavy oil storage tanks; four are not in use; one is a boiler fuel oil tank. A Southern Pacific and Southern Railroad spur line lies between St. Helens Road and the lower tank farm.

The upper tank farm is northeast of the lower tank farm and is at ground level. It consists of two large tanks not in use, a creosote storage tank and a creosote shipping tank. A new pencil pitch storage building is being built northeast of the creosote shipping tank. Another S.P. & S. Railroad spur runs from the main plant entrance to the area between the upper tank farm and the new pitch storage building.

NWT 002487

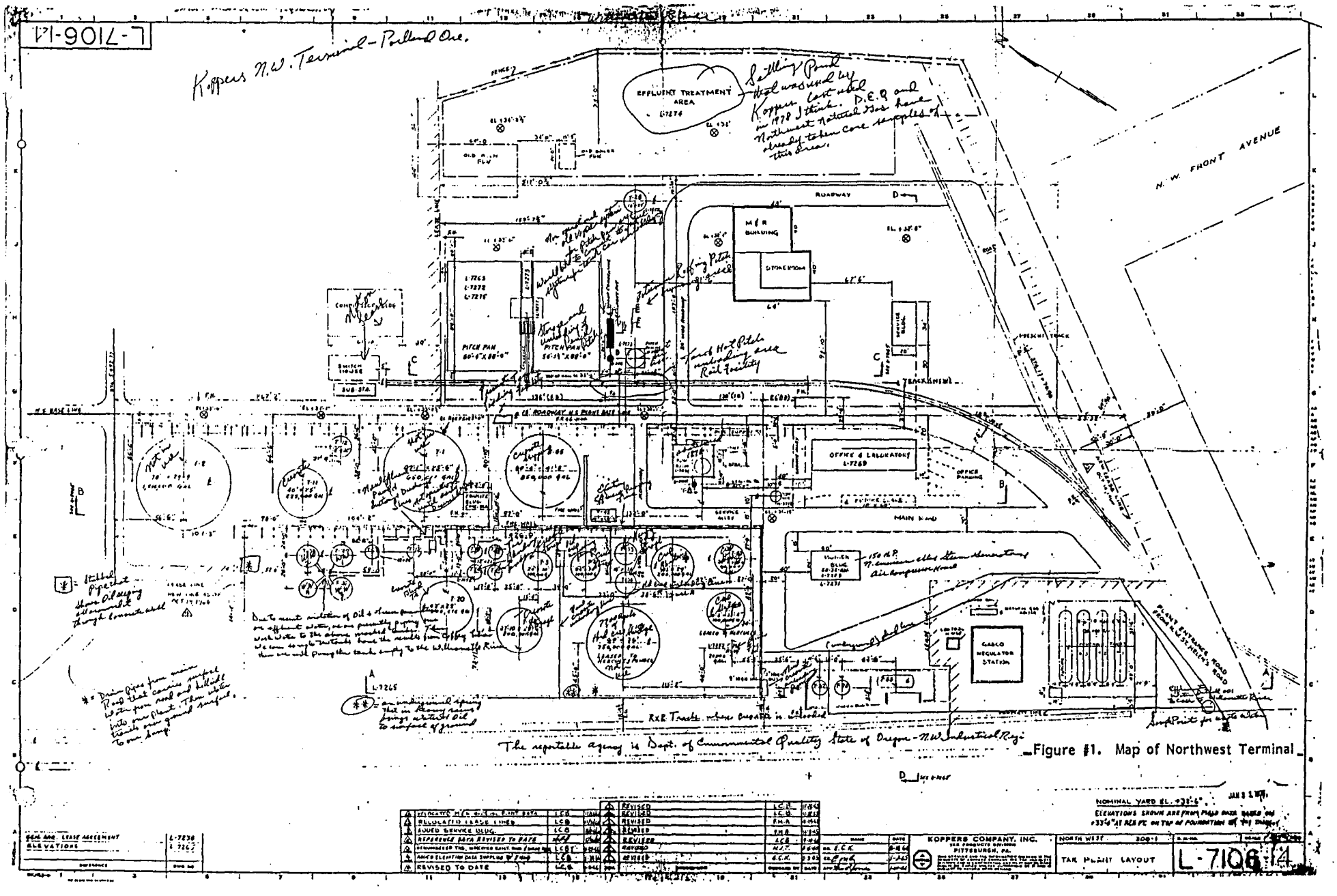

Figure #1. Map of Northwest Terminal

NWT 002488

The north central portion of the plant was formerly an effluent settling pond which was last used in 1978. It has since been filled with layers of soil, sand, and sludge and is now vacant ground.

Surface water from St. Helens Road drains to the lower tank farm while surface water from the rest of the plant either infiltrates the ground or drains toward the Willamette River.

The property is completely fenced and has four gates. The main gate, located in the southeast portion of the plant, accesses St. Helens Road. There are secondary gates on the remaining three sides.

HISTORY

The property is owned by the Northwest Natural Gas Company, who operated a coke plant and coke oven gas plant on the site until Koppers leased the land in 1969. Koppers has used the property primarily as a pencil pitch storage and distribution terminal. Additionally, creosote is blended to produce specialty tar products. A large pitch storage building is currently being erected. This will ensure that pitch will be stored on a concrete pad and out of the weather. There are eight employees at the terminal.

ENVIRONMENTAL STATUS

AIR QUALITY

Air emission sources at the terminal include the boiler, storage tank vents and ~~vapors from loading and unloading trucks and~~

NWT 002489

tank vents and vapors from loading and unloading trucks and railcars. A permit to operate the boiler has been filed with the City of Portland. No other air permits exist for the plant.

The boiler burns natural gas and has the capability to burn fuel oil as backup fuel. Emissions testing and monitoring are not required for boilers which burn natural gas as a primary fuel.

Organic vapor emissions from the tank vents have not been estimated. Permits are not needed for these tanks because the vapor pressure of creosote is less than that required for VOC storage tank permitting.

During railcar unloading, the hatches are open and a visible steam and vapor cloud is released. No testing of this source has been performed to determine the need for a vapor control system for railcar unloading.

CONFIDENTIAL

ASBESTOS

The plant has stripped asbestos insulation from piping. The Director of Oregon's Department of Environmental Quality and the Administrator of EPA were not notified of the intent to dismantle asbestos containing structures as required. The notification must include the description of items to be dismantled, including their age and prior use, an estimate of the amount of asbestos present on the structure, the scheduled starting and completion dates of renovation, the procedures to be used to handle asbestos during demolition and the name of the site where the asbestos will be disposed.

NWT 002490

Presently, there are 15 drums of asbestos being stored at the plant. This material is double bagged in leak tight, double lined bags which are stored in drums. The drums are not labeled with asbestos caution labels as required.

WATER QUALITY

CONFIDENTIAL

Sanitary wastewater from Northwest Terminal is discharged to the City of Portland POTW. No permit for this discharge exists. Storm water runoff flows toward the Willamette River.

Tank farm runoff and boiler blowdown are discharged through a culvert which leads to an unnamed creek south of Saint Helens Road before flowing to the Willamette River. A NPDES permit was issued for this discharge. A renewal application for the NPDES permit was submitted to DER on June 28, 1984; however, a renewed permit is not on file at the plant or in Pittsburgh. Despite the possibility that a permit for this discharge may not exist, the plant monitors the discharge and submits monthly monitoring reports to the state. The method of handling water from this discharge has changed since the NPDES permit was issued. The plant now collects water in four storage tanks and has it tested to ensure no parameters exceed NPDES limits before discharging wastewater to the outfall. This may violate the sampling schedule established in the permit.

According to the Oregon regulations, the plant could eliminate its NPDES by discharging all wastewater to the Portland POTW if the POTW has a NPDES or WPCF (water pollution control facility) permit.

NWT 002491

The drain from the sink in the laboratory empties directly into the tank farm sump before being pumped into one of the water holding tanks. This does not appear to affect the quality of water being discharged to the NPDES outfall.

SOLID WASTE

CONFIDENTIAL

Northwest Terminal does not generate any wastes on a regular basis. Because of this, the Part A permit for the plant was withdrawn ~~from regulators~~ it on April 25, 1984. Wastes are generated as the result of spill cleanup on a sporadic basis. Four drums of contaminated soil were collected as the result of a spill involving a Koppers transporter in Washington state. Plant personnel cleaned up the spill and shipped the drums of contaminated soil to the plant in a rented truck. The drums have been in storage at the plant for an unknown period of time. Labeling, storage, inspection and permitting requirements have been violated as a result of the drums not having been disposed properly. The drums are currently housed in a maintenance building, and are surrounded by bags of sodium sulfite so that they are not easily accessible for inspection.

Several rusted drums of pitch or sludge are being stored alongside a building west of the new pitch building. These drums are not labeled. If they contain wastes, they must have secured lids, be stored on an impervious pad surrounded by diking and have labels which include the contents and the accumulation date. The plant is not in compliance with waste accumulation regulations.

NWT 002492

LEGACIES

Many of the areas at the plant are not covered by environmental regulations, or may have the potential to affect the environment because of past operating and disposal practices. These situations are known as environmental legacies.

There are several unused tanks at the plant which contain sludges. These include:
1000 gallons of tar sludge in the old distillation column;
anthracene and creosote sludge in a 77000 gallon tank;
30000 gallons of sludge in #1 tank;
9000 gallons of crystalline creosote sludge in #66 tank;
78000 gallons of crystalline creosote sludge in #101 tank;
700 gallons of tar and water in #19 tank;
19000 gallons of tar, water and creosote sludge in #2 tank;
an unnumbered tank is empty and unused.
The contents of two tanks in the southeast corner of the plant are unknown.

CONFIDENTIAL

A former leach field is north of the new pitch building. This reportedly consists of several layers of gravel and sludges. Observation pipes are still in place around the leach field. Sludges in the field have the potential to contribute to soil and groundwater contamination.

Another area north of the new pitch storage building and adjacent to the north fence line was used in the past to dump spill cleanup and off-spec product. Thin layers of soil were placed

NWT 002493

over each layer of waste disposed in this area. This may also contribute to soil and groundwater contamination.

Many creosote spills have occurred throughout the years at the railcar unloading area along the south edge of the plant. Much of the spilled material was allowed to infiltrate the ground. Creosote seeping into the lower tank farm through the southern tank farm wall, and creosote which filled a pump foundation excavation, show evidence that these spilled materials are mounding to the south of the tank farm dike.

A diesel fuel line outside the plant site was ruptured by contractors off of the plant site. However, spillage and underground seepage along the pipe line contaminated a portion of the plant area with diesel fuel.

Plant personnel indicted that there has been spillage at most of the areas at the plant at some time during Koppers' operation.

CONFIDENTIAL

NWT 002494

RECOMMENDATIONS

o Estimate or test emissions from railcar unloading. If missions are found to be in excess of 25 tons per year, apply for a permit to operate an air emissions source.

o Label all drums containing asbestos.

o Dispose of all asbestos stored at the plant as soon as possible.

o Before demolishing any other asbestos containing structures, notify the Director of DER and the Administrator of EPA of the start and finish dates of the project,as well as the amount of asbestos to be removed.

o Apply for a permit to discharge wastewater to the City of Portland POTW.

o Obtain a copy of the renewed NPDES permit from the DER.

o Notify the DER of the changes made to the wastewater handling system.

o Check to see if the Portland POTW has a NPDES or WPCF permit. If so, determine if the plant's NPDES discharge can be converted to a POTW discharge.

o Collect laboratory solvents instead of putting them in the sink drain. If necessary, dispose of these through a registered laboratory waste disposal company.

o Label the four drums of hazardous waste.

NWT 002495

o Dispose of the drums of waste immediately.

o Sample the contents of all stray drums at the plant and dispose of them properly.

o Clean sludges out of all unused tanks and dispose of the sludges properly. Dismantle any tanks which will not be used in the future.

o Initiate a hydrogeologic investigation of the plant site to determine the amount and extent of subsurface contamination. In particular, scrutinize the former dump area, the former leach field, the area around the railcar unloading tracks, the tank farms and the area affected by the diesel line rupture. Make a determination of the source of any contamination, and whether it was introduced by Koppers.

CONFIDENTIAL

NWT 002496

SUMMARY

Koppers' Northwest Terminal plant is in compliance with most environmental regulations. There are no significant air emissions sources, although some testing or calculations may be necessary to determine the need for an air emissions permit for the railcar loading/unloading process. Asbestos regulations have not been observed by the plant during the removal of insulations from pipes.

The plant's NPDES discharge is in compliance with limitations stipulated in the permit, even though the plant does not have a copy of the current permit. The wastewater handling system has been changed since the permit was issued, and this may affect the status of any permit renewals. It may be possible to eliminate the NPDES permit by obtaining a permit to discharge to the Portland POTW.

Spill clean up constitutes the bulk of hazardous wastes generated by the plant. Several drums of waste are improperly stored at the plant. Because of this, nearly all requirements regarding the storage of wastes are being violated.

Although there are some non-compliance situations at the Northwest Terminal, they can probably be cleared up with little effort.

CONFIDENTIAL

NWT 002497

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

86-119A
NPDES
Analysis

Interoffice Correspondence

To	John Oxford	From	J. M. Dern
Location	Northwest Terminal	Location	K-1928
Subject	PAH Analysis	Date	March 8, 1988

Please sign the attched letter and forward by Certified Mail Return Receipt Requested to Oregon DEQ in Portland.

Jordan M. Dern/mrw

Jordan M. Dern

JMD/mrw

cc: L. F. Flaherty
J. R. Batchelder
M. R. Urbassik
B. S. Nolan

Koppers Company, Inc.
436 Seventh Avenue
Pittsburgh, PA 15219
Telephone 412-227-2000

KOPPERS

March 7, 1988

CERTIFIED MAIL
Return Receipt
Requested

Oregon Department of Environmental
Quality
811 Southwest Sixth Avenue
Portland, OR 97204

RE: Koppers Company, Inc.
Portland, Oregon
NPDES Permit #100419

Dear Sir:

In compliance with special condition Number 4, Section D of the subject permit, please find attached the results of the PAH sampling conducted on February 3, 1988. Questions should be directed to Mr. Jordan Dern of Keystone Environmental Resources, our environmental consultant. His address is :

436 Seventh Avenue
Suite 1928
Pittsburgh, PA 15219

Sincerely,

John A. Oxford
Terminal Manager

JAO/JMD/mrw

Enclosure

CHAIN OF CUSTODY RECORD

PLANT CODE	PROJECT NAME	NUMBER OF CONTAINERS
220	WASTE WATER PAH	
SAMPLERS (Signature)	John A O'Hara Steve Holtzman	

STA. NO.	DATE	TIME	COMP.	GRAB	WELL	STATION LOCATION	NUMBER OF CONTAINERS	PAH	OIL & GREASE	PHENOL					CONDUCTIVITY	pH	REMARKS OR OBSERVATIONS
1	2/3/88	2:30 pm		X		West Water Tank	3										
Temp of Water at Time of Sample = 46°F																	

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Reliquished by: (Signature)	Date	Time	Received by: (Signature)
John A O'Hara	2/3/88	3:05p	D Francis				
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Reliquished by: (Signature)	Date	Time	Received by: (Signature)
Reliquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Ice Chest Temp °C	Ice Chest # D-15	Chain of Custody Tag #
			M C Ballard	2/5/88	9:00			

*DISTRIBUTION: Original accompanies shipment; Copy to Coordinator Field Files.

Samples received in good condition
No temp. taken for cooler. Lowes have not written on sample jars.

PAGE 1 OF 1

NWT 002500

TABLE 2: SUMMARY OF PAH DATA

Sample: 88020162

Source: WASTEWATER TANK
Description: NPDES PERMITTING

Date Collected: 02/03/88
Date Received: 02/05/88

Date Extracted: 02/05/88
Date Analyzed: 02/15/88

Clean up Method

silica gel clean-up	✓ yes	___ no
florisil clean-up	___ yes	___ no
alumina clean-up	___ yes	___ no
sulfur clean-up	___ yes	___ no

Polynuclear Aromatic Hydrocarbons

Acenaphthene	58.1
Acenaphthylene	141
Anthracene	1.92
Benzo(a)anthracene	1.75
Benzo(a)pyrene	0.425
Benzo(b)fluoranthene	0.730
Benzo(g,h,i)perylene	1.13
Benzo(k)fluoranthene	0.247
Chrysene	1.87
Dibenz(ah)anthracene	1.51
Fluoranthene	6.18
Fluorene	21.3
Indeno(123-cd)pyrene	0.766
Phenanthrene	11.5
Pyrene	5.28

Other Polynuclear Aromatic Compounds tested:

Carbazole	<2.00
Naphthalene	366

The above results are reported in ug/L .

All PAH identifications are from retention data only.

B. Nalon K-14

RECEIVED 86-119A

DEC 17 1987 cc: MRN BSN

Environmental Resources JW 12/18

KOPPERS

Interoffice Correspondence

To Jordan Dern

Location K-901

Subject Pencil Pitch & Oregon D.E.Q

From John Offord

Location N.W. Plant

Date 12-11-87

Dear Jordan,

Thought you should know that Oregon D.E.Q took a sample of Pencil Pitch from our October ship that was unloaded at the Port of Portland. They ran a Bio-assay for Salmon and other fish mortalities.

We are told that the results were favorable - there were no mortalities of any fish subjected to the test.

Regards,

John

CC: S. Flaherty K-1750

J. Butala K-1201

K43-REV. 5 100M 9-80

Re-119 corresp

NORTHWEST NATURAL GAS COMPANY

220 N.W. SECOND AVENUE PORTLAND, OREGON 97209 - 3991

(503) 226-4211

August 18, 1995

Shannon Craig
Beazer East, Inc.
436 Seventh Avenue, Suite 1101
Pittsburgh PA 15219

Dear Ms. Craig:

Please find enclosed the final Remedial Investigation/Feasibility Study for the Northwest Natural Gas property located at 7900 N.W. St. Helens Road, Portland, Oregon.

I apologize for the length of time it has taken to send you this report since our meeting in July, however, the final negotiations with the Oregon Department of Environmental Quality (ODEQ) took longer than anticipated. The ODEQ approved the plan on August 11, 1995.

We are hoping to begin work on the site by August 28, 1995.

Please let me know if you have any questions and need further information. I can be reached at (503) 226-4211, Ex. 4322.

Sincerely,

Sandra K. Hart

Sandra K. Hart, Director
Environmental Management

Enclosure

cc: William F. Giarla, Beazer East, Inc.
Carla L. Kelley
Ronald K. Opitz

10000

SKH656/smj

APPROVED
Jan. 4, 1972
Smith & Eynon

KOPPERS

Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

ATTN: Mr. James C. Willmann

RE: Your December 1971
Letter on Spills

Dear Mr. Willmann:

All our storage tanks are in diked areas so that spills caused by tank rupture or overfilling are contained. The only oil we store is creosote. This can amount to as high as 7-800,000 gallons. We do not handle hazardous materials.

All of our employees are pollution conscious and have been trained to shut off valves and isolate areas where pipe failures occur.

The only other remote possibility for a spill is in the unloading of crude tar or creosote from ships or barges. In the event of a hose failure, our employees have been instructed on procedures to shut down the pump immediately and isolate the hose against back flow. Someone is on duty at dockside 100% of the time during unloading. In addition to this, our hoses are pressure tested annually at a pressure in excess of pumping pressures. We unload a maximum of 3 cargoes a year.

Very truly yours,

Paul W. Guth
Plant Superintendent

PWG:lm

10000 -

P. W. Guth

Northwest Plant

Oregon Solid Waste Regulations

K. R. Caldwell

Pittsburgh, Pa.

December 1, 1971

How will your plant be affected by the above subject regulations that were sent to you by C. W. Fisher on November 30, 1971.

KRC/mak

10000

TABLE I

ORGANIC MATERIALS DIVISION
KOPPERS COMPANY, INC.

NORTHWEST PLANT
PORTLAND, OREGON

NATURE AND DESCRIPTION OF SAMPLES RECEIVED MAY 3, 1971
(THREE-DAY COMPOSITES)

NOTE: See table of June 7, 1971

Lab Sample No.	Nature of Sample	DESCRIPTION		
		Color	Odor	Remarks
PO-NW-3	Tank 28	Muddy green	Sulfide	2 x 1/2 gal. One with $CuSO_4$ for phenol analysis
PO-NW-4	Farm Sump	Light brown	Oily	(ditto)
PO-NW-5	Well #6	Rusty brown	?	(ditto)
PO-NW-6	Well #3	Brown	?	(ditto)

Effluent Services Group
Environmental Health & Safety Section
Monroeville Research Center
June 23, 1971

10000

CWF:jd

TABLE II

ORGANIC MATERIALS DIVISION
KOPPERS COMPANY, INC.

NORTHWEST PLANT
PORTLAND, OREGON

SUMMARY OF TESTS AND ANALYSES ON SAMPLES RECEIVED MAY 3, 1971
(THREE-DAY COMPOSITES)

NOTE: See table of June 7, 1971

Tests and Analyses	Tank 28 PO-NW-3	Farm Sump PO-NW-4	Well #6 PO-NW-5	Well #3 PO-NW-6
pH	9.2	6.9	6.6	6.7
Alkalinity, as ppm $CaCO_3$, to pH = 4.5	2,400	-	-	-
Oils, ppm, petroleum ether	380	50	15	30
Total Organic Carbon, ppm	1,200	55	25	40
Solids on Evaporation, ppm				
Total at 103°C	1,700	100	1,100	1,300
Fixed at 600°C	100	50	900	1,200
Volatile at 600°C	1,600	50	200	100
Suspended Solids, ppm				
Total at 103°C	100	50	800	500
Fixed at 600°C	0	20	600	440
Volatile at 600°C	100	30	200	60
Ammonia as Nitrogen, ppm	906	1.3	8	0.9
Nitrates, ppm	2	< 1	< 1	< 1
Phosphorus, ppm	0.44	3.0	3.1	2.8

Effluent Services Group
Environmental Health & Safety Section
Monroeville Research Center
June 23, 1971

10000

CWF:jd

Paul Cuth

Northwest Plant

Samples

K. R. Caldwell

Pittsburgh, Pa.

April 22, 1971

I have requested Clarence Fisher to send you sample bottles and preparation instructions for samples of:

1. Three day composite of water to [redacted] irrigation.

2. Three day composite of water in wells at [redacted] irrigation.

3. Three day composite of water from sump in tank farm.

Also as soon as you determine what the limits or specification of water that will be permitted to be discharged in the sanitary district, let me know.

I assume you have checked with C. C. Pratt on analysis methods.

KRC/mak

cc: C. W. Fisher
J. Little
D. L. O'Dell/Attn. R. L. Shannon
C. O. Pratt

10000

MT. HOOD CHEMICAL CORPORATION

PORTLAND 227-3505 BELLEVUE 454-8316 SPOKANE 747-4151

Ed Rosenfeld

Key:

This is all the information I could find on anything pertaining to water.

Paul

KRC ☐
MHF ☐
APS ☐
MAY 7 1971

KLM ☒ FILE ☐

10000

Filed in Book NW SHEET 1 OF 4

U. S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER QUALITY ADMINISTRATION
WASHINGTON, D. C. 20242

REPORT OF INDUSTRIAL WASTE WATER DISPOSAL for Year ending 1970

FOR FWQA USE ONLY

SECTION I - IDENTIFICATION

1. PLANT NAME, LOCATION, AND MAILING ADDRESS (Include ZIP code)
Koppers Co. Inc.
7500 N.W. St. Helens Rd
Portland, Oregon 97229

2. NAME AND MAILING ADDRESS OF COMPANY HEADQUARTERS OR PARENT CORPORATION
Koppers Co. Inc.
Koppers Bld.
Pittsburgh, Penna. 15219

3. NAME, TITLE, AND SIGNATURE OF OFFICIAL FORWARDING THIS REPORT
Paul W. Huth Plant Superintendent

TELEPHONE NO.
286-3681

4. DATE OF REPORT
4-23-71

5A. PRINCIPAL PRODUCTS OR PROCESSES OF THIS PLANT
coal tar pitches & creosote

5B. S.I.C. CODE(S)
PRIMARY (1)
OTHER (2) (3)

6. PLANT OPERATION
A [X] YEAR-ROUND (If seasonal operation give months)
B [ ] SEASONAL
FROM (1)
TO (2)

C. HOURS PER WEEK (1) 120

D. NO. WEEKS WORKED 1 SHIFT (1) 2 SHIFTS (2) 3 SHIFTS (3) 52

E. NUMBER OF PRODUCTION EMPLOYEES (1) 1-19 (2) 20-49 (3) 50-99 (4) 100-499 (5) 500-1000 (6) OVER 1000

SECTION II - WATER SOURCES AND WASTE DISCHARGE POINTS

7. WATER INTAKE

NAME, TYPE OF SOURCE	Purpose (Check all items) Process (1)	Boiler Feed (2)	Sanitary Service (3)	Noncontact Cooling (4)
A. PUBLIC WATER SYSTEM (Give name) Burgau of Water Works Portland, Oregon (a) [X] Publicly owned (b) [ ] Privately owned		✓	✓	✓
B. SURFACE WATER (Self-supplied, give name)				
C. GROUND WATER (Self-supplied, give type)				

8. WASTE DISCHARGE

NAME, TYPE OF DISCHARGE POINT	Type of Discharge: Industrial (Include boiler feed) Treated (1)	Industrial Not Treated (2)	Sanitary Sewage Treated (3)	Sanitary Sewage Not Treated (4)	Noncontact Cooling (5)
A. PUBLIC SEWER (Give name) (a) Publicly owned (b) Privately owned (c) Check if service charge					
B. SURFACE WATER (Give name) Willamette River	✓	✓			✓
C. GROUND (Give type) Septic tank - Soil Percolation		✓		✓	

9. IF ITEM 8B(S) ABOVE IS CHECKED, GIVE:
A. SOURCE WATER TEMP. 50°F
B. WASTE WATER TEMP. 80 °F
C. EFFLUENT VOL. (gal./day) 14000
D. RECIRCULATION INVOLVED? (See instr.) (1) [ ] YES (2) [X] NO

If all discharge is to a public sewer, see instructions for "NOTE" following Item 9 before completing the rest of this form.

SECTION III - WASTE TREATMENT FACILITIES COSTS & MANPOWER REQUIREMENTS

10. GIVE APPROXIMATE EXPENDITURES FOR EXISTING WASTE WATER TREATMENT FACILITIES AND OR IN-PLANT CONTROL SINCE 1948.
(Under type, enter code numbers from Appendix A of instructions, which correspond to the most advanced degree of treatment)

ITEM	(1) TYPE	(2) YEAR PLACED IN OPERATION	(3) ORIGINAL COST IN THOUSANDS
A. ORIGINAL FACILITY	101-105-401-601-603	1966	
B. ADDITIONS/IMPROVEMENTS, (See instructions) (1)			
(2)			
(3)			
C. UNDER CONSTRUCTION			

11. LIST NUMBER OF EMPLOYEES IN EACH CATEGORY BELOW WHO SPEND MORE THAN 40% OF THEIR TIME IN WATER POLLUTION CONTROL WORK. *See Appendix B, instructions for definitions of categories.*

PROFESSIONAL-TECHNICAL	NO.	OPERATIONS MAINTENANCE	NO.	OTHER	NO.
A. SUPERINTENDENT		F. SENIOR OPERATOR FOREMAN		P. UNSKILLED	
B. ENGINEER/SAN. ENGR.		G. EQUIPMENT OPERATOR		Q. CLERICAL	
C. CHEMIST		H. INSTRUMENT REPAIRMAN		M.	
D. BIOLOGIST		I. MAINTENANCE MAN		N.	
E. LAB TECHNICAL		J. ATTENDANT		O.	

12. EXPENDITURES *(thousands of dollars)* AND MANPOWER LEVELS FOR WASTE TREATMENT OR CONTROL FOR PAST YEAR AND ESTIMATES FOR NEXT FIVE CALENDAR YEARS.

ITEM	PAST YEAR (1)	YEAR (2)	YEAR (3)	YEAR (4)	YEAR (5)	YEAR (6)	FIVE YEAR PROJECTED TOTAL (7)
A. FACILITIES AND/OR IN-PLANT CONTROL	0						
B. OPERATION/MAINTENANCE	0.05						
C. NUMBER OF PERSONNEL (See instructions)	0						
D. TOTAL MAN-YEARS	12.6						

13. REMARKS

10000

NWT 002510

REPORT OF INDUSTRIAL WASTE WATER DISPOSAL (cont.)	PLANT NAME: Koppers Co Inc. (Northwest)	SHEET 2 OF 4

SECTION IV - WATER ANALYSES

Complete one of these sheets for each separated waste discharge from the plant (See instructions, item 14, Part B)

14A. NAME OF SEPARATED WASTE DISCHARGE	B. TYPE OF DISCHARGE	C. NO. OF BATCH DISCHARGES PER DAY	D. AVERAGE GALLONS PER BATCH
water separated from oils	(1) [ ] Continuous (2) [✓] Batch	1 per wk	10000

15. EQUIVALENT PRODUCTION UNIT AND AMOUNT PER OPERATING DAY OF PRODUCT ASSOCIATED WITH THIS DISCHARGE: 1000 gals coal tar input — 30

16A. POINT OF DISCHARGE	16B. LATITUDE	17A. IF GROUND DISCHARGE SPECIFY TYPE	17B. LOCATION OF DISCHARGE POINT TO SURFACE WATER BODY
A [ ] Sewer B [ ] Surface Water Body C [✓] Ground	NA 16C. LONGITUDE: NA	(1) [ ] Irrigation (2) [ ] Injection Well (3) [✓] Pond (4) [ ] Other (Specify):	(1) DISTANCE FROM SHORE/BANK: NA ft. (2) DEPTH BELOW SURFACE: NA ft.

18. EFFLUENT SAMPLE COLLECTION AND ANALYSIS	A. SOURCE	B. FREQUENCY	C. ANALYSIS BY	D. SAMPLE DATE(S)
	✓ (1) Grab Sample	(1) Daily	✓ (1) In plant	(1)
	(2) Avg. Grab Sample	(2) Weekly	(2) Outside Lab	(2)
	(3) Composite Sample	✓ (3) Monthly	(3) Gov't Agency (Name)	(3)
	(4) Continuous	(4) Other		(4)

19. WATER QUALITY INDICATORS (where applicable)

ITEM	A. INTAKE WATER BEFORE TREATMENT (1)	A. INTAKE WATER AFTER TREATMENT (2)	B. WASTE WATER EFFLUENT BEFORE TREATMENT (1)	B. WASTE WATER EFFLUENT AFTER TREATMENT (2)	ITEM	A. INTAKE WATER BEFORE TREATMENT (1)	A. INTAKE WATER AFTER TREATMENT (2)	B. WASTE WATER EFFLUENT BEFORE TREATMENT (1)	B. WASTE WATER EFFLUENT AFTER TREATMENT (2)
a. FLOW (gal./day)					f. CHEMICAL ANALYSIS (cont.)				
b. pH					(16) NO_2 (as N)				
c. TEMPERATURE (°F)				60°F	(17) ORGANIC N				
d. COLOR (units)					(18) POLYDAHL				
e. SPECIFIC CONDUCTANCE (μmhos/cm²)					(19) PHOSPHORUS-ORTHO (as P)				
f. CHEMICAL ANALYSIS (mg/L)					(20) PHOSPHORUS-TOTAL (as P)				
(1) TOTAL SOLIDS					(21) Cr				
(2) TOTAL VOLATILE SOLIDS					(22) Cu				
(3) TOTAL SUSPENDED SOLIDS					(23) Fe				
(4) TOTAL DISSOLVED SOLIDS					(24) Cd				
(5) ACIDITY (as $CaCO_3$)					(25) Pb				
(6) ALKALINITY (as $CaCO_3$)					(26) Mn				
(7) 5-DAY BOD					(27) Zn				
(8) COD					(28) F				
(9) OIL AND GREASE				O	g. OTHER CHARACTERISTICS				
(10) CHLORIDE					As				
(11) SULFATE				O	Hg				
(12) SULFIDE					29				
(13) PHENOLS				<0.1 PPM	30				
(14) NH_3 (as N)					31				
(15) NO_3 (as N)					32				

20. CODED DESCRIPTION OF WASTE TREATMENT PROCESSES (Enter code numbers from Appendix A of instructions, in the order in which treatment steps occur.)

21. REMARKS

10000

NWT 002511

REPORT OF INDUSTRIAL WASTE WATER DISPOSAL (cont.) | PLANT NAME | SHEET 4 OF 4

SECTION IV - WATER ANALYSES

Complete one of these sheets for each separated waste discharge from the plant (See instructions, Item 16, Part II)

16A. NAME OF SEPARATED WASTE DISCHARGE: Surface drainage

16B. TYPE OF DISCHARGE: (1) [X] Continuous (2) [ ] Batch

16C. NO. OF BATCH DISCHARGES PER DAY: NA

16D. AVERAGE GALLONS PER BATCH: NA

16. EQUIVALENT PRODUCTION UNIT AND AMOUNT PER OPERATING DAY OF PRODUCT ASSOCIATED WITH THIS DISCHARGE: NA

16. POINT OF DISCHARGE: A [ ] Sewer B [X] Surface Water Body C [ ] Ground

16C. LATITUDE:

16E. LONGITUDE:

17A. IF GROUND DISCHARGE, SPECIFY TYPE: (1) [ ] Irrigation (2) [ ] Injection Well (3) [ ] Pond (4) [ ] Other (Specify):

17B. LOCATION OF DISCHARGE POINT TO SURFACE WATER BODY: (1) DISTANCE FROM SHORE/BANK: 0 ft (2) DEPTH BELOW SURFACE: 0 ft

18. EFFLUENT SAMPLE COLLECTION AND ANALYSIS	A. SOURCE	B. FREQUENCY	C. ANALYSIS BY	D. SAMPLE DATE(S)
	[ ] (1) Grab Sample	[ ] (1) Daily	[ ] (1) In plant	(1)
	[ ] (2) Avg. Grab Sample	[ ] (2) Weekly	[ ] (2) Outside Lab	(2)
	[ ] (3) Composite Sample	[ ] (3) Monthly	[ ] (3) Gov't Agency (Name)	(3)
	[ ] (4) Continuous	[ ] (4) Other		(4)

19. WATER QUALITY INDICATORS (where applicable)

ITEM	A. INTAKE WATER BEFORE TREATMENT (1)	A. INTAKE WATER AFTER TREATMENT (2)	B. WASTE WATER EFFLUENT BEFORE TREATMENT (1)	B. WASTE WATER EFFLUENT AFTER TREATMENT (2)
a. FLOW (gal./day)				
b. pH				
c. TEMPERATURE (°F)				
d. COLOR (units)				
e. SPECIFIC CONDUCTANCE (μmhos/cm²)				
f. CHEMICAL ANALYSIS (mg/L)				
(1) TOTAL SOLIDS				
(2) TOTAL VOLATILE SOLIDS				
(3) TOTAL SUSPENDED SOLIDS				
(4) TOTAL DISSOLVED SOLIDS				
(5) ACIDITY (as $CaCO_3$)				
(6) ALKALINITY (as $CaCO_3$)				
(7) 5-DAY BOD				
(8) COD				
(9) OIL AND GREASE				
(10) CHLORIDE				
(11) SULFATE				
(12) SULFIDE				
(13) PHENOLS				
(14) NH_3 (as N)				
(15) NO_3 (as N)				

ITEM	A. INTAKE WATER BEFORE TREATMENT (1)	A. INTAKE WATER AFTER TREATMENT (2)	B. WASTE WATER EFFLUENT BEFORE TREATMENT (1)	B. WASTE WATER EFFLUENT AFTER TREATMENT (2)
f. CHEMICAL ANALYSIS (cont.)				
(16) NO_2 (as N)				
(17) ORGANIC N				
(18) [illegible]				
(19) PHOSPHORUS-ORTHO (as P)				
(20) PHOSPHORUS-TOTAL (as P)				
(21) Cr				
(22) Cu				
(23) Fe				
(24) Cd				
(25) Pb				
(26) Mn				
(27) Zn				
(28) F				
g. OTHER CHARACTERISTICS				
As				
Hg				
29				
30				
31				
32				

20. CODED DESCRIPTION OF WASTE TREATMENT PROCESSES (Enter code numbers from Appendix A of instructions, in the order in which treatment steps occur.)

21. REMARKS

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EPA-129 (Rev. 4-70) (Page [illegible])

NWT 002512

PROPOSED WASTE DISCHARGE PERMIT PROVISIONS

Prepared by the Staff of the
DEPARTMENT OF ENVIRONMENTAL QUALITY

PRELIMINARY PROPOSAL

Recommended Expiration Date: 12-31-71
Page 1 of 3

APPLICANT:

Northwest Natural Gas Company
123 N. W. Flanders Street
Portland, Oregon 97209

REFERENCE INFORMATION

File Number: 62231
Appl. No.: 1124 Received: 9-9-70
Major Bnt: Willamette Minor Bnt:
Receiving Stream: Willamette River
River Mile:
County: Multnomah

Until such time as this permit expires or is modified or revoked, Northwest Natural Gas Company is herewith permitted to:

a. Extend an existing cooling water line so that it will be submerged below low water level of the Willamette River.
b. Discharge uncontaminated cooling waters to the Willamette River for the company's natural gas plant.

All of the above activities must be carried out in conformance with the requirements, limitations, and conditions which follow.

All other waste discharges are prohibited.

1. Prior to March 31, 1971, the permittee shall complete all necessary negotiations with the City of Portland and shall submit to the Department of Environmental Quality evidence of agreement together with a schedule for completing construction of necessary facilities so that all wastes acceptable, or that can be made acceptable by pretreatment, be discharged to the city's sanitary sewer. These facilities shall be completed by September 1, 1971 such that the wastes can be discharged to the city's sanitary sewer system within 30 days after notification of the completion of such sewer in the area. Plans for collection, pretreatment and disposal facilities shall be submitted to the Department of Environmental Quality (and the city) for review and approval prior to construction.

2. For all wastes which are not acceptable for discharge to the city system, the permittee shall construct and place into operation before September 1, 1971 such facilities as are necessary to provide the highest and best treatment in accordance with the following requirements:

   a. Prior to March 31, 1971, detailed engineering plans and specifications shall be submitted to the Department of Environmental Quality for review and approval in writing prior to construction as required by ORS 449.395.

   b. All facilities shall be constructed in accordance with the approved plans.

   c. The Department of Environmental Quality shall be notified in writing when the facilities are complete and ready to be placed in operation.

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3. Prior to March 31, 1971, the permittee shall submit to the Department of Environmental Quality a program and time schedule for the continuation of a land fill which will eliminate the two existing waste disposal ponds.

4. All plant processes and all existing waste collection, treatment, and disposal facilities shall be operated and maintained at all times at maximum efficiency and in a manner which will minimize waste discharges.

5. Sanitary wastes shall be disposed of to a septic tank and drainfield system which has been installed in accordance with the recommendations of the Oregon State Board of Health and the local county health department or by other approved means.

6. All solids which are removed from the waste shall be utilized or disposed of in a manner which will prevent their entry into the waters of the state and such that health hazards and nuisance conditions are not created.

7. No petroleum base products or other substances which might cause the Water Quality Standards of the State of Oregon to be violated shall be discharged or otherwise allowed to reach any of the waters of the state.

8. In the event the permittee is temporarily unable to comply with any of the conditions of this permit, due to breakdown of equipment or other cause, the permittee shall immediately notify the Department of Environmental Quality of the breakdown or cause, and the steps taken to correct the problem and prevent its recurrence.

9. Authorized representatives of the Department of Environmental Quality shall be permitted access to the premises of all facilities owned and operated by the permittee at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data, and carrying out other necessary functions related to this permit.

10. Whenever a significant change in the character of the waste is anticipated or whenever a change in the waste to be discharged in excess of the conditions of this permit is anticipated, a new application shall be submitted together with the necessary reports, plans, and specifications for the proposed changes. No change shall be made until plans are approved and a new permit issued.

11. In the event that a change in the conditions of the receiving waters results in a dangerous degree of pollution, the Department of Environmental Quality may specify additional conditions to this permit.

12. This permit is subject to termination if the Department of Environmental Quality finds:

    a. That it was procured by misrepresentation of any material fact or by lack of full disclosure in the application.

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b. That there has been a violation of any of the conditions contained herein.

c. That there has been a material change in quantity or character of waste or method of waste disposal.

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REPORT OF INDUSTRIAL WASTE WATER DISPOSAL (cont.) | 17. PLANT NAME: Koppers Co Inc (Northwest) | SHEET 3 OF 4

SECTION IV - WATER ANALYSES

Complete one of these sheets for each separated waste discharge from the plant *(See instructions, Item 14, Part II)*

14A. NAME OF SEPARATED WASTE DISCHARGE	B. TYPE OF DISCHARGE	C. NO. OF BATCH DISCHARGES PER DAY	D. AVERAGE GALLONS PER BATCH
Cooling water Surface drainage & boiler blowdown	(1) [X] Continuous (2) [ ] Batch	NA	NA

14. EQUIVALENT PRODUCTION UNIT AND AMOUNT PER OPERATING DAY OF PRODUCT ASSOCIATED WITH THIS DISCHARGE
NA

15. POINT OF DISCHARGE	16A. LATITUDE	17A. IF GROUND DISCHARGE, SPECIFY TYPE	17B. LOCATION OF DISCHARGE POINT TO SURFACE WATER BODY
A [ ] Sewer B [X] Surface Water Body C [ ] Ground	16B. LONGITUDE	(1) [ ] Irrigation (2) [ ] Injection Well (3) [ ] Pond (4) [ ] Other (Specify):	(1) DISTANCE FROM SHORE/BANK: 0 ft. (2) DEPTH BELOW SURFACE: 0 ft.

18. EFFLUENT SAMPLE COLLECTION AND ANALYSIS	A. SOURCE	B. FREQUENCY	C. ANALYSIS BY	D. SAMPLE DATE(S)
	(1) Grab Sample	(1) Daily	(1) In plant	(1)
	(2) Avg. Grab Sample	(2) Weekly	(2) Outside Lab	(2)
	(3) Composite Sample	(3) Monthly	(3) Gov't Agency (Name)	(3)
	(4) Continuous	(4) Other		(4)

19. WATER QUALITY INDICATORS *(where applicable)*

ITEM	A. INTAKE WATER BEFORE TREATMENT (1)	A. INTAKE WATER AFTER TREATMENT (2)	B. WASTE WATER EFFLUENT BEFORE TREATMENT (1)	B. WASTE WATER EFFLUENT AFTER TREATMENT (2)
a. FLOW (gal./day)				
b. pH				
c. TEMPERATURE (°F)				
d. COLOR (units)				
e. SPECIFIC CONDUCTANCE (μmhos/cm²)				
f. CHEMICAL ANALYSIS (mg/l.)				
(1) TOTAL SOLIDS				
(2) TOTAL VOLATILE SOLIDS				
(3) TOTAL SUSPENDED SOLIDS				
(4) TOTAL DISSOLVED SOLIDS				
(5) ACIDITY (as $CaCO_3$)				
(6) ALKALINITY (as $CaCO_3$)				
(7) 5-DAY BOD				
(8) COD				
(9) OIL AND GREASE				
(10) CHLORIDE				
(11) SULFATE				
(12) SULFIDE				
(13) PHENOLS				
(14) NH_3 (as N)				
(15) NO_3 (as N)				

ITEM	A. INTAKE WATER BEFORE TREATMENT (1)	A. INTAKE WATER AFTER TREATMENT (2)	B. WASTE WATER EFFLUENT BEFORE TREATMENT (1)	B. WASTE WATER EFFLUENT AFTER TREATMENT (2)
f. CHEMICAL ANALYSIS (cont.)				
(16) NO_2 (as N)				
(17) ORGANIC N				
(18) KJELDAHL				
(19) PHOSPHORUS-ORTHO (as P)				
(20) PHOSPHORUS-TOTAL (as P)				
(21) Cr				
(22) Cu				
(23) Fe				
(24) Cd				
(25) Pb				
(26) Mn				
(27) Zn				
(28) F				
g. OTHER CHARACTERISTICS (1) As				
(2) Hg				
(3) 29				
(4) 30				
(5) 31				
(6) 32				

20. CODED DESCRIPTION OF WASTE TREATMENT PROCESSES *(Enter code numbers from Appendix A of instructions, in the order in which treatment steps occur.)*

21. REMARKS

10000

NWT 002516

RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical Consultants
8050 S.W. Cirrus Drive
Beaverton, Oregon 97005
(503) 644-9141

March 26, 1987 PR-4334

Koppers Company Inc.
7540 N.W. St. Helens Road
Portland, OR 97229

Attn: John Oxford

SUBJECT: GEOTECHNICAL EXPLORATION
RAILROAD SPUR SETTLEMENT
PORTLAND, OR.

Dear Mr. Oxford:

This letter confirms your verbal authorization on March 25, 1987 for the subject work. As we discussed, our firm would perform a series of drilled borings as close as practical to the existing railroad tracks. Borings would be drilled approximately 30 feet on center over approximately a 500 foot long stretch of tracks (17 borings). Borings would be drilled and sampled to a depth of about 15 feet and would be for the sole purpose of developing subgrade parameters for the evaluation of rail track ballasting and support.

Borings will be drilled with a trailer mounted continuous flight auger, and will be sampled at approximately five foot intervals. Representative soil samples will be returned to our laboratory for testing. Our explorations will be limited to considerations of subgrade support and will not address groundwater quality or environmental assessment.

I have tentatively scheduled our field work to begin on Thursday, April 2, 1987. Our field work should require two and one-half to three days to complete. Our report would be

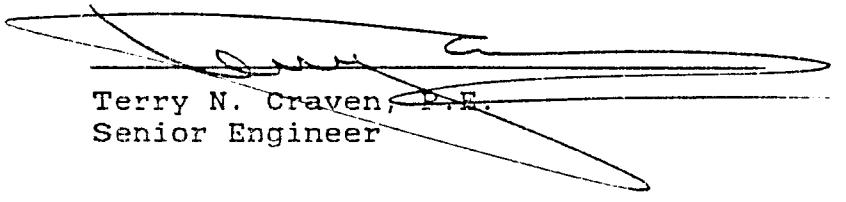
MAR 30 1987

available three weeks after we begin the field work. Preliminary verbal recommendations could be provided earlier.

The estimated costs necessary to complete the geotechnical exploration and report are $4900.00. All costs are based on our attached Schedule of Charges and General Conditions.

If you have any questions regarding this exploration, please contact the undersigned.

Respectfully submitted,
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.



Terry N. Craven, P.E.
Senior Engineer

RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical Consultants

8050 S.W. Cirrus Drive
Beaverton, Oregon 97005
(503) 644-9141

1986 Schedule of Charges and General Conditions

The compensation to RITTENHOUSE-ZEMAN & ASSOCIATES, INC. for our professional services is based upon the conditions set forth below.

PERSONNEL CHARGES

Charges for employees are determined by the hourly rates listed below. Time spent in either local or inter-city travel, when travel is in the interest of work, will be charged for in accordance with this schedule; when traveling by public carrier, a maximum charge of eight hours per day will be made.

Project Engineer/Geologist	$60/hour
Engineer/Geologist	50/hour
Senior Technician	50/hour
Technician	40/hour
Per Diem	50/day
Mileage	0.30/mile
Transportation by Public Carrier	Cost plus 10%
Printing, Reproduction, Permits, Telephone Calls, etc	At Cost
Outside Services or Subcontractors	Cost plus 10%

OVERTIME

Hours worked on any project in excess of eight hours per day or that are worked on Saturday or Sunday will be billed at 20% above the rates listed when these overtime hours are requested by the client or are reasonably necessary to meet job requirements.

BILLING

Invoices will be submitted once per month and are payable upon receipt unless otherwise agreed. Interest of 1 1/2% per month (but not exceeding the maximum allowable by law) will be added to any account not paid within 30 days. Any attorney's fees or other cost incurred in collecting any delinquent amount shall be paid by the Client.

TERMINATION

In the event that the Client requests termination of the work prior to completion, we reserve the right to complete such analyses and records as required to place our files in order as we consider necessary to protect our professional reputation. At our discretion, a termination charge may also be made to cover our proposal and administrative costs relating to the project.

RIGHT OF ENTRY

The Client is responsible to provide by map or drawing, a description of the property, its location and the location of any buried utilities or structures. Unless otherwise agreed, we will be furnished right-of-entry on the land to make planned borings, observations and other explorations. We will take reasonable precautions to minimize damage from use of equipment, but have not included in our fee the cost for restoration of damage which may result from our operations. If the Client desires us to restore the property to its former condition, we can accomplish this and add the cost to our fee.

(OVER)

SAMPLE RETENTION

All samples of soil and rock will be discarded 30 days after submission of our report unless the Client requests otherwise, in writing. Storage charges will be applied to any samples stored beyond 30 days.

OWNERSHIP OF DOCUMENTS

All designs, drawings, specifications, notes, data, sample materials, report reproducibles and other work developed by us are instruments of service and as such remain the property of RITTENHOUSE-ZEMAN & ASSOCIATES, INC. The Client agrees that all reports and other work furnished to the Client or his agents and assigns, which is not paid for, will be returned upon demand and will not be used for any purpose whatever. RITTENHOUSE-ZEMAN & ASSOCIATES, INC. will retain all pertinent summaries and reports relating to the services performed for a period of at least five years following submission of the report, during which period the records will be made available to the Client at all reasonable times. RITTENHOUSE-ZEMAN & ASSOCIATES, INC. reserves the right at any time to discard field notes, laboratory test sheets, calculation sheets, etc., which are included or summarized in said report.

GENERAL LIABILITY INSURANCE

RITTENHOUSE-ZEMAN & ASSOCIATES, INC. maintains General Liability Insurance for bodily injury and property damage with an aggregate limit of $500,000 per occurrence and we will furnish certificates of such insurance upon request. In the event the Client desires additional coverage of this type, we will upon the Client's written request, obtain additional insurance (if possible) at the Client's expense. Our liability to the Client for bodily injury or property damage arising out of work performed for the Client for which legal liability may be found to rest upon us, other than for professional errors and omissions, will be limited to our General Liability Insurance coverage.

LIMITATIONS OF PROFESSIONAL LIABILITY

Our findings, recommendations, specifications or professional opinions will be presented, within the limits prescribed by the Client, after being prepared in accordance with generally accepted professional engineering and geologic practice. We make no other warranty, either expressed or implied. For any injury or loss on account of any error, omission or other professional negligence, the Client agrees to limit RITTENHOUSE-ZEMAN & ASSOCIATES, INC. and/or its professional employees' liability to the Client and to all agents, contractors and subcontractors arising out of the performance of our professional services, such that the total aggregate liability to all those named shall not exceed $75,000 or our fee, whichever is greater. In the event that the Client does not wish to limit our professional liability to this sum, we will waive this limitation upon the Client's written request made at the time of the initial authorization on a given project, provided that the Client agrees to pay for this waiver an additional 5% of our total fee or $500 whichever is greater.

In the event the Client makes a claim against RITTENHOUSE-ZEMAN & ASSOCIATES, INC. and/or its professional employees, at law or otherwise, for any alleged error, ommission or other act arising out of the performance of our professional services, and the Client fails to prove such claim or prevail in an adversary proceeding, then the Client shall pay all costs incurred by RITTENHOUSE-ZEMAN & ASSOCIATES, INC. and/or its professional staff in defending itself against the claim.

KOPPERS

Interoffice Correspondence

To	J. A. Oxford	**From**	J. E. McFadden
Location	Northwest	**Location**	Monroeville
Subject	Soil Analysis	**Date**	May 1, 1987

Attached are copies of V. Romell's analysis of your soil samples.

J. E. McFadden

JEM/bjm

Attachments

cc: J. M. Dern
L. F. Flaherty

MAY 4

K-5 REV. 2

KOPPERS

Interoffice Correspondence

To	J. E. McFadden	From	Vaughn Romell
Location	Industrial Products	Location	Absorption Spectroscopy
Subject	Portland, Oregon-Soil (4420)	Date	April 27, 1987

Your soil samples 87-23-E and -F (AL-167432 and 167433) from Portland have been examined by solvent extraction-infrared spectral (IR) techniques for identification of organic contaminants.

Both samples were found to contain a small amount of carbon disulfide extractable material identified as creosote components (similar to a "whole" creosote). Also exhibited is a weak 3.4 micron absorption indicating the presence of aliphatic hydrocarbon (petroleum derived) structure (present in both extracts).

The aromaticity index (I_A) and creosote/oil ratio were calculated for both extracts with the following results:

Sample	I_A	Creosote/Oil Ratio*
Soil Sample Test Hole 2 ~~6~~ FT		
87-23-E	0.53	83/17
Soil sample Test Hole 4 FT.		
87-23-F	0.45	80/20

* The creosote/oil is calculated assuming a mixture of Grade 1 creosote and Nujol mineral oil is present.

Experimental

The samples as received were found to be very heterogeneous mixtures of liquid/solids; sampling was performed from the top of the containers as practical as possible. The samples were then extracted with CS_2. The CS_2 solutions were dehydrated by filtering the solutions through sodium sulfate; the solubles were evaporated and identified by IR.

Vaughn Romell

sjb
cc: D. W. Grandy
R. Obrycki
L. Whiteford
Files
cf

K-5 REV. 2

KOPPERS

Interoffice Correspondence

To	J. E. McFadden	From	Vaughn Romell
Location	Industrial Products	Location	Absorption Spectroscopy
Subject	Portland, Oregon (4420)	Date	April 27, 1987

Your samples of water and soil have been examined by carbon disulfide extraction-infrared spectral (IR) procedures for identification of organic contaminants. The results are as follows:

Your Sample No.	AL No.	Identification of Extracts
87-65-A (Water Sample)	168280	Polynuclear aromatic hydrocarbons (similar to a "whole" creosote) + minor aliphatic hydrocarbon (petroleum derived oil or other aliphatic material). I_A = 0.87. Creosote/oil Ratio* = 91/9.
87-65-B (Soil Sample S-2)	168281	Qualitatively identical to extracts from sample -A. I_A = 0.95. Creosote/oil Ratio* = 93/7.
87-65-C (Soil Sample S-1)	168282	Similar to samples -A and -B but rich in anthracene and carbazole (creosote crystals). I_A = 0.84. Creosote/oil Ratio* = 91/9.

* The creosote/oil ratio, calculated as a mixture of Grade 1 creosote and Nujol mineral oil, is intended to serve only as an estimate of the amount of aromatic (coal tar derived) species versus the non-aromatic (petroleum derived) species, assuming specific coal tar and petroleum sources.

Experimental

Portions of each sample were extracted with carbon disulfide; the carbon disulfide solutions were dehydrated via filtration through sodium sulfate. The CS_2 solubles were collected, evaporated (no heat), and identified by IR techniques.

Vaughn Romell

sjb
cc: D. W. Grandy
R. Obrycki
L. Whiteford
Files
cf

Form designed for use with elite (12-pitch) typewriter.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Pesticides Report For Pesticide-Producing Establishments

(Section 7, Federal Insecticide, Fungicide, and Rodenticide Act, as amended, 92 Stat. 829)

EPA

NOTE: Read all instructions before completing.
Information reported on this form is treated as BUSINESS CONFIDENTIAL.

Form Approved. OMB No. 2000-0029
Approval expires 1-31-88 PAGE OF

6. Establishment Duns Number: 02-773-4359
7. EPA Establishment Number: 00061-OR-001
8. EPA Establishment SIC Codes: 5161

ESTABLISHMENT NAME AND MAILING ADDRESS

1. Establishment Name	2. Street Name and Number or Postal Number		
KOPPERS COMPANY INC NORTHWEST	7540 N W STREET HELENS ROAD		
3. City		4. State	5. ZIP Code
PORTLAND		OR	97229

ESTABLISHMENT SITE ADDRESS

9. Street Name	10. City	11. State	12. ZIP Code
7540 N W STREET HELENS ROAD	PORTLAND	OR	97229
13. Signature of Establishment Officer	14. Title	15. Date (mo/day/yr)	16. Telephone
[signature]	Manager, Toxicology & Prod. Registration	0 2 2 8 86	412-227-2592

PESTICIDE PRODUCTION INFORMATION

A

17. Product Code [1] 18. EPA Product Registration Number 61-94
19. Product Name COAL TAR CREOSOTE
20. Product Classification [0][2] 21. Product Type [1] 21a. Specific Gravity (Liquids Only) ~~Stated as:~~ 1.080 ~~Kgs/Liter or~~ ~~Lbs/Gal~~
22. Market Produced For [2] 23. Use Classification [2]
24. Amount Produced Last Year [1985] 874972
25. Amount to be Produced This Year [1986] 400000
26. Amount Sold/Distributed Last Year [1985] US 2902028
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units [G]
Foreign 9

B

17. Product Code [ ] 18. EPA Product Registration Number 61-94
19. Product Name
20. Product Classification [ ][ ] 21. Product Type [ ] 21a. Specific Gravity (Liquids Only) ~~Stated as:~~
22. Market Produced For [ ] 23. Use Classification [ ]
24. Amount Produced Last Year [1985]
25. Amount to be Produced This Year [1986]
26. Amount Sold/Distributed Last Year [1985] US
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units [ ]
Foreign

C

17. Product Code [ ] 18. EPA Product Registration Number -
19. Product Name
20. Product Classification [ ][ ] 21. Product Type [ ] 21a. Specific Gravity (Liquids Only) ~~Stated as:~~
22. Market Produced For [ ] 23. Use Classification [ ]
24. Amount Produced Last Year [1985]
25. Amount to be Produced This Year [1986]
26. Amount Sold/Distributed Last Year [1985] US
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units [ ]
Foreign

D

17. Product Code [ ] 18. EPA Product Registration Number -
19. Product Name
20. Product Classification [ ][ ] 21. Product Type [ ] 21a. Specific Gravity (Liquids Only) ~~Stated as:~~
22. Market Produced For [ ] 23. Use Classification [ ]
24. Amount Produced Last Year [1985]
25. Amount to be Produced This Year [1986]
26. Amount Sold/Distributed Last Year [1985] US
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units [ ]
Foreign

E

17. Product Code [ ] 18. EPA Product Registration Number -
19. Product Name
20. Product Classification [ ][ ] 21. Product Type [ ] 21a. Specific Gravity (Liquids Only) ~~Stated as:~~
22. Market Produced For [ ] 23. Use Classification [ ]
24. Amount Produced Last Year [1985]
25. Amount to be Produced This Year [1986]
26. Amount Sold/Distributed Last Year [1985] US
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units [ ]
Foreign

FOR EPA USE ONLY

Continued on Attached Sheet [ ]

28. Signature	29. EPA Office	30. Date Received	31. Date Reviewed	32. Reporting Year
				1985

NWT 002525

Form designed for use with elite (12-pitch) typewriter.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Pesticides Report For Pesticide-Producing Establishments

(Section 7, Federal Insecticide, Fungicide, and Rodenticide Act, as amended, 92 Stat. 829)

EPA

NOTE: Read all instructions before completing.
Information reported on this form is treated as BUSINESS CONFIDENTIAL.

Form Approved. OMB No. 2000-0029
Approval expires 1-31-88 PAGE 1 OF 1

6. Establishment Duns Number: 02-773-4359

7. EPA Establishment Number: 00061-OR-001

8. EPA Establishment SIC Codes: 5161

ESTABLISHMENT NAME AND MAILING ADDRESS

1. Establishment Name	2. Street Name and Number or Postal Number		
KOPPERS COMPANY INC NORTHWEST	7540 N W ~~STREET~~ St. HELENS ROAD		
3. City		4. State	5. ZIP Code
PORTLAND		OR	97229

ESTABLISHMENT SITE ADDRESS

9. Street Name	10. City	11. State	12. ZIP Code
7540 N W ~~STREET~~ St. HELENS ROAD	PORTLAND	OR	97229
13. Signature of Establishment Officer	14. Title	15. Date (mo/day/yr)	16. Telephone
J. H. Butala	Manager, Toxicology & Product Registration	02 16 87	412-227-2592

PESTICIDE PRODUCTION INFORMATION

A

17. Product Code: 1 — 18. EPA Product Registration Number: 61-94
19. Product Name: COAL TAR CREOSOTE
20. Product Classification: 0 2 — 21. Product Type: 2 — 21a. Specific Gravity (Liquids Only) ~~stated as~~: 1.080 ~~kgs/liter or~~ ~~Lbs/Gal~~
22. Market Produced For: 2 — 23. Use Classification: 2
24. Amount Produced Last Year [1986] 843655
25. Amount to be Produced This Year [1987] 800000
26. Amount Sold/Distributed Last Year [1986] US 1329244 — Foreign 110000
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units: G

B

17. Product Code: — 18. EPA Product Registration Number: -
19. Product Name:
20. Product Classification: — 21. Product Type: — 21a. Specific Gravity (Liquids Only) ~~stated as~~: ~~kgs/liter or~~ ~~Lbs/Gal~~
22. Market Produced For: — 23. Use Classification:
24. Amount Produced Last Year [1986]
25. Amount to be Produced This Year [1987]
26. Amount Sold/Distributed Last Year [1986] US — Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units:

C

17. Product Code: — 18. EPA Product Registration Number: -
19. Product Name:
20. Product Classification: — 21. Product Type: — 21a. Specific Gravity (Liquids Only) ~~stated as~~: ~~kgs/liter or~~ ~~Lbs/Gal~~
22. Market Produced For: — 23. Use Classification:
24. Amount Produced Last Year [1986]
25. Amount to be Produced This Year [1987]
26. Amount Sold/Distributed Last Year [1986] US — Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units:

D

17. Product Code: — 18. EPA Product Registration Number: -
19. Product Name:
20. Product Classification: — 21. Product Type: — 21a. Specific Gravity (Liquids Only) ~~stated as~~: ~~kgs/liter or~~ ~~Lbs/Gal~~
22. Market Produced For: — 23. Use Classification:
24. Amount Produced Last Year [1986]
25. Amount to be Produced This Year [1987]
26. Amount Sold/Distributed Last Year [1986] US — Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units:

E

17. Product Code: — 18. EPA Product Registration Number: -
19. Product Name:
20. Product Classification: — 21. Product Type: — 21a. Specific Gravity (Liquids Only) ~~stated as~~: ~~kgs/liter or~~ ~~Lbs/Gal~~
22. Market Produced For: — 23. Use Classification:
24. Amount Produced Last Year [1986]
25. Amount to be Produced This Year [1987]
26. Amount Sold/Distributed Last Year [1986] US — Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units:

FOR EPA USE ONLY

Continued on Attached Sheet ☐

28. Signature	29. EPA Office	30. Date Received	31. Date Reviewed	32. Reporting Year
				1986

NWT 002526

Form designed for use with elite (12-pitch) typewriter.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Pesticides Report For Pesticide-Producing Establishments

EPA

(Section 7, Federal Insecticide, Fungicide, and Rodenticide Act, as amended, 92 Stat. 829)

NOTE: Read all instructions before completing.
Information reported on this form is treated as BUSINESS CONFIDENTIAL.

Form Approved. OMB No. 2000-0029
Approval expires 1-31-88 PAGE 1 OF 1

6. Establishment Duns Number	02-773-4359
7. EPA Establishment Number	00061-OR-001
8. EPA Establishment SIC Codes	5161

ESTABLISHMENT NAME AND MAILING ADDRESS

1. Establishment Name	2. Street Name and Number or Postal Number
KOPPERS COMPANY INC NORTHWEST	7540 N W STREET HELENS ROAD

3. City	4. State	5. ZIP Code
PORTLAND	OR	97229

ESTABLISHMENT SITE ADDRESS

9. Street Name	10. City	11. State	12. ZIP Code
7540 N W STREET HELENS ROAD	PORTLAND	OR	97229

13. Signature of Establishment Officer	14. Title	15. Date (mo/day/yr)	16. Telephone
John H. Butala [signature]	Toxicologist and Mgr., Occupational Health & Product Safety	02 09 88	412-227-2592

PESTICIDE PRODUCTION INFORMATION

A

17. Product Code: 1
18. EPA Product Registration Number: 61-94
19. Product Name: COAL TAR CREOSOTE

20. Product Classification	02	21. Product Type	2
22. Market Produced For	2	23. Use Classification	2

21a. Specific Gravity (Liquids Only) stated as: 1.080 kgs/Liter or Lbs/Gal

	Year	Amount
24. Amount Produced Last Year	1987	1,426,668
25. Amount to be Produced This Year	1988	1,250,000
26. Amount Sold/Distributed Last Year	1987 US	1,386,676
Foreign		26166

27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units: G

B

17. Product Code:
18. EPA Product Registration Number:
19. Product Name:

20. Product Classification: 21. Product Type: 21a. Specific Gravity (Liquids Only) stated as: kgs/Liter or Lbs/Gal
22. Market Produced For: 23. Use Classification:

24. Amount Produced Last Year 1987
25. Amount to be Produced This Year 1988
26. Amount Sold/Distributed Last Year 1987 US Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units

C

17. Product Code:
18. EPA Product Registration Number:
19. Product Name:

20. Product Classification: 21. Product Type: 21a. Specific Gravity (Liquids Only) stated as: kgs/Liter or Lbs/Gal
22. Market Produced For: 23. Use Classification:

24. Amount Produced Last Year 1987
25. Amount to be Produced This Year 1988
26. Amount Sold/Distributed Last Year 1987 US Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units

D

17. Product Code:
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19. Product Name:

20. Product Classification: 21. Product Type: 21a. Specific Gravity (Liquids Only) stated as: kgs/Liter or Lbs/Gal
22. Market Produced For: 23. Use Classification:

24. Amount Produced Last Year 1987
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26. Amount Sold/Distributed Last Year 1987 US Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units

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24. Amount Produced Last Year 1987
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26. Amount Sold/Distributed Last Year 1987 US Foreign
27. Unit of Measure: P=Pound G=Gallons K=Kilograms L=Liters T=Tons U=Units

FOR EPA USE ONLY Continued on Attached Sheet ☐

28. Signature	29. EPA Office	30. Date Received	31. Date Reviewed	32. Reporting Year
				1987

EPA Form 3540-16 (Rev. 1-85) Previous editions are obsolete.

86-119

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

JUN 3 1987

Interoffice Correspondence

To	L. F. Flaherty	From	Jordan M.Dern
Location	K-1750	Location	K-1928
Subject	NWNG Site Investigation	Date	June 1, 1987

The attached drawings indicate the location of soil borings and groundwater monitoring wells. Depending on specific setting, one well and two soil samples may be taken fron the old spray field.

I have spoken with Ed Bolen of NWNG and indicated our overall agreement with the plan.

Jordan M. Dern

Enclosure

cc: J. Oxford Northwest
M. Urbassik
T. Hays - K-1400

WILLAMETTE

BURLINGTON NORTHERN R.R.

N.W. ST. HELENS ROAD

SS-9

SS-10

SS-8

LEGEND

- SURFACE SOIL SAMPLE
- SEDIMENT SAMPLE
- SS-9 EXISTING SHALLOW SOIL SAMPLE

N E S W

0 100 200 300 400 500

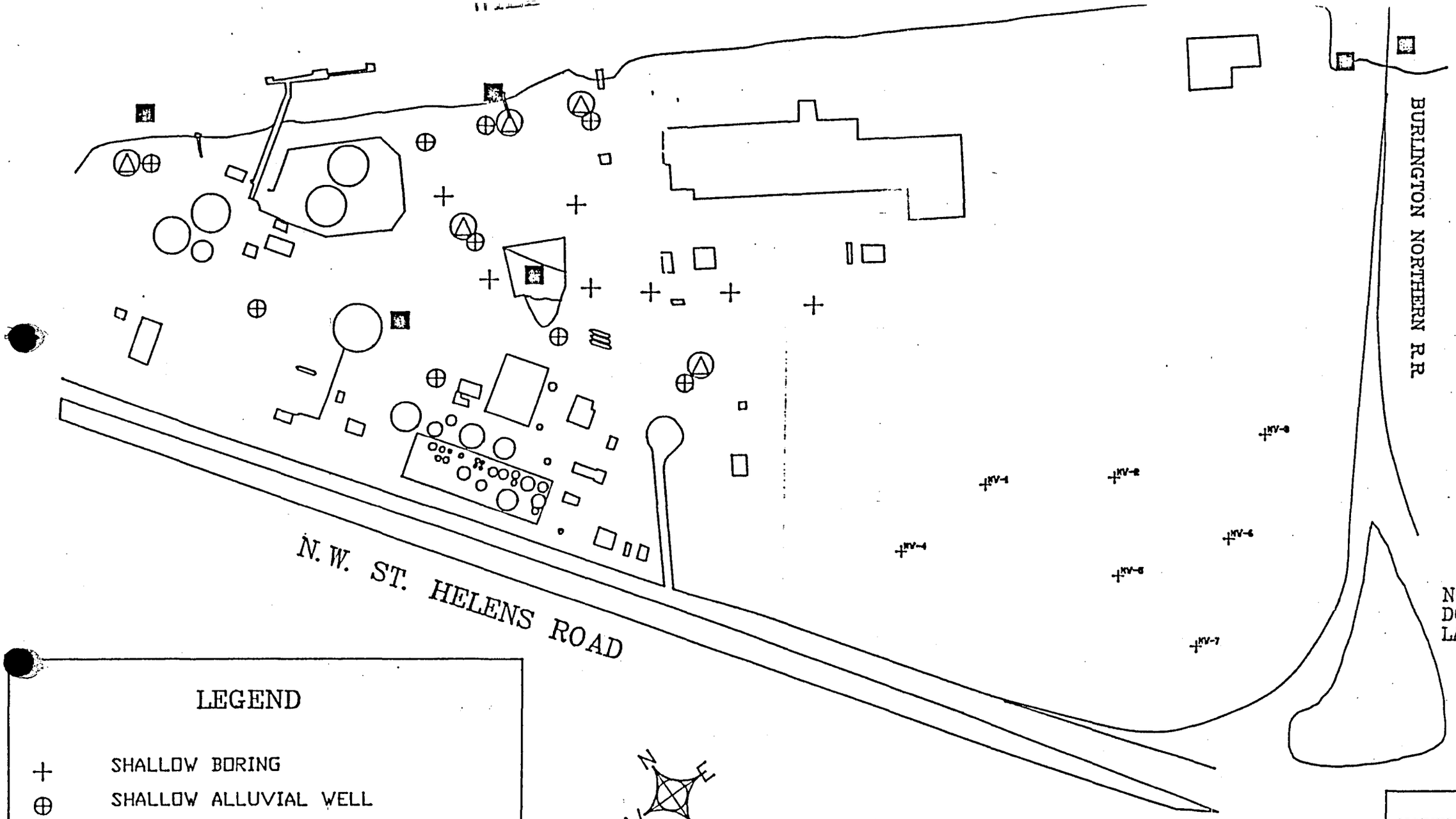
NORTH

PROPOS
SEL

CAMP DR

2300 13th S
SUITE 400

NWT 002529



LEGEND

- + SHALLOW BORING
- ⊕ SHALLOW ALLUVIAL WELL
- △ INTERMEDIATE ALLUVIAL WELL
- + MW-1 EXISTING MONITOR WELL
- ■ SURFACE WATER SAMPLE

NORTH DOANE'S LAKE SITE

PROPOSED BORING, WE
SURFACE WATER SAMPI

CAMP DRESSER & McKEE IN
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING REPORT

RAIL SPUR SETTLEMENT
PORTLAND, OREGON

PREPARED FOR:

KOPPERS COMPANY INC.

O-4334

APRIL 1987

RITTENHOUSE-ZEMAN & ASSOCIATES

Geotechnical Consultants

APR 20 2007

RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical Consultants
8050 S.W. Cirrus Drive
Beaverton, Oregon 97005
(503) 644-9141

April 15, 1987 O-4334

Koppers Company Inc.
7540 N.W. St. Helens Rd.
Portland OR 97229

Attn: John Oxford

SUBJECT: GEOTECHNICAL EXPLORATION
RAILROAD SPUR SETTLEMENT
PORTLAND, OR.

Dear Mr. Oxford:

This report summarizes the results of the subject geotechnical study, as authorized by you on March 25, 1987.

It appears that the observed settlement is the result of a combination of factors, including inadequate ballast thickness, poor subgrade soils and high ground water. If a new rail section is proposed we recommend 12 inches of ballast over 30 inches of sub-ballast over filter fabric over an undisturbed subgrade.

We are available to answer any questions you may have concerning this report and would be happy to assist you during construction phases of this project.

Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Terry N. Craven, P.E.

R. Warren Krager, Geologist

1.0 INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering study for the proposed railroad spur improvement project. The study was authorized by Mr. John Oxford of Koppers Company Inc. on March 25, 1987. The railroad spur location is illustrated on the attached Site Plan, Plate 1.

The purpose of our study was to explore subsurface conditions for the purpose of railbed support. The scope of our work consisted of drilling and sampling 15 borings at about 30 feet on center along the most heavily failed portion of track.

This study has been accomplished in accordance with generally accepted geotechnical engineering practice for the exclusive use of Koppers Company, Inc. and their agents, for specific application to the above described project.

2.0 SITE AND PROJECT DESCRIPTION

The railroad spur is located northeast of N.W. St. Helens Rd. between the Burlington Northern Railroad and the Koppers Company tank farm. The area of tracks identified by Kopper's representative as requiring repairs is approximately 500 feet long. The approximate location is shown on the Site Plan, Plate 1.

Although longitudinal settlements have occurred, the principal concern is differential settlement between the rails. Figure 1 illustrates the approximate magnitude of the problem. On Figure 1 we have shown "Track Tilt", which is defined as the relative difference in elevation between the two tracks at selected locations. These measurements were made with a carpenter's level and straight edge and should be considered

approximate only. They are intended to illustrate the relative magnitude of the distress.

3.0 SUBSURFACE CONDITIONS

Subsurface explorations were performed on April 2nd and 3rd, 1987. Explorations were drilled with a trailer mounted solid stem auger to depths of 15 to 20 feet. Borings were drilled along the rail spur at about 30 feet on center at locations requested by Koppers Company. Borings were logged by an experienced geologist from our Beaverton office. Approximate surface elevations are presented on Figure 2. Elevations are based on an arbitrary reference of elevation 0.0 at B-12.

Borings indicated variable rail support as outlined below. Boring logs are attached.

Ballast: Ballast thicknesses encountered ranged from 10 inches to in excess of three and one half feet. Thicknesses are illustrated on Figure 3. Thicknesses are measured from the ground surface and actual thickness below ties is likely to be eight or nine inches less than the values shown. Ballast generally consisted of two inch minus rounded to subrounded gravel. In many areas the lower portion of the ballast contained large amounts of silt, probably indicating intrusion by soft subgrade soils (herein after referred to as dirty ballast). In a few areas, most notably where ballast thicknesses exceed about two feet, the lower portion of the ballast consisted of larger fractured rock. This may be the result of attempts to stabilize soft areas of subgrade at the time of initial rail construction.

Subgrade Soils: Subgrade soils were found to consist of variable, soft to stiff silts and sandy silts. Portions of the

alignment were underlain by up to 10 feet of fill, but in general the fills consisted of the same type of soil as native. Fills were generally indistinguishable from native soils except for soil fabric or occasional non-soil inclusions. In four borings organic topsoil or wood was encountered in the fill or at the boundary between fill and native soil.

Groundwater: Groundwater was encountered at depths ranging from 3 to 10 feet, but soil coloration indicated that ground water levels may approach the ground surface during prolonged wet weather.

4.0 CONCLUSIONS AND RECOMMENDATIONS

As discussed previously, Figure 1 illustrates approximate track tilt adjacent to each boring location. Track tilt is defined as the difference in surface elevation between the two rails at a specified location. This is considered to be the best measure of the type of rail distress that is a concern on this project. Track tilt was measured with a straight edge and carpenter's level and should be considered approximate only. Figure 2 illustrates approximate surface elevations at each boring location, and Figure 3 illustrates general subsurface conditions including ballast thickness and depth to ground water. As discussed previously, ballast thickness was measured from the ground surface and the thickness below ties is likely to be eight or nine inches less than the value shown.

As would be expected, comparisons of these three figures show a moderate correlation between track tilt and shallow ground water. Surprisingly there appears to be little or no correlation between ballast thickness and track tilt, although this effect is masked somewhat by the fact that the areas of thicker ballast tended to also have the highest ground water

levels and the ballast tended to contain large amounts of silt at depth (dirty ballast). The silt intrusion may indicate that the ballast in these areas pushed down into a soft subgrade at the time of construction or that prior settlement and reballasting has been performed in these locations.

We performed preliminary calculations of required ballast thickness in general accordance with the method developed by Talbot, and referenced by the AREA Manual for Railway Engineering. Based on a C.B.R. value of 1.0 for uncompacted silts, and a typical rail car wheel loading of 30 kips, a ballast layer of 3.0 to 4.0 feet would be appropriate for this site, with adequate drainage.

Based on the above comments we believe that the observed rail distress has resulted from a combination of factors including:

- Insufficient ballast thickness;
- Inadequate subsurface drainage;
- Intrusion into the ballast by underlying soft silts;
- Lateral shifting of ballast due to its rounded character;
- Consolidation of native silts under static railcar loads;
- Deterioration of wood/organics in fill underlying ballast;
- Possibly frost action.

Although the retaining wall near this track has rotated somewhat it does not appear that it has influenced the railroad track. It is possible, however, that if this wall undergoes significant rotation or failure it could cause major track distress. We would recommend that the causes of this wall movement be investigated.

Rail settlements are often progressive. As settlements become noticeable, effective loads increase due to eccentric loading conditions and dynamic wheel loads at the irregular areas. We concur with your judgment that repairs are necessary. Repairs can consist of either reballasting the existing track or construction of a new structural section. Although reballasting is a common approach it is normally only a temporary solution and periodic maintenance should be anticipated. If soft subgrade soils and dirty ballast are not removed it is probable that soft silts will eventually progress upward into new ballast. If reballasting should be selected as a remedy, the life to next maintenance could be extended by improving subsurface drainage at the same time. We understand that it is your present intent to reconstruct the railbed section and the remainder of our report is directed to that objective. We would be happy to discuss reballasting with you if desired.

5.0 NEW RAILBED SECTION

Based on the existing soft soil conditions we recommend that that the frequently applied dynamic subgrade stress not exceed about 1500 psf. For normal rail spur loading conditions (normal wheel load not exceeding 30 kips and max. speed of 5 mph) this would require about 3.5 feet of ballast below the ties. This could consist of 12 inches of crushed rock ballast over 30 inches of sub-ballast. Typical specifications for ballast and sub-ballast materials are attached. Both ballast and sub-ballast should be compacted to at least 95% relative compaction based on the modified AASHTO test method (T-180). In addition we recommend that a filter fabric (Fibretex 150 or equal) be placed between the sub-ballast and native soil to reduce silt infiltration due to internal erosion or pumping.

Prior to installing sub-ballast or filter fabric all existing dirty ballast, organic soils and underlying soft, disturbed subgrade soil should be removed. We expect that the depth of excavation necessary to install the required thickness of ballast will normally result in the removal of all existing dirty ballast or softened soil, but occasional deeper areas may be encountered. Of particular concern is the area near B-4 where substantial amounts of wood and interspersed voids were encountered in the upper 10 feet. In addition, care will be required during excavation to avoid causing further subgrade disturbance.

We also recommend that subsurface drainage be provided by installing at least one perforated drain pipe at the bottom of the sub-ballast. This pipe should drain by gravity to a suitable disposal away from the tracks. The above comments are illustrated on Figure 4.

We emphasize that ballast designed in accordance with AREA methods is intended to provide reasonably good service under most conditions. However it is not practical to construct a rock ballast that will be totally maintenance free. The possibility of some future need for releveling should be anticipated, but based on the apparently long performance of the existing section we believe that the proposed design should provide relatively trouble free performance for many years.

An alternative to the above solution, that would require less excavation consists of supporting the tracks on a concrete slab, probably 12 to 18 inches thick. The design of such a slab is beyond the scope of our current work, but we would be happy to pursue this solution if desired.

6.0 CHEMICAL CONTAMINATION

As we discussed with you, and as noted on our boring logs, it is possible that some ground contamination exists at this site. Representative soil samples have been turned over to you for analysis. We emphasize that our study is limited to soil support considerations and we neither sampled for nor tested for possible chemical contamination. Soil exploration borings were drilled using standard soil sampling techniques and no attempt was made to prevent the possible introduction of minor amounts of oil due to drilling procedures, nor to eliminate cross contamination between exploration holes.

If contamination exists it could affect design solutions concerning both disposal of excavated soil and subsurface drainage provisions (including suitable materials for drain pipes and suitable disposal locations for subsurface water). RZA has a highly competent chemical waste department if you wish assistance in this area.

7.0 FUTURE GEOTECHNICAL SERVICES

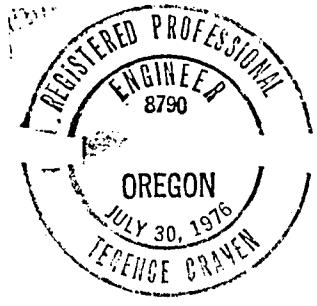
The recommendations contained in this report are based on information gathered during our field and laboratory study, and on design information provided by Koppers Company. We have not yet received a detailed copy of the plans for this project. We recommend that we be provided an opportunity to review the final plans and specifications when they become available. This will allow us to determine whether any change in concept may have affected the validity of our recommendations, and whether our recommendations have been correctly interpreted.

In order to correlate preliminary soil data with actual soil conditions encountered during construction and to check for construction conformance to our report, we also recommend that

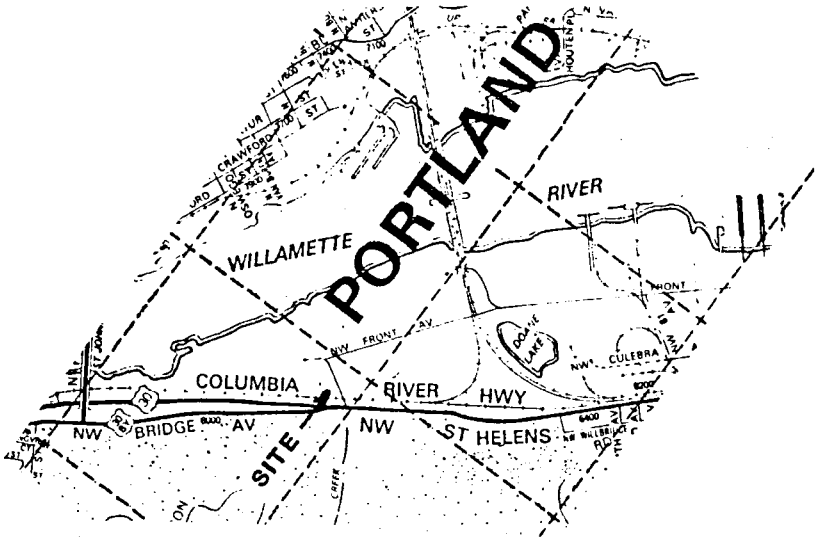
we be retained for construction observation of stripping, grading, compaction and other soils related portions of this project.

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

R. Warren Krager, Geologist



Terry N. Craven, P.E.



TANK

WALL

B-1 B-2 B-3 B-4 B-5 B-6 B-7 B-8 B-9 B-10 B-11 B-12 B-13 B-14 B-15

B-9 Approximate Boring Locations

Borings Spaced Approximately 30 Feet Apart

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical Consultants
8050 S.W. Cirrus Drive
Beaverton, Oregon 97005

RZA

KOPPERS CHEMICAL

SITE PLAN PLATE 1

W.O. O-4334
By SA
Date APRIL 1987
Scale NTS

NWT 002541

TRACK TILT
KOPPERS CHEMICAL

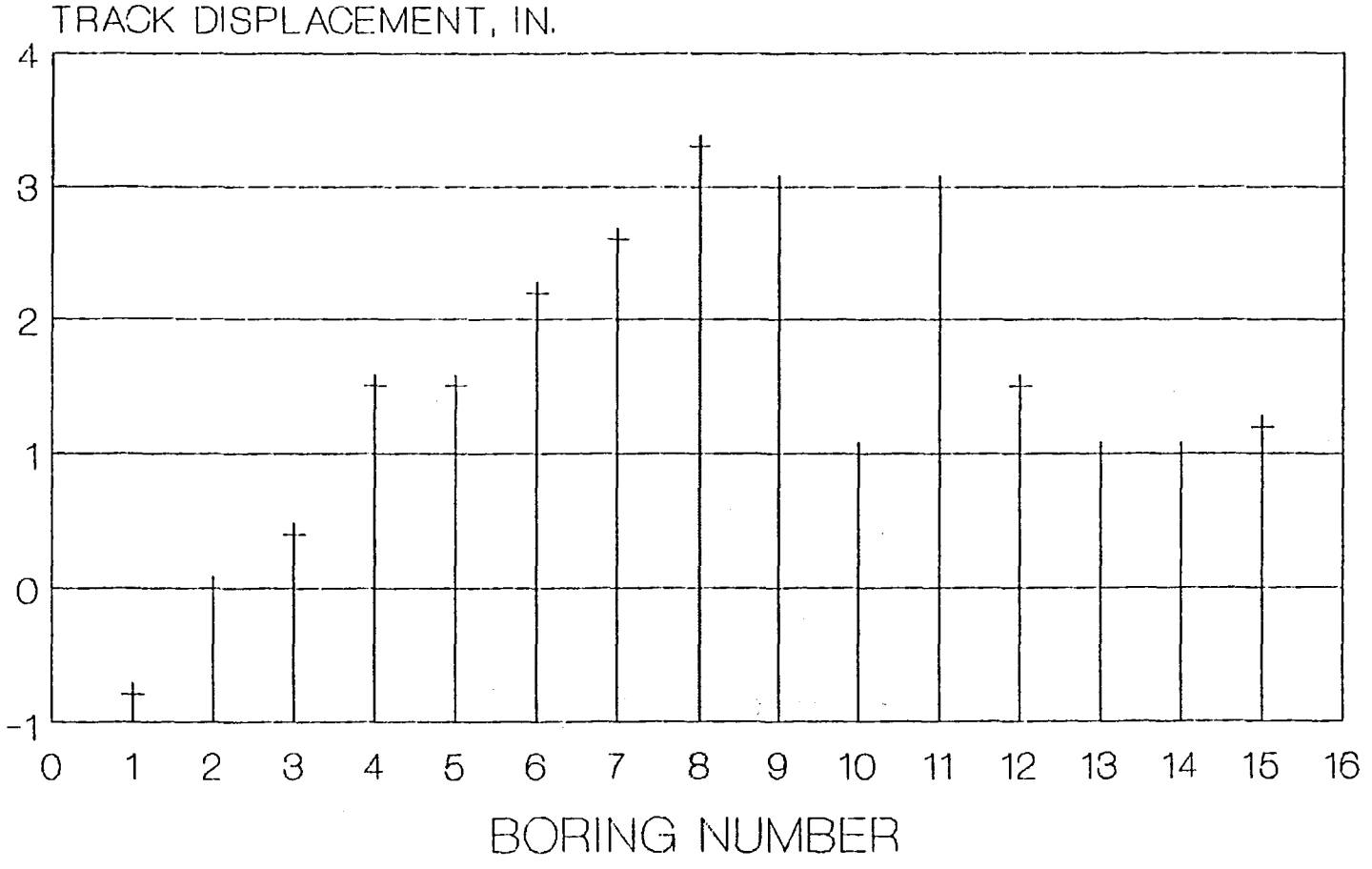


Figure 1.

NWT 002542

BORING ELEVATION
KOPPERS CHEMICAL

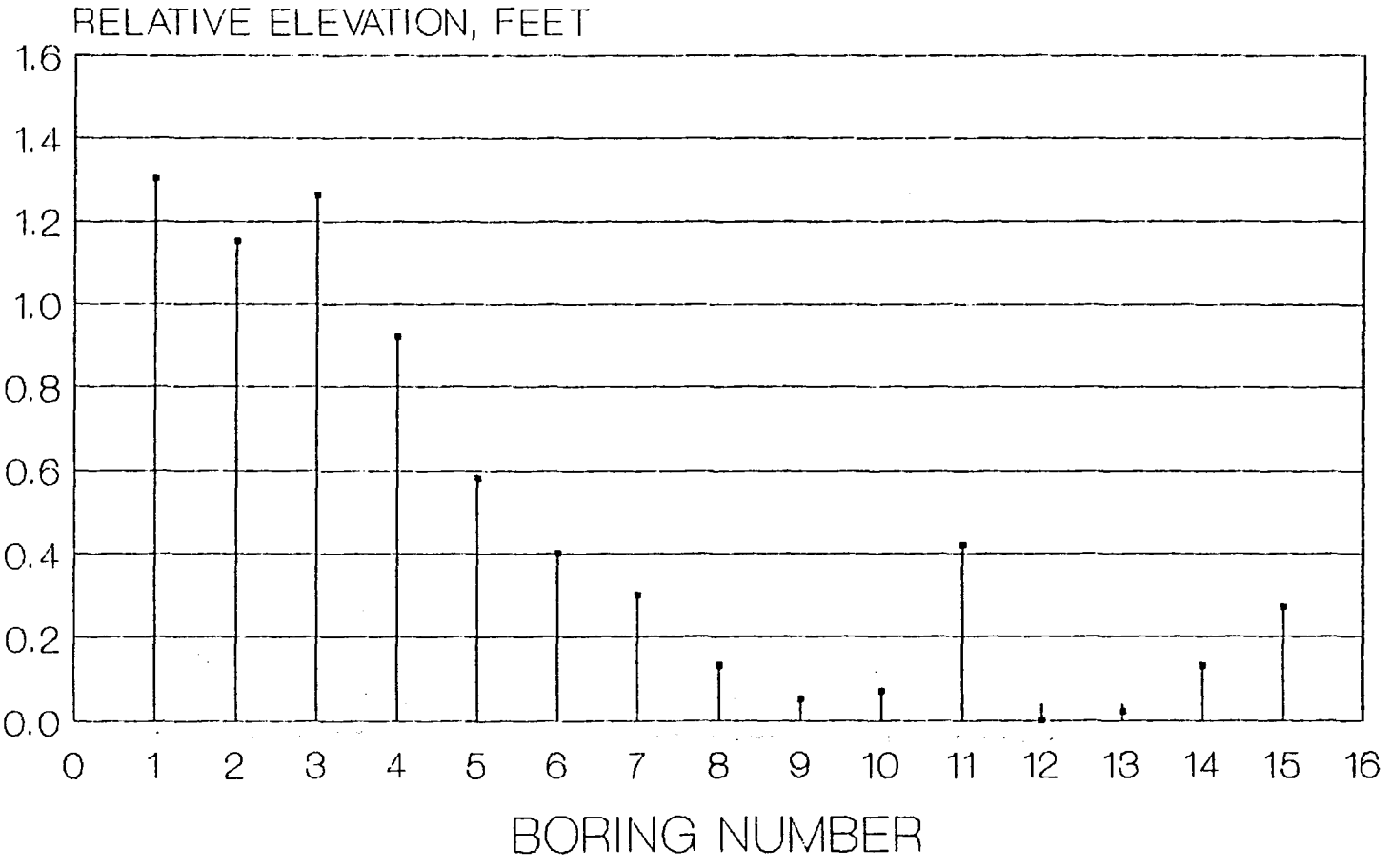


Figure 2.

NWT 002543

BALLAST & GROUND WATER
KOPPERS CHEMICAL

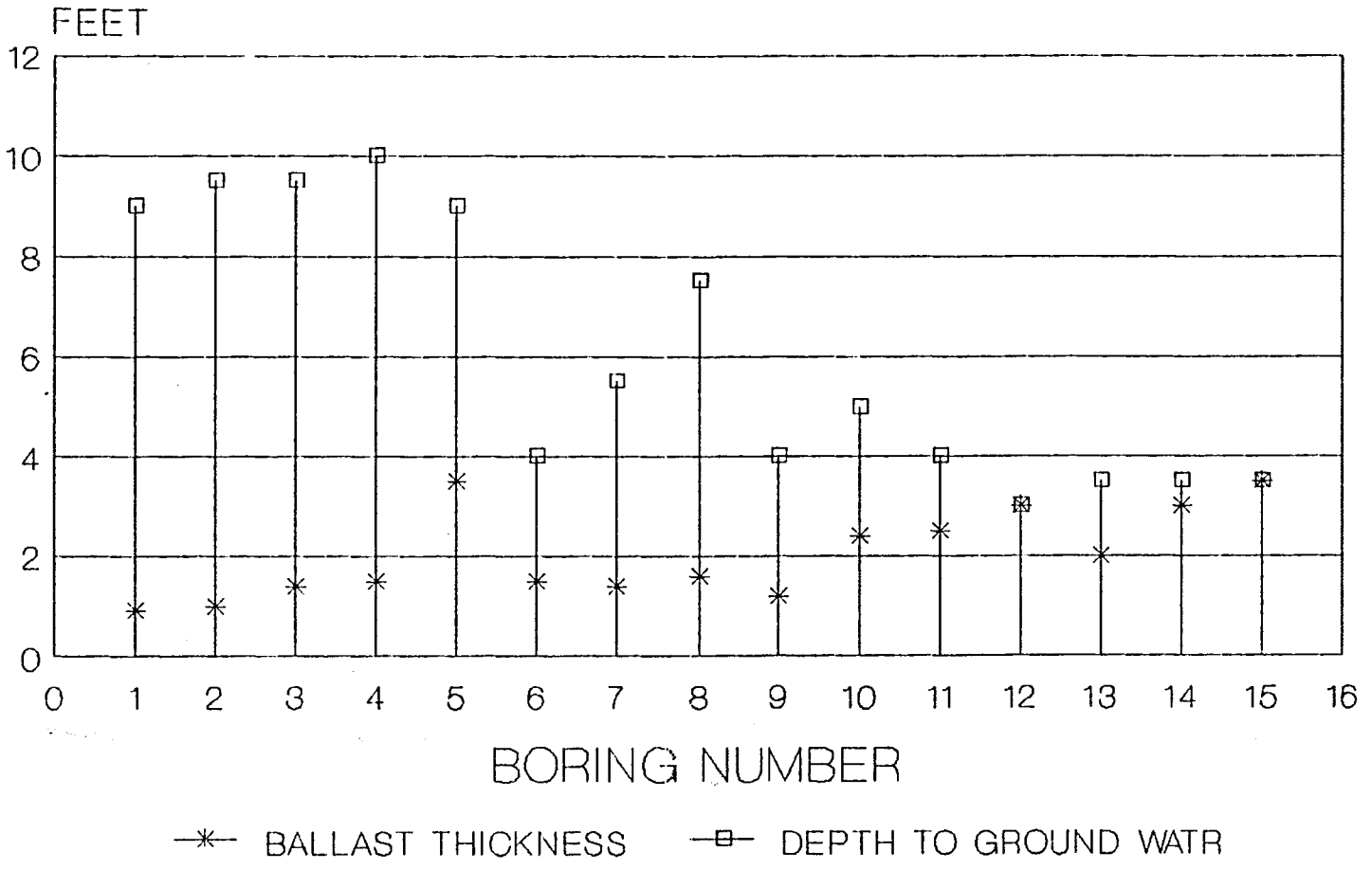


Figure 3.

NWT 002544

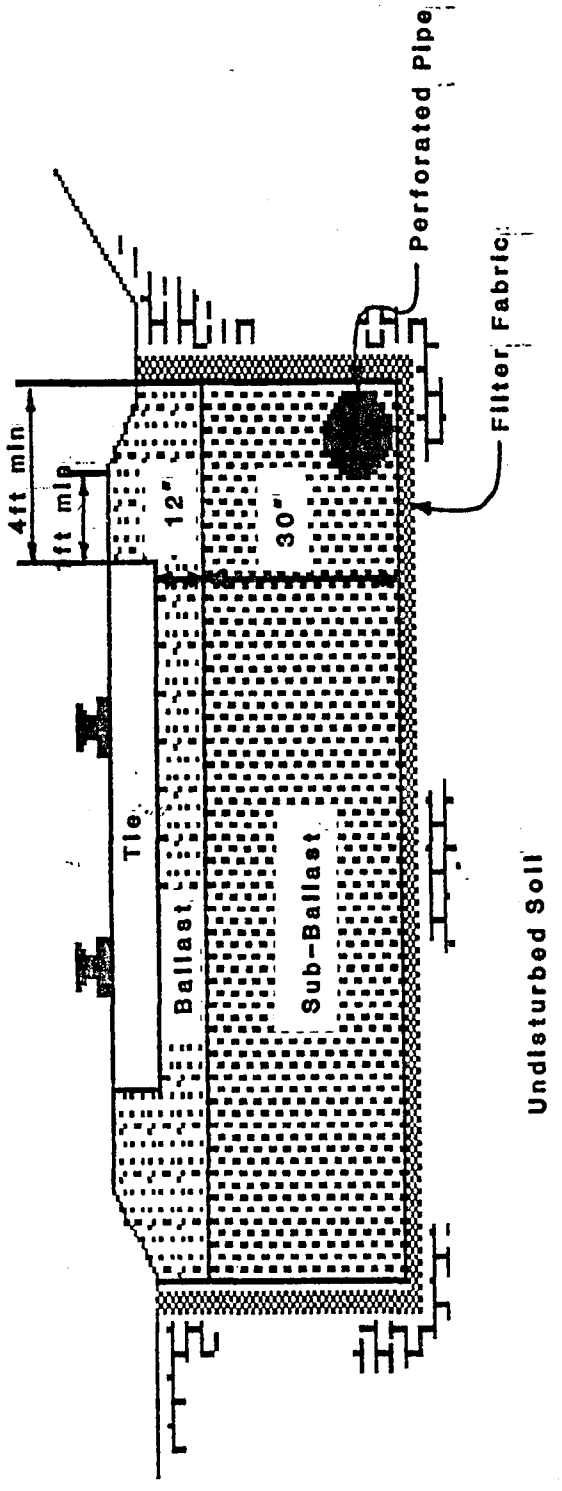


Figure 4

W.O. _____

By _____

Date _____

Scale _____

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Geotechnical Consultants

8050 S.W. Cirrus Drive

Beaverton, Oregon 97005

RZA

MATERIAL FOR BALLAST AND SUB-BALLAST

Ballast shall consist of crushed stone conforming to OSHD Standard Specifications (1984) Section 703.12 for Asphalt Macadam Aggregates, designated size 1 1/2"-3/4", unless otherwise approved by the engineer.

Sub-ballast shall consist of crushed stone conforming to OSHD Standard Specifications (1984) for Aggregate Subbase, Section 703.06, with the following additional specifications:

- Material shall have at least one mechanically fractured face on 70% (by weight) of the material retained on a 1/4 inch sieve and 50% (by weight) of the 1/4" to No. 10 material.

- Gradation shall fall within the following ranges unless otherwise approved by the engineer.

Sieve Size	Percent Passing by Weight
2"	100
1"	90-100
3/8"	50- 85
No. 10	25- 50
No. 40	10- 30
No. 200	0- 10

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Crushed rock, some SILT.			
5	Stiff to medium stiff, damp to wet, medium gray and brown mottled SILT (FILL).			
10			▽	
15	Medium stiff, wet, medium gray to gray-brown SILT to sandy SILT.			
	Bottom of boring at 16.5'.			
20				

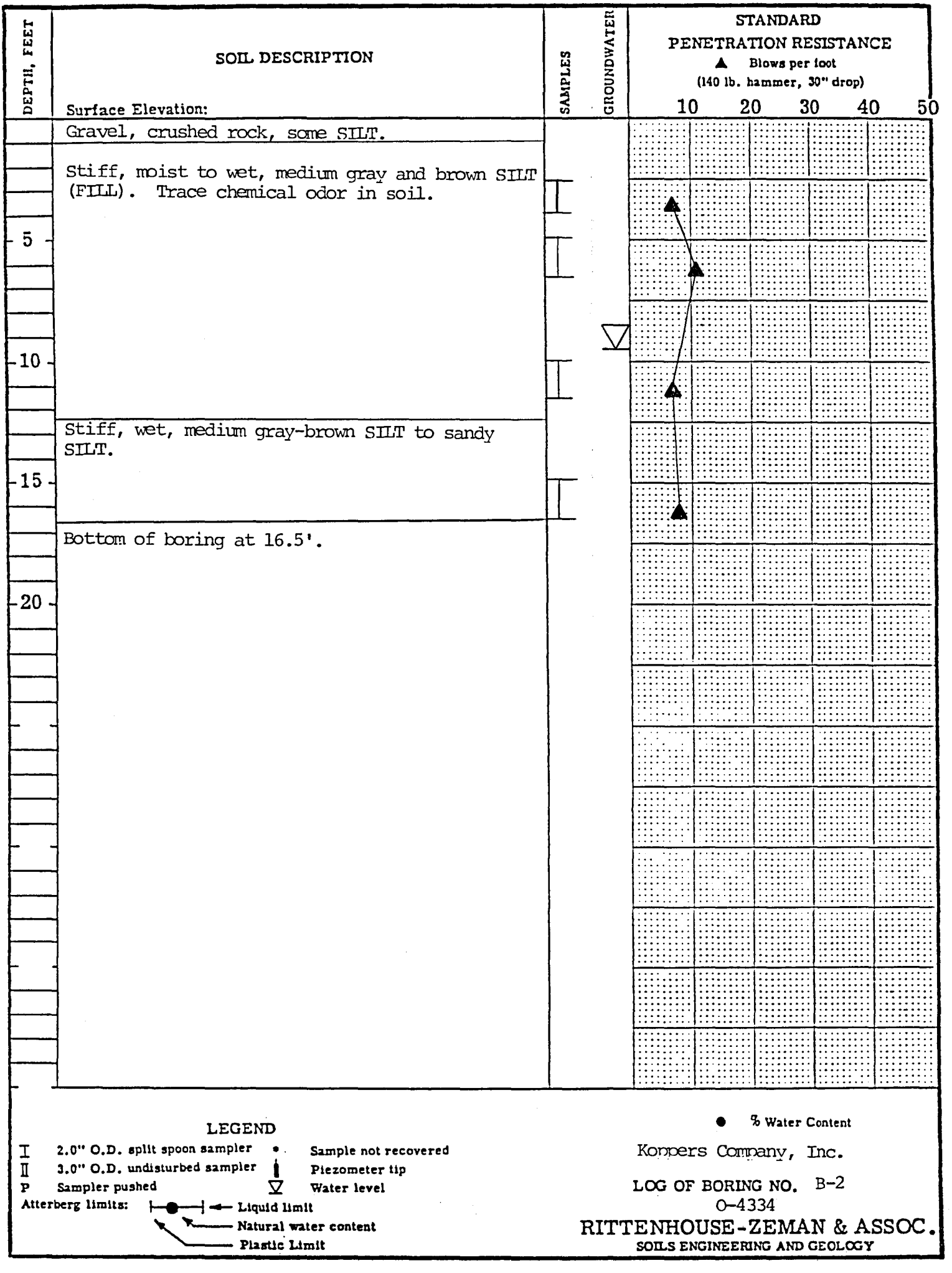
LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Atterberg limits: Liquid limit, Natural water content, Plastic Limit
• Sample not recovered
Piezometer tip
▽ Water level
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-1
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY


DEPTH, FEET
SOIL DESCRIPTION
Surface Elevation:
SAMPLES
GROUNDWATER
STANDARD
PENETRATION RESISTANCE
▲ Blows per foot
(140 lb. hammer, 30" drop)
10
20
30
40
50
Gravel, crushed rock, some SILT.
Stiff, moist to wet, medium gray and brown SILT (FILL). Trace chemical odor in soil.
Stiff, wet, medium gray-brown SILT to sandy SILT.
Bottom of boring at 16.5'.
5
10
15
20
LEGEND
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Sample not recovered
Piezometer tip
Water level
Atterberg limits:
Liquid limit
Natural water content
Plastic Limit
● % Water Content
Koppers Company, Inc.
LOG OF BORING NO. B-2
0-4334
RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 002548

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel railroad ballast.			
	Stiff, damp to wet, medium gray and gray-brown SILT (FILL). Some organics present.			
5				
10			▽	
	Stiff, wet, medium brown, medium gray, sandy SILTS, silty SANDS.			
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

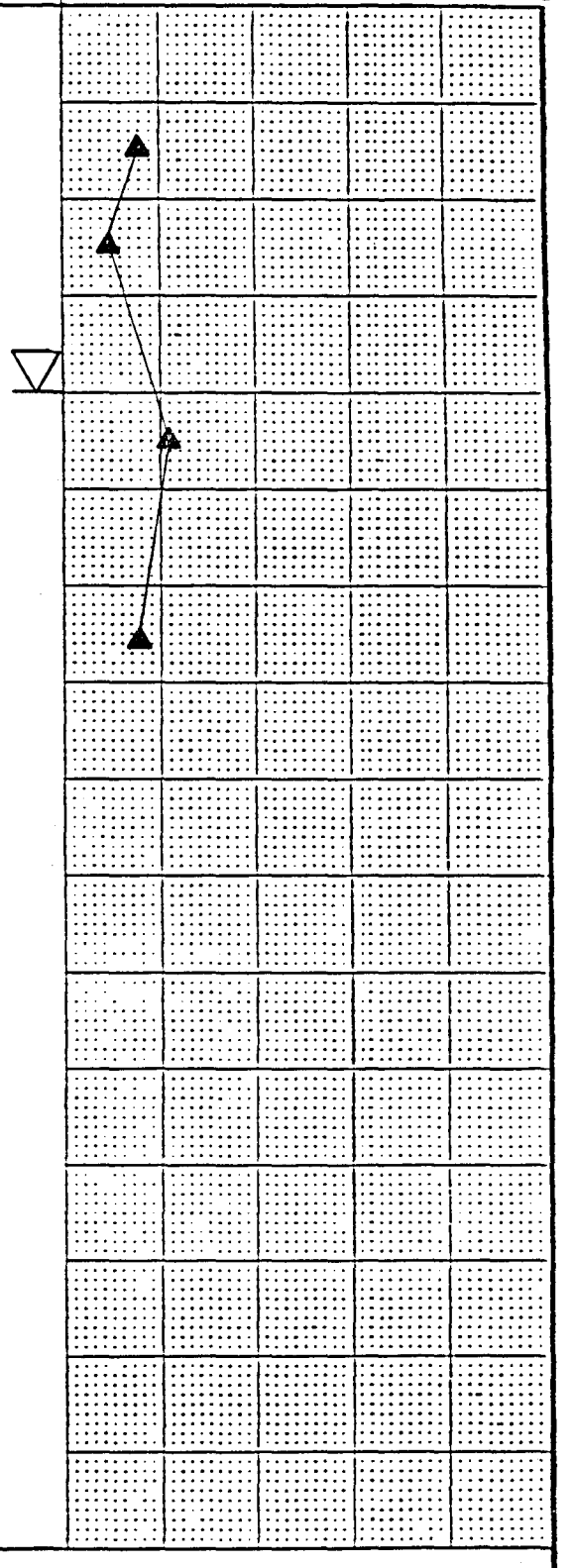
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Atterberg limits: Liquid limit, Natural water content, Plastic Limit
• Sample not recovered
Piezometer tip
▽ Water level
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-3
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel ballast, some organic SILTS.			
5	Stiff, moist to wet, medium gray, medium brown SILT (FILL). Wood debris between 5-10'. Voids of about 1' encountered at 7.0'.			
10			▽	
15	Stiff, wet, medium brown mottled SILT and sandy SILT.			
20	Bottom of boring at 16.5'.			



LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-4
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Asphalt, rock base, stiff damp, dark gray SILT with some larger rock to about 3.5'. Two previous starts on B-5 encountered inpenetrable ballast at 3.0'.			
5	Stiff, moist to wet, medium gray-brown mottled SILT.	I	▽	▲
10		I		▲
	Stiff, wet, medium brown SILT and sandy SILT.			
15		I		▲
	Bottom of boring at 16.5'.			
20				

LEGEND

I	2.0" O.D. split spoon sampler	•	Sample not recovered
II	3.0" O.D. undisturbed sampler		Piezometer tip
P	Sampler pushed	▽	Water level

Atterberg limits: ⊢●⊣ ← Liquid limit; ← Natural water content; ← Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-5
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravels. Below 1.5' dark gray SILT with some gravels.			
5	Medium stiff to stiff, wet, medium gray and brown mottled SILT, sandy SILT.			
10				
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

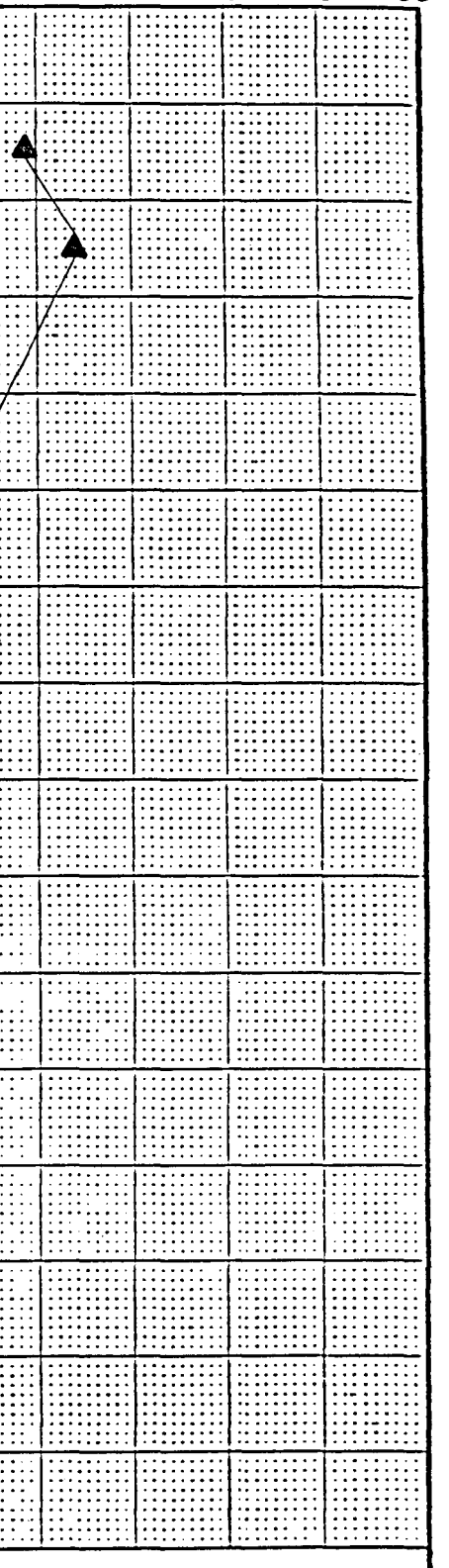
Koppers Company, Inc.

LOG OF BORING NO. B-6
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER
	1-2" rounded gravel ballast, some gray SILT.		
5	Stiff, moist to wet, dark gray SILT with some gravels.		
10	Stiff to medium stiff, wet, medium brown and gray mottled sandy SILT.		
15			
20	Bottom of boring at 16.5'.		

STANDARD PENETRATION RESISTANCE
▲ Blows per foot
(140 lb. hammer, 30" drop)
10 20 30 40 50



LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-7
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel ballast some dark gray SILT.			
	Medium stiff, damp, dark gray organic clayey SILT with some rock to 3.5'.			
5	Stiff, damp to wet, gray-brown-rust mottled SILT, sandy SILT, some lenses of sand. Cleaner sand lenses contain chemical residue. Oil product appears to float on ground water.		▽	
10				
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-8
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	1-2" rounded gravel railroad ballast some black SILT.			
	Medium stiff, moist to wet, dark gray, black sandy SILT. Some gravels. Petroleum product saturated below 3.5'.		▽	
5				
	Stiff, wet, medium gray sandy SILT.			
	Oily substance visible on all samples and auguer flights.			
10				
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-9
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 002555

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel ballast, some dark gray SILT some larger diced rock present below 1.5'.			
5	Stiff, wet, dark gray and brown SILT and gray silty SAND.		▽	
	Petroleum product visible on samples and auger flights below about 3.5'.			
10		I		▲
15		I		▲
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-10

O-4334

RITTENHOUSE-ZEMAN & ASSOC.

SOILS ENGINEERING AND GEOLOGY

NWT 002556

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel ballast with some dark gray to black sandy SILT matrix, some larger diced rock present below 1.5'.			
	Loose, wet, silver gray, oily, silty SAND (FILL) Petroleum/creosote odor. Ground water at 4'.		▽	
5	Soft, wet, black organic SILT, some roots (TOPSOIL).	I		Water sample obtained after drilling at 3.8' depth.
	Medium stiff to stiff, moist to wet, greenish-brown to dark gray SILT to sandy SILT. Note: Oily sheen and slight petroleum/creosote odor noted on samples.			
10		I		
15		I		
	End of boring at 16.5'.			
20				
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Atterberg limits: ⊢●⊣ Liquid limit; Natural water content; Plastic Limit
• Sample not recovered
Piezometer tip
▽ Water level
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-11

O-4334

RITTENHOUSE-ZEMAN & ASSOC.

SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	1-1 1/2" rounded gravel ballast			
	2" rounded to diced gravel ballast with silty sandy matrix. Ground water encountered at 3',		▽	
5	Soft, wet, gray-black (with silver gray sheen) oily organic SILT. Petroleum/creosote odor (FILL?).	I		
	Stiff, moist, mottled greenish-gray with brown SILT, some sand.			
	Note: Creosote odor and oily sheen on samples.			
10		I		▲
15		I		▲
	End of boring at 16.5'.			
20				
25				
30				
35				
40				

LEGEND

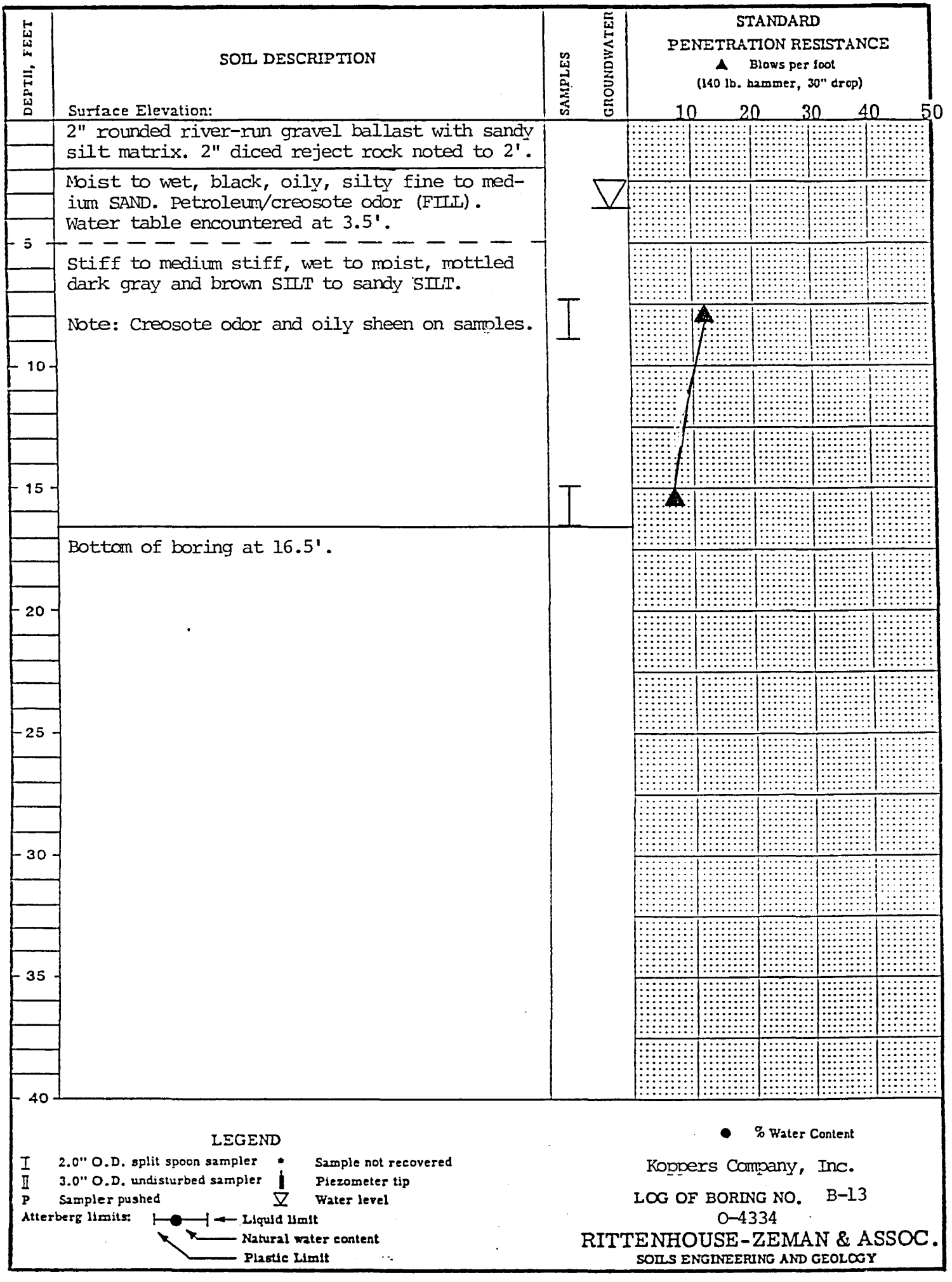
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-12
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY


DEPTH, FEET
SOIL DESCRIPTION
Surface Elevation:
SAMPLES
GROUNDWATER
STANDARD
PENETRATION RESISTANCE
▲ Blows per foot
(140 lb. hammer, 30" drop)
10 20 30 40 50
2" rounded river-run gravel ballast with sandy silt matrix. 2" diced reject rock noted to 2'.
Moist to wet, black, oily, silty fine to medium SAND. Petroleum/creosote odor (FILL).
Water table encountered at 3.5'.
5
Stiff to medium stiff, wet to moist, mottled dark gray and brown SILT to sandy SILT.
Note: Creosote odor and oily sheen on samples.
10
15
Bottom of boring at 16.5'.
20
25
30
35
40
LEGEND
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
Water level
Atterberg limits:
Liquid limit
Natural water content
Plastic Limit
● % Water Content
Koppers Company, Inc.
LOG OF BORING NO. B-13
O-4334
RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	2" rounded (river-run) gravel ballast with oily black silty matrix to 2" diced rock ballast. Water table encountered at 3.5'.		▽	
5	Wet, black to silver-gray oily, silty fine to medium SAND (FILL). Creosote odor.	I		
	Medium stiff, moist to very moist, mottled greenish-gray with brown SILT to sandy SILT.			
	Note: Oily splotches or seams evident in sandy lenses of samples and petroleum/creosote odor.			
10		I		▲
15		I		▲
20		I		▲
	Bottom of boring at 21.5'.			
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-14
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 002560

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	1-2" rounded river-run gravel ballast with oily black, sandy SILT.			
	4" diced rock ballast with oily black, fine to medium SAND (FILL).			
5	Bottom of boring at 3.5' due to inpenetrable conditions caused by large ballast clast size and caving conditions. Note: Four attempts to penetrate ballast in this area were unsuccessful.			
10				
15				
20				
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-15

O-4334

RITTENHOUSE-ZEMAN & ASSOC.

SOILS ENGINEERING AND GEOLOGY

DATA PACKAGE FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

Northwest Natural Gas Company
Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

July 22, 1996

HAHN AND ASSOCIATES, INC.
Environmental Management

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DATA PACKAGE FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY

Northwest Natural Gas Company
Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

July 22, 1996

Prepared for:

Northwest Natural Gas Company
Portland, Oregon

Prepared by:

Hahn and Associates, Inc.
Portland, Oregon

Project #2708

NWT 002563

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NWT 002564

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TABLE 1 - Summary of Water Level Measurements and Groundwater Elevations

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Elevation of Top of Casing

Date of Elevation Survey	Elevation of Top of Casing (feet msl)*															
	MW-1-22	MW-2-32	MW-3-26	MW-3-56	MW-4-35	MW-4-57	MW-5-32	MW-6-32	MW-6-61	MW-8-29	MW-8-56	MW-9-29	MW-10-25	MW-10-61	MW-11-32	MW-12-36
7-Dec-95	34.75	34.46	34.11	34.07	34.54	34.53	27.83	35.51	34.50	39.09	39.13	37.65	39.22	39.33	38.39	38.69

Measured Water Level

Date Measured	Measured Water Level (feet btc)															
	MW-1-22	MW-2-32	MW-3-26	MW-3-56	MW-4-35	MW-4-57	MW-5-32	MW-6-32	MW-6-61	MW-8-29	MW-8-56	MW-9-29	MW-10-25	MW-10-61	MW-11-32	MW-12-36
5-Dec-95	14.15	15.23	15.58	15.79	16.12	16.39	9.46	16.71	15.77	19.75	20.61	6.20	14.98	13.42	12.69	9.37
5-Jan-96	14.47	20.04	19.47	21.85	22.47	22.38	15.57	14.84	21.58	19.01	26.74	7.33	15.20	16.32	12.19	10.82
12-Feb-96	7.74	8.61	8.52	8.63	9.09	9.10	2.41	9.55	8.97	16.99	13.56	3.32	11.11	8.92	8.95	5.27
18-Mar-96	12.44	18.03	17.87	19.66	20.24	20.21	13.37	12.10	19.39	15.22	24.54	6.13	11.95	14.47	9.42	9.01
16-Apr-96	13.65	18.83	18.13	19.47	20.26	20.07	13.36	13.42	19.51	15.58	24.44	6.93	12.63	15.07	10.12	9.69
10-May-96	13.75	19.47	18.98	22.01	22.58	22.60	15.78	13.30	21.55	15.77	26.93	6.94	12.98	15.90	10.40	10.24
17-Jun-96	13.88	17.40	17.40	18.21	18.61	18.73	11.96	13.40	18.13	16.00	23.15	5.03	13.51	13.96	10.90	9.98

Groundwater Elevation

Date Measured	Groundwater Elevation (feet msl)*																
	MW-1-22	MW-2-32	MW-3-26	MW-3-56	MW-4-35	MW-4-57	MW-5-32	MW-6-32	MW-6-61	MW-8-29	MW-8-56	MW-9-29	MW-10-25	MW-10-61	MW-11-32	MW-12-36	River Stage**
5-Dec-95	20.60	19.23	18.53	18.28	18.42	18.14	18.37	18.80	18.73	19.34	18.52	31.45	24.24	25.91	25.70	29.32	19.0
5-Jan-96	20.28	14.42	14.64	12.22	12.07	12.15	12.26	20.67	12.92	20.08	12.39	30.32	24.02	23.01	26.20	27.87	12.5
12-Feb-96	27.01	25.85	25.59	25.44	25.45	25.43	25.42	25.96	25.53	22.10	25.57	34.33	28.11	30.41	29.44	33.42	26.5
18-Mar-96	22.31	16.43	16.24	14.41	14.30	14.32	14.46	23.41	15.11	23.87	14.59	31.52	27.27	24.86	28.97	29.68	14.5
16-Apr-96	21.10	15.63	15.98	14.60	14.28	14.46	14.47	22.09	14.99	23.51	14.69	30.72	26.59	24.26	28.27	29.00	14.7
10-May-96	21.00	14.99	15.13	12.06	11.96	11.93	12.05	22.21	12.95	23.32	12.20	30.71	26.24	23.43	27.99	28.45	11.7
17-Jun-96	20.87	17.06	16.71	15.86	15.93	15.80	15.87	22.11	16.37	23.09	15.98	32.62	25.71	25.37	27.49	28.71	15.7

NOTE: * = City of Portland Datum
btc = below top of casing
msl = mean sea level

**Willamette River, Portland Harbor Stage, obtained from National Weather Service and adjusted to feet msl - City of Portland datum

NWT 002566

TABLE 2a - Monitoring Well Construction Summary Data

Remedial Investigation
Former Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project #2708

Monitoring Well	Date Installed	Monument Type	Well Diameter (inches)	Top of Casing (feet bgs)	Boring Depth (feet bgs)	Top Screen (feet bgs)	Base Screen (feet bgs)	Screen Type	Slot Size (inches)	Sand Pack
MW-1-22	24-Oct-95	Above-grade	2	-2.75	22.0	11.0	21.0	Slotted PVC	0.020	10-20
MW-2-32	6-Nov-95	Flush	2	1.34	32.5	21.5	31.5	Slotted PVC	0.020	10-20
MW-3-26	1-Nov-95	Above-grade	2	-2.91	26.0	15.0	25.0	Continuous wrap stainless steel	0.020	10-20
MW-3-56	1-Nov-95	Above-grade	2	-2.87	56.0	45.0	55.0	Continuous wrap stainless steel	0.020	10-20
MW-4-35	31-Oct-95	Above-grade	2	-2.84	35.0	24.0	34.0	Continuous wrap stainless steel	0.020	10-20
MW-4-57	30-Oct-95	Above-grade	2	-2.83	57.0	46.0	56.0	Continuous wrap stainless steel	0.020	10-20
MW-5-32	27-Oct-95	Above-grade	2	-2.73	32.0	21.0	31.0	Slotted PVC	0.020	10-20
MW-6-32	9-Nov-95	Flush	2	0.29	32.0	21.0	31.0	Continuous wrap stainless steel	0.020	10-20
MW-6-61	7-Nov-95	Flush	2	1.30	61.0	50.0	60.0	Continuous wrap stainless steel	0.020	10-20
MW-8-29	26-Oct-95	Above-grade	2	-2.59	29.0	18.0	28.0	Continuous wrap stainless steel	0.020	10-20
MW-8-56	25-Oct-95	Above-grade	2	-2.63	56.0	45.0	55.0	Continuous wrap stainless steel	0.020	10-20
MW-9-29	23-Oct-95	Flush	2	0.25	29.0	18.0	28.0	Slotted PVC	0.020	10-20
MW-10-25	9-Nov-95	Above-grade	2	-2.72	25.0	14.0	24.0	Continuous wrap stainless steel	0.020	10-20
MW-10-61	8-Nov-95	Above-grade	2	-2.83	61.0	50.0	60.0	Continuous wrap stainless steel	0.020	10-20
MW-11-32	3-Nov-95	Above-grade	2	-2.99	32.0	21.0	31.0	Continuous wrap stainless steel	0.020	10-20
MW-12-36	23-Oct-95	Above-grade	2	-2.79	36.0	25.0	35.0	Slotted PVC	0.020	10-20

Note: bgs = below ground surface btc = below top of casing PVC = polyvinyl chloride

Updated: 7/15/96 RBE
File: 2708 MW Construction

NWT 002567

TABLE 2b - Monitoring Well Elevation Data

Remedial Investigation
Former Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project #2708

Monitoring Well	Ground Surface (feet msl)	Top of Casing (feet msl)	Boring Depth (feet msl)	Top Screen (feet msl)	Base Screen (feet msl)	Groundwater Elevation (12/5/95) (feet msl)	Groundwater Elevation – Top Screen (feet)	Top of Silt Elevation (feet msl)
MW-1-22	32.0	34.75	10.0	21.0	11.0	20.60	-0.4	9.5
MW-2-32	35.8	34.46	3.3	14.3	4.3	19.23	4.9	4.3
MW-3-26	31.2	34.11	5.2	16.2	6.2	18.53	2.3	6.2
MW-3-56	31.2	34.07	-24.8	-13.8	-23.8	18.28	32.1	6.2
MW-4-35	31.7	34.54	-3.3	7.7	-2.3	18.42	10.7	6.7
MW-4-57	31.7	34.53	-25.3	-14.3	-24.3	18.14	32.4	6.7
MW-5-32	25.1	27.83	-6.9	4.1	-5.9	18.37	14.3	9.1
MW-6-32	35.8	35.51	3.8	14.8	4.8	18.80	4.0	5.3
MW-6-61	35.8	34.50	-25.2	-14.2	-24.2	18.73	32.9	5.3
MW-8-29	36.5	39.09	7.5	18.5	8.5	19.34	0.8	9.0
MW-8-56	36.5	39.13	-19.5	-8.5	-18.5	18.52	27.0	9.0
MW-9-29	37.9	37.65	8.9	19.9	9.9	31.45	11.6	26.9
MW-10-25	36.5	39.22	11.5	22.5	12.5	24.24	1.7	13.0
MW-10-61	36.5	39.33	-24.5	-13.5	-23.5	25.91	39.4	13.0
MW-11-32	35.4	38.39	3.4	14.4	4.4	25.70	11.3	4.9
MW-12-36	35.9	38.69	-0.1	10.9	0.9	29.32	18.4	31.4

Note: msl = mean sea level

Updated: 7/15/96 RBE
File: 2708 MW Construction

NWT 002568

TABLE 3a - Summary Of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Soil Boring Number	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet bgs)	Analytical Results mg/kg (ppm)													
					ODEQ Method TPH-HCID			ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
								TPH-G	TPH-418.1M										
					Gasoline	Diesel	Oil	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
B-01	950921-B1-01	2708-S009	21-Sep-95	0.2	Detected	Detected	Detected	ND>10	130	7.2	13.4	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	0.427	60
B-01	950921-B1-02	2708-S009	21-Sep-95	0.2 (dup)	ND>20	Detected	Detected	-	220	26.1	56.0	-	-	-	-	-	-	0.382	58
B-01	950921-B1-05	2708-S009	21-Sep-95	10.5	ND>20	Detected	Detected	-	**640**	337	1,280	-	-	-	-	-	-	50.7	130
B-01	950921-B1-06	2708-S009	21-Sep-95	12.0	-	-	-	-	**560**	-	-	-	-	-	-	-	-	-	-
B-01	950921-B1-09	2708-S009	21-Sep-95	21.0	ND>20	ND>50	ND>100	-	-	0.93	5.0	-	-	-	-	-	-	4.07	-
B-02	950927-B2-05	2708-S016	27-Sep-95	16.0	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	4.51	15
B-02	950927-B2-07	2708-S016	27-Sep-95	20.5	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	-	-
B-03	950921-B3-05	2708-S007	21-Sep-95	10.5	ND>20	Detected	Detected	-	120	23.0	49.0	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	7.44	22
B-03	950921-B3-07	2708-S007	21-Sep-95	15.0	-	-	-	-	5.9	ND	ND	-	-	-	-	-	-	-	-
B-03	950921-B3-10	2708-S007	21-Sep-95	22.5	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	3.07	-
B-04	950921-B4-05	2708-S008	21-Sep-95	16.5	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	0.277	-
B-05	950928-B5-05	2708-S021	28-Sep-95	15.5	ND>20	Detected	Detected	-	**780**	0.94	3.6	-	-	-	-	-	-	2.67	-
B-06	950927-B6-02	2708-S016	27-Sep-95	8.0	ND>20	Detected	Detected	-	**810**	4,413	12,487	-	-	-	-	-	-	-	-
B-06	950927-B6-03	2708-S016	27-Sep-95	15.5	ND>20	ND>50	Detected	-	54	40.2	86.5	-	-	-	-	-	-	-	-
B-07	950927-B7-05	2708-S017	27-Sep-95	17.0	ND>20	ND>50	ND>100	-	-	ND	ND	-	-	-	-	-	-	-	-
B-08	950918-B8-04	2708-S001	18-Sep-95	10.0	ND>20	Detected	Detected	-	54	185	338	-	-	-	-	-	-	-	-
B-08	950918-B8-05	2708-S001	18-Sep-95	12.5	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-
B-08	950918-B8-06	2708-S001	18-Sep-95	12.5 (dup)	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-
B-08	950918-B8-08	2708-S001	18-Sep-95	18.0	-	-	-	-	-	ND	0.24	-	-	-	-	-	-	-	-
B-09	950918-B9-02	2708-S002	18-Sep-95	10.0	Detected	Detected	Detected	**1,200**	25	2,422	19,438	**104**	44	78	103	329	-	-	-
B-09	950918-B9-08	2708-S002	18-Sep-95	28.0	-	-	-	**270**	**1,600**	-	-	-	-	-	-	-	-	-	-
B-09	950918-B9-09	2708-S002	18-Sep-95	30.5	ND>20	ND>50	ND>100	-	-	9.5	43.5	-	-	-	-	-	-	-	-
B-09	950918-B9-10	2708-S002	18-Sep-95	34.0	-	-	-	-	-	ND	0.46	-	-	-	-	-	-	-	-
B-10	950925-B10-04	2708-S013	25-Sep-95	17.5	ND>20	ND>5	ND>100	-	-	ND	ND	ND>0.3	ND>0.3	ND>0.3	ND>0.3	-	ND	ND>0.5	2.0
B-11	950928-B11-01	2708-S019	28-Sep-95	0.2	ND>20	Detected	Detected	-	**1,600**	-	-	-	-	-	-	-	-	-	-
B-11	950928-B11-06	2708-S020	28-Sep-95	12.5	ND>20	Detected	Detected	-	**1,700**	3.3	973	ND>0.3	ND>0.3	3.4	3.0	6.4	-	-	-
B-11	950928-B11-09	2708-S020	28-Sep-95	23.0	ND>20	ND>50	ND>100	-	-	ND	1.1	-	-	-	-	-	-	-	-
B-13	951006-B13-03	2708-S035	6-Oct-95	10.5	-	-	-	**1,000**	**2,700**	3,916	29,387	**28**	ND>20	**110**	22	160	ND	ND>0.1	1.9
B-13	951006-B13-07	2708-S035	6-Oct-95	18.5	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
B-13	951006-B13-10	2708-S036	6-Oct-95	24.0	-	-	-	ND>10	ND>5	ND	ND	-	-	-	-	-	-	-	-
B-14	950928-B14-01	2708-S019	28-Sep-95	0.2	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	-	-
B-14	950928-B14-02	2708-S019	28-Sep-95	2.5	ND>20	Detected	Detected	-	280	-	-	-	-	-	-	-	-	-	-
B-14	950928-B14-03	2708-S019	28-Sep-95	5.0	ND>20	ND>50	ND>100	-	-	ND	ND	-	-	-	-	-	-	-	-
B-15	951006-B15-05	2708-S036	6-Oct-95	21.0	-	-	-	70	200	45.9	638	7.9	ND>0.3	3.9	2.5	14	-	-	-
B-15	951006-B15-08	2708-S036	6-Oct-95	27.0	-	-	-	-	-	0.21	1.8	-	-	-	-	-	-	-	-
B-17	950929-B17-01	2708-S022	29-Sep-95	3.0	-	-	-	-	-	24.1	59.1	-	-	-	-	-	-	-	-
B-17	950929-B17-05	2708-S022	29-Sep-95	16.5	Detected	Detected	Detected	**2,400**	**4,700**	114	1,814	-	-	-	-	-	ND	-	-

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002569

TABLE 3a - Summary Of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Soil Boring Number	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet bgs)	Analytical Results mg/kg (ppm)														
					ODEQ Method TPH-HCID			ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
								TPH-G	TPH-418.1M										
					Gasoline	Diesel	Oil	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
B-17	950929-B17-07	2708-S022	29-Sep-95	23.5	ND>20	ND>50	ND>100	-	-	ND	0.89	-	-	-	-	-	-	-	-
B-18	950919-B18-05	2708-S003	19-Sep-95	12.0	Detected	Detected	ND>100	3,100	99	0.66	59.3	360	280	31	220	891	0.36	ND>0.25	13
B-18	950919-B18-08	2708-S003	19-Sep-95	19.5	-	-	-	850	44	-	-	-	-	-	-	-	-	-	-
B-18	950919-B18-09	2708-S003	19-Sep-95	22.0	-	-	-	24	380	-	-	-	-	-	-	-	-	-	-
B-18	950919-B18-10	2708-S003	19-Sep-95	24.5	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
B-19	950919-B19-01	2708-S003	19-Sep-95	0.2	ND>20	Detected	Detected	-	68	324	933	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	-	57
B-19	950919-B19-03	2708-S004	19-Sep-95	6.5	-	-	-	1,600	1,500	35.8	408	41	120	39	160	360	ND	-	1.6
B-19	950919-B19-04	2708-S004	19-Sep-95	10.5	Detected	Detected	Detected	3,200	1,500	-	-	-	-	-	-	-	-	-	11
B-19	950919-B19-05	2708-S004	19-Sep-95	12.0	-	-	-	1,900	6,800	-	-	-	-	-	-	-	-	-	-
B-19	950920-B19-07	2708-S005	20-Sep-95	18.0	Detected	Detected	ND>100	130	760	0.10	80.0	-	-	-	-	-	-	-	-
B-19	950920-B19-08	2708-S005	20-Sep-95	27.0	-	-	-	-	-	0.03	2.0	-	-	-	-	-	-	-	-
B-20	950929-B20-03	2708-S022	29-Sep-95	10.5	Detected	Detected	Detected	940	340	245	1,093	120	64	16	60	260	ND	-	4.5
B-20	950929-B20-07	2708-S023	29-Sep-95	23.5	-	-	-	220	11	0.26	12.7	-	-	-	-	-	-	-	-
B-21	951003-B21-04	2708-S027	3-Oct-95	11.5	ND>20	ND>50	ND>100	-	-	0.42	7.1	-	-	-	-	-	-	-	9.8
B-22	951003-B22-01	2708-S027	3-Oct-95	3.5	ND>20	Detected	Detected	-	530	-	-	-	-	-	-	-	-	-	-
B-22	951003-B22-05	2708-S027	3-Oct-95	13.5	ND>20	ND>50	ND>100	-	-	1.7	40.3	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	-	5.9
B-22	951003-B22-09	2708-S028	3-Oct-95	24.0	ND>20	Detected	Detected	-	600	30	485	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	-	2.5
B-22	951003-B22-10	2708-S028	3-Oct-95	26.5	ND>20	Detected	ND>100	-	12	-	-	-	-	-	-	-	-	-	-
B-23	951003-B23-02	2708-S028	3-Oct-95	10.5	Detected	Detected	ND>100	1,300	930	-	-	-	-	-	-	-	-	0.17	-
B-23	951003-B23-05	2708-S029	3-Oct-95	18.5	ND>20	Detected	ND>100	-	16	-	-	-	-	-	-	-	-	-	-
B-23	951003-B23-08	2708-S029	3-Oct-95	26.5	ND>20	Detected	ND>100	-	110	1.1	76.9	13	ND>0.3	ND>0.3	1.3	14	ND	-	5.2
B-23	951003-B23-10	2708-S029	3-Oct-95	31.5	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	-	-
B-23	951003-B23-12	2708-S029	3-Oct-95	34.5	-	-	-	-	-	ND	ND	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	-	-
B-24	951002-B24-03	2708-S024	2-Oct-95	10.5	Detected	Detected	Detected	1,500	640	277	1,092	-	-	-	-	-	-	-	-
B-24	951002-B24-10	2708-S024	2-Oct-95	29.0	-	-	-	-	-	ND	0.14	6.8	2.3	ND>0.3	0.3	9.4	-	-	-
B-25	951002-B25-03	2708-S025	2-Oct-95	12.5	Detected	Detected	ND>100	120	35	3.3	12.5	-	-	-	-	-	-	-	-
B-25	951002-B25-05	2708-S025	2-Oct-95	20.0	-	-	-	-	-	ND	0.45	-	-	-	-	-	-	-	-
B-26	951003-B26-01	2708-S030	4-Oct-95	0.2	ND>20	ND>5	ND>100	-	-	5.1	9.3	-	-	-	-	-	-	-	-
B-26	951003-B26-06	2708-S030	4-Oct-95	20.5	Detected	Detected	Detected	1,300	1,600	862	15,530	160	110	16	90	376	ND	-	10
B-26	951003-B26-13	2708-S030	4-Oct-95	39.5	-	-	-	ND>10	ND>5	ND	1.1	-	-	-	-	-	-		
B-27	950920-B27-06	2708-S005	20-Sep-95	13.0	ND>20	Detected	ND>100	-	8.5	-	-	-	-	-	-	-	-	-	1.9
B-27	950920-B27-08	2708-S005	20-Sep-95	18.0	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	-	-
B-27	950920-B27-10	2708-S005	20-Sep-95	23.0	Detected	Detected	Detected	700	570	90.5	1,243	110	46	ND>30	ND>30	156	ND	-	5.2
B-27	950920-B27-12	2708-S006	20-Sep-95	28.0	-	-	-	94	ND>5	9.6	125	22	3.6	ND>0.6	1.2	27	-	-	-
B-27	950920-B27-15	2708-S006	20-Sep-95	35.5	-	-	-	-	-	1.2	12.2	-	-	-	-	-	-	-	-
B-28	951002-B28-01	2708-S025	2-Oct-95	0.2	Detected	ND>50	Detected	ND>10	35	45.5	86.8	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	-	21
B-28	951002-B28-02	2708-S025	2-Oct-95	0.2 (dup)	-	-	-	-	-	65.5	135	-	-	-	-	-	-	-	-

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002570

TABLE 3a - Summary Of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Soil Boring Number	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet bgs)	Analytical Results mg/kg (ppm)														
					ODEQ Method TPH-HCID			ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
								TPH-G	TPH-418.1M										
					Gasoline	Diesel	Oil	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
B-28	951002-B28-07	2708-S025	2-Oct-95	15.0	Detected	Detected	Detected	24	200	167	612	5.5	ND>2	ND>2	2.3	7.8	ND	-	5.6
B-28	951002-B28-11	2708-S026	2-Oct-95	24.0	-	-	-	ND>10	ND>5	ND	2.3	1.0	ND>0.3	ND>0.3	ND>0.3	1.0	-	-	-
B-29	950922-B29-01	2708-S011	22-Sep-95	0.2	ND>20	Detected	Detected	-	190	139	230	-	-	-	-	-	-	-	-
B-29	950922-B29-08	2708-S011	22-Sep-95	18.0	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	-	-
B-29	950922-B29-10	2708-S011	22-Sep-95	23.5	-	-	-	ND>10	9.3	-	-	-	-	-	-	-	-	-	-
B-29	950922-B29-12	2708-S012	22-Sep-95	28.0	Detected	Detected	Detected	53	220	-	-	-	-	-	-	-	-	-	-
B-29	950922-B29-15	2708-S012	22-Sep-95	35.5	Detected	Detected	Detected	1,800	4,800	5,214	58,822	150	140	35	110	435	ND	-	1.7
B-29	950925-B29-17	2708-S013	25-Sep-95	44.0	-	-	-	ND>10	44	2.6	16.5	-	-	-	-	-	-	-	-
B-29	950925-B29-18	2708-S013	25-Sep-95	47.0	-	-	-	-	-	ND	0.18	-	-	-	-	-	-	-	-
B-30A	950922-B30-01	2708-S010	22-Sep-95	0.2	ND>20	Detected	Detected	-	390	500	965	-	-	-	-	-	-	-	-
B-30	950922-B30-06	2708-S010	22-Sep-95	11.5	-	-	-	320	3,200	939	6,776	18	1.9	12	20	52	ND	3.03	25
B-30	950922-B30-08	2708-S010	22-Sep-95	17.0	ND>20	ND>50	ND>100	-	-	-	-	-	-	-	-	-	-	-	-
B-30	950922-B30-12	2708-S010	22-Sep-95	28.5	Detected	Detected	Detected	150	120	94.3	853	17	ND>3	2.8	ND>3	20	-	-	-
B-30	950922-B30-13	2708-S011	22-Sep-95	33.5	-	-	-	12	ND>5	-	-	-	-	-	-	-	-	-	-
B-31	950925-B31-01	2708-S013	25-Sep-95	0.2	ND>20	Detected	Detected	-	240	23.0	38.1	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	0.59	14
B-31	950925-B31-06	2708-S014	25-Sep-95	21.0	Detected	Detected	Detected	250	2,200	1,846	12,666	ND>3	ND>3	9.1	9.6	19	ND	-	12
B-31	950925-B31-08	2708-S014	25-Sep-95	24.5	-	-	-	ND>10	34	2.1	5.5	-	-	-	-	-	-	-	-
B-31	950925-B31-10	2708-S014	25-Sep-95	28.0	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
B-31	950925-B31-11	2708-S014	25-Sep-95	28.0 (dup)	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
B-32	951003-B32-01	2708-S031	4-Oct-95	0.2	ND>20	Detected	Detected	-	66	34.8	61.2	-	-	-	-	-	-	-	-
B-32	951003-B32-03	2708-S031	4-Oct-95	11.5	Detected	Detected	Detected	760	6,600	3,156	28,772	-	-	-	-	-	-	3.02	-
B-32	951003-B32-15	2708-S032	4-Oct-95	46.5	Detected	Detected	Detected	1,400	4,100	1,728	21,961	-	-	-	-	-	-	-	-
B-32	951003-B32-18	2708-S032	4-Oct-95	58.5	ND>20	ND>50	ND>100	-	-	ND	1.2	1.0	ND>.3	ND>.3	ND>.3	1.0	-	-	-
B-33	951005-B33-01	2708-S033	5-Oct-95	0.2	ND>20	Detected	Detected	-	170	575	955	-	-	-	-	-	-	-	-
B-33	951005-B33-02	2708-S033	5-Oct-95	3.0	ND>20	Detected	Detected	-	140	152	37.5	-	-	-	-	-	-	-	-
B-33	951005-B33-03	2708-S034	5-Oct-95	5.5	Detected	Detected	Detected	430	2,700	1,054	8,238	47	22	29	28	126	ND	3.9	20
B-33	951005-B33-11	2708-S034	5-Oct-95	38.5	Detected	Detected	Detected	1,700	7,600	-	-	-	-	-	-	-	-	-	-
B-33	951005-B33-14	2708-S034	5-Oct-95	54.0	Detected	Detected	Detected	36	230	3.0	65.0	0.72	0.82	1.0	1.1	3.6	ND	-	2.1
B-33	951006-B33-18	2708-S035	6-Oct-95	69.0	ND>20	ND>50	ND>100	-	-	0.5	5.7	-	-	-	-	-	-	-	-
B-34	950926-B34-01	2708-S015	26-Sep-95	0.2	ND>20	Detected	Detected	-	41	49.2	94.1	-	-	-	-	-	-	-	-
B-34	950926-B34-05	2708-S015	26-Sep-95	11.5	Detected	Detected	Detected	3,400	4,200	1,639	13,499	-	-	-	-	-	-	6.48	-
B-34	950926-B34-12	2708-S015	26-Sep-95	36.5	-	-	-	1,900	69	-	-	-	-	-	-	-	-	-	-
B-35	951005-B35-01	2708-S033	5-Oct-95	0.2	ND>20	ND>50	Detected	-	27	19.5	38.9	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	-	-
B-35	951005-B35-06	2708-S033	5-Oct-95	22.0	Detected	Detected	Detected	2,200	7,700	4,014	41,602	-	-	-	-	-	-	0.67	-
B-35	951005-B35-10	2708-S033	5-Oct-95	29.0	ND>20	ND>50	ND>100	-	-	0.78	9.3	-	-	-	-	-	-	-	-
M-11	951102-M11-01	2708-S047	2-Nov-95	0.2	ND>20	Detected	Detected	-	14	67.4	106	-	-	-	-	-	-	-	9.9
M-11	951102-M11-09	2708-S047	2-Nov-95	39.0	-	-	-	-	-	9.7	7.9	-	-	-	-	-	-	-	-

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002571

TABLE 3a - Summary Of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Soil Boring Number	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet bgs)	Analytical Results mg/kg (ppm)														
					ODEQ Method TPH-HCID			ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
								TPH-G	TPH-418.1M										
					Gasoline	Diesel	Oil	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
M-11	951102-M11-10	2708-S047	2-Nov-95	43.5	-	-	-	-	-	0.97	10.9	-	-	-	-	-	-	-	-
MW-01-22	951024-M1-01	2708-S039	24-Oct-95	0.2	-	-	-	-	-	3.1	5.8	-	-	-	-	-	-	0.25	-
MW-01-22	951024-M1-02	2708-S039	24-Oct-95	3.5	-	-	-	-	460	8.4	12.8	-	-	-	-	-	-	ND>.5	-
MW-01-22	951024-M1-06	2708-S039	24-Oct-95	23.5	-	-	-	-	ND>5	ND	0.46	-	-	-	-	-	-	0.88	-
MW-02-32	951106-M2-01	2708-S049	6-Nov-95	0.2	-	-	-	-	-	5.2	10.3	-	-	-	-	-	-	0.47	4.9
MW-02-32	951106-M2-06	2708-S049	6-Nov-95	24.0	-	-	-	-	ND>5	0.15	0.43	-	-	-	-	-	-	-	-
MW-03-56	951101-M3-10	2708-S045	1-Nov-95	31.0	-	-	-	-	-	3.7	10.1	-	-	-	-	-	-	-	-
MW-03-56	951101-M3-13	2708-S046	1-Nov-95	38.0	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
MW-03-56	951101-M3-17	2708-S046	1-Nov-95	53.5	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
MW-03-56	951101-M3-18	2708-S046	1-Nov-95	53.5 (dup)	-	-	-	-	-	0.04	0.16	-	-	-	-	-	-	-	-
MW-04-57	951030-M4-01	2708-S043	30-Oct-95	0.2	ND>20	Detected	Detected	-	57	114	195	-	-	-	-	-	ND	0.8	29
MW-04-57	951030-M4-06	2708-S043	30-Oct-95	25.5	-	-	-	-	-	872	3,261	ND>.3	ND>.3	ND>.3	ND>.3	ND	ND	1.3	15
MW-04-57	951030-M4-15	2708-S044	30-Oct-95	57.0	-	-	-	-	-	ND	0.26	-	-	-	-	-	-	-	-
MW-05-32	951027-M5-01	2708-S042	27-Oct-95	0.2	ND>20	ND>50	ND>100	-	-	0.82	1.4	-	-	-	-	-	-	-	-
MW-05-32	951027-M5-05	2708-S042	27-Oct-95	15.5	-	-	-	ND>10	350	810	1,942	-	-	-	-	-	-	-	-
MW-05-32	951027-M5-07	2708-S042	27-Oct-95	21.5	-	-	-	-	-	0.24	0.91	-	-	-	-	-	-	-	-
MW-05-32	951027-M5-10	2708-S042	27-Oct-95	31.5	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
MW-06-61	951107-M6-01	2708-S050	7-Nov-95	2.5	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-	-
MW-06-61	951107-M6-08	2708-S050	7-Nov-95	30.0	-	-	-	-	-	1,389	20,614	67	ND>30	140	56	263	-	-	-
MW-06-61	951107-M6-10	2708-S050	7-Nov-95	38.5	-	-	-	-	-	0.11	1.8	ND>.3	ND>.3	ND>.3	ND>.3	ND	-	-	-
MW-06-61	951107-M6-11	2708-S050	7-Nov-95	43.0	-	-	-	-	-	ND	0.06	-	-	-	-	-	-	-	-
MW-08-56	951025-M8-01	2708-S040	25-Oct-95	0.2	-	-	-	-	-	203	281	-	-	-	-	-	-	0.61	-
MW-08-56	951025-M8-11	2708-S040	25-Oct-95	44.0	-	-	-	-	-	0.78	8.1	-	-	-	-	-	-	-	-
MW-08-56	951025-M8-15	2708-S041	25-Oct-95	55.0	ND>20	ND>50	ND>100	-	-	ND	0.64	-	-	-	-	-	-	-	-
MW-09-29	951023-M9-01	2708-S037	23-Oct-95	0.2	ND>20	ND>50	ND>100	-	-	11.7	21.5	-	-	-	-	-	-	-	-
MW-09-29	951023-M9-04	2708-S037	23-Oct-95	5.0	ND>20	Detected	Detected	-	19	78.5	163	ND>.3	ND>.3	ND>.3	ND>.3	ND	-	518	-
MW-09-29	951023-M9-05	2708-S037	23-Oct-95	11.5	ND>20	ND>50	ND>100	-	-	0.16	0.52	-	-	-	-	-	-	-	-
MW-10-61	951108-M10-01	2708-S052	8-Nov-95	0.2	ND>20	ND>50	Detected	-	-	45.0	78.7	-	-	-	-	-	ND	-	6.4
MW-10-61	951108-M10-02	2708-S052	8-Nov-95	0.2 (dup)	-	-	-	-	-	64.1	107	-	-	-	-	-	-	-	-
MW-10-61	951108-M10-09	2708-S052	8-Nov-95	28.0	-	-	-	-	-	ND	0.76	43	3.0	0.7	ND>.8	47	-	-	-
MW-12-36	951023-M12-01	2708-S037	23-Oct-95	0.2	ND>20	Detected	Detected	-	29	65.5	116	-	-	-	-	-	-	-	-
MW-12-36	951023-M12-06	2708-S038	23-Oct-95	22.0	Detected	Detected	ND>100	160	30	0.27	8.6	ND>3	8.2	3.5	21	33	ND	-	2.9
MW-12-36	951023-M12-07	2708-S038	23-Oct-95	26.5	ND>20	ND>50	ND>100	-	-	ND	ND	-	-	-	-	-	-	-	-
Reference Standards**					-	-	-	80	500	-	-	2.0	80	100	800	-	-	40,000	2,000

Note: EPA = U.S. Environmental Protection Agency
ODEQ = Oregon Department of Environmental Quality
ppm = parts per million

mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated
BTEX = benzene, toluene, ethylbenzene, and xylenes

PAHs = polynuclear aromatic hydrocarbons
HCID = hydrocarbon identification
TPH = total petroleum hydrocarbons

* = Sample number prefix: 2708-
** = TPH standards based on the ODEQ UST Level 2 Soil Cleanup Standards (OAR 340-122-335); Other standards based on Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045).
BOLD = Detected above Reference Standard

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002572

Table 3b - Summary Of Analytical Results for Soil Samples
PAHs by EPA Method 8270 (SIM)

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
Soil Boring	Sample Number	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
B-01	950921-B1-01	2708-S009	21-Sep-95	0.2	0.14	ND>0.05	0.14	1.0	1.6	0.52	1.5	1.3	1.4	0.22	1.3	0.06	0.93	0.07	0.88	2.3	7.2	13.4
B-01 (dup)	950921-B1-02	2708-S009	21-Sep-95	0.2	0.51	0.41	1.1	3.7	5.6	1.7	5.2	5.1	5.6	0.84	5.7	0.34	3.5	0.46	5.8	10.4	26.1	56.0
B-01	950921-B1-05	2708-S009	21-Sep-95	10.5	6.1	5.8	21.7	45.3	72.3	26.7	55.7	65.8	82.8	7.7	140	9.6	46.2	313	142	239	337	1,280
B-01	950921-B1-09	2708-S009	21-Sep-95	21.0	0.13	ND>0.05	0.24	0.19	0.21	0.06	0.17	0.17	0.19	ND>0.05	0.36	0.14	0.11	0.21	2.2	0.65	0.93	5.0
B-03	950921-B3-05	2708-S007	21-Sep-95	10.5	0.30	0.14	3.1	3.2	5.2	1.9	4.8	4.2	4.1	0.64	5.9	0.20	3.2	0.16	3.1	8.9	23.0	49.0
B-03	950921-B3-07	2708-S007	21-Sep-95	15.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-05	950928-B5-05	2708-S021	28-Sep-95	15.5	0.14	0.44	0.19	ND>0.20	0.20	ND>0.20	0.18	1.1	ND>0.20	ND>0.20	0.34	ND>0.20	0.56	ND>0.20	ND>0.20	0.49	0.94	3.6
B-06	950927-B6-02	2708-S016	27-Sep-95	8.0	21	124	191	574	972	370	767	1,080	833	159	1,680	74	738	884	1,180	2,840	4,413	12,487
B-06	950927-B6-03	2708-S016	27-Sep-95	15.5	ND>1.0	0.55	2.1	5.7	8.8	3.5	7.1	9.6	7.6	1.1	10.2	ND>1.0	6.4	ND>1.0	5.5	18.3	40.2	86.5
B-07	950927-B7-05	2708-S017	27-Sep-95	17.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-08	950918-B8-04	2708-S001	18-Sep-95	10.0	0.48	4.0	2.8	18	40	12	47	58	24	6.0	26	0.71	38	2.3	7.2	52	185	338
B-08	950918-B8-08	2708-S001	18-Sep-95	18.0	0.18	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.06	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	0.24
B-09	950918-B9-02	2708-S002	18-Sep-95	10.0	558	457	603	472	420	139	487	344	601	56.5	1,350	464	246	7,560	3,410	2,270	2,422	19,438
B-09	950918-B9-09	2708-S002	18-Sep-95	30.5	1.9	0.17	1.3	1.6	1.8	0.66	2.1	1.8	1.9	0.22	4.4	0.99	1.2	8.3	7.8	7.4	9.5	43.5
B-09	950918-B9-10	2708-S002	18-Sep-95	34.0	ND>0.05	ND>0.05	0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.08	ND>0.05	ND>0.05	ND>0.05	0.20	0.13	ND	0.46
B-10	950925-B10-04	2708-S013	25-Sep-95	17.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-11	950928-B11-06	2708-S020	28-Sep-95	12.5	7.8	0.61	2.7	0.83	0.50	ND>0.50	0.53	ND>0.50	1.4	ND>0.50	4.20	6.7	ND>0.50	915	25.2	7.4	3.3	973
B-11	950928-B11-09	2708-S020	28-Sep-95	23.0	0.07	ND>0.05	0.09	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.17	0.08	ND>0.05	ND>0.05	0.35	0.29	ND	1.1
B-13	951006-B13-03	2708-S035	6-Oct-95	10.5	1,630	155	578	564	752	238	942	747	811	89.9	2,350	481	519	13,000	2,950	3,580	3,916	29,387
B-13	951006-B13-07	2708-S035	6-Oct-95	18.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-13	951006-B13-10	2708-S036	6-Oct-95	24.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-14	950928-B14-03	2708-S019	28-Sep-95	5.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-15	951006-B15-05	2708-S036	6-Oct-95	21.0	16.1	4.1	6.6	6.8	9.7	3.2	9.3	9.0	9.7	1.0	27.7	6.9	6.2	400	80	41.3	45.9	638
B-15	951006-B15-08	2708-S036	6-Oct-95	27.0	ND>0.05	0.05	0.13	ND>0.05	0.05	0.16	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.24	0.04	ND>0.05	0.13	0.59	0.40	0.21	1.8
B-17	950929-B17-01	2708-S022	29-Sep-95	3.0	0.03	0.22	0.92	3.5	5.6	1.3	5.7	5.3	3.6	0.67	11	0.15	3.7	0.09	4.0	14	24.1	59.1
B-17	950929-B17-05	2708-S022	29-Sep-95	16.5	161	10	111	28	15	5.8	16	5.9	44	1.1	114	119	4.2	478	477	224	114	1,814
B-17	950929-B17-07	2708-S022	29-Sep-95	23.5	0.08	ND>0.05	0.09	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.07	0.06	ND>0.05	0.16	0.32	0.11	ND	0.89
B-18	950919-B18-05	2708-S003	19-Sep-95	12.0	1.9	0.16	0.44	0.17	0.09	0.03	0.07	0.05	0.26	ND>0.50	1.1	1.8	0.03	44.8	6.7	1.7	0.66	59.3
B-18	950919-B18-10	2708-S003	19-Sep-95	24.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-19	950919-B19-01	2708-S003	19-Sep-95	0.2	6.8	0.52	212	53.1	57.6	29.6	61.0	46.0	71.4	10.0	115	20.1	41.5	2.9	91.7	114	324	933

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002573

Table 3b - Summary Of Analytical Results for Soil Samples
PAHs by EPA Method 8270 (SIM)

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																
Soil Boring	Sample Number*	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
B-19	950919-B19-03	2708-S004	19-Sep-95	6.5	13.4	4.6	14.4	7.6	5.4	2.4	5.8	5.1	9.7	0.96	25.4	13.0	3.9	180	83.3	33.3	35.8	408
B-19	950920-B19-07	2708-S005	20-Sep-95	18.0	0.50	0.17	ND>0.05	0.05	ND>0.05	0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.18	0.77	ND>0.05	76.3	1.7	0.28	0.10	80.0
B-19	950929-B19-08	2708-S005	20-Sep-95	27.0	0.08	ND>0.05	0.08	0.03	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.13	0.10	ND>0.05	1.1	0.30	0.14	0.03	2.0
B-20	950929-B20-03	2708-S022	29-Sep-95	10.5	35.8	9.4	122	40.4	44.5	19.0	45.0	29.3	67.1	4.7	113	57.8	23.8	27.8	239	214	245	1,093
B-20	950929-B20-07	2708-S023	29-Sep-95	23.5	0.07	0.10	0.06	0.05	0.06	ND>0.05	0.05	0.06	0.05	ND>0.05	0.18	0.11	0.04	11.2	0.36	0.30	0.26	13
B-21	951003-B21-04	2708-S027	3-Oct-95	11.5	1.3	0.44	0.20	0.12	0.08	0.08	ND>0.05	ND>0.05	0.14	ND>0.05	0.59	0.09	ND>0.05	0.71	2.5	0.86	0.42	7.1
B-22	951003-B22-05	2708-S027	3-Oct-95	13.5	9.4	0.08	1.2	0.63	0.19	0.12	0.15	0.06	0.58	ND>0.05	5.3	5.7	0.06	0.31	12	4.3	1.7	40.3
B-22	951003-B22-09	2708-S028	3-Oct-95	24.0	78.8	0.50	18	9.2	4.0	1.7	2.6	0.49	12.0	0.15	65.4	59.9	0.58	0.41	160	71.7	30.2	485
B-23	951003-B23-08	2708-S029	3-Oct-95	26.5	0.87	1.2	0.52	0.20	0.19	0.10	0.20	0.19	0.27	ND>0.05	1.4	3.0	0.16	58.8	8.2	1.6	1.1	76.9
B-23	951003-B23-12	2708-S029	3-Oct-95	34.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-24	951002-B24-03	2708-S024	2-Oct-95	10.5	52.4	7.5	34.9	41.9	53.2	21.3	59.5	42.0	64.1	5.5	132	28.5	31.0	115	186	217	277	1,092
B-24	951002-B24-10	2708-S024	2-Oct-95	29.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.14	ND>0.05	ND>0.05	ND	0.14
B-25	951002-B25-03	2708-S025	2-Oct-95	12.5	0.41	0.15	0.29	0.41	0.71	0.25	0.78	0.75	0.60	0.08	1.2	0.53	0.50	1.2	2.5	2.1	3.3	12.5
B-25	951002-B25-05	2708-S025	2-Oct-95	20.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.45	ND>0.05	ND>0.05	ND	0.45
B-26	951003-B26-01	2708-S030	4-Oct-95	0.2	0.09	ND>0.05	0.10	0.73	1.2	0.49	0.99	0.84	0.77	0.16	1.5	ND>0.05	0.79	ND>0.05	0.46	1.2	5.1	9.3
B-26	951003-B26-06	2708-S030	4-Oct-95	20.5	608	449	1,220	124	134	57.0	138	171	265	20.7	949	681	123	6,420	2,630	1,540	862	15,530
B-26	951003-B26-13	2708-S030	4-Oct-95	39.5	0.06	0.05	0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.07	0.06	ND>0.05	0.55	0.19	0.10	ND	1.1
B-27	950920-B27-10	2708-S005	20-Sep-95	23.0	53.0	32.6	21.9	17.2	16.3	6.2	18	13.6	21.0	1.9	79.1	45.7	9.6	586	208	113	90.5	1,243
B-27	950920-B27-12	2708-S006	20-Sep-95	28.0	8.6	2.0	3.1	1.9	1.6	0.78	1.7	1.3	2.6	0.11	9.9	6.5	0.92	44.7	26.4	13.3	9.6	125
B-27	950920-B27-15	2708-S006	20-Sep-95	35.5	1.1	0.14	0.36	0.31	0.26	0.09	0.16	0.15	0.28	ND>0.05	1.3	0.88	0.11	1.8	3.5	1.8	1.2	12.2
B-28	951002-B28-01	2708-S025	2-Oct-95	0.2	0.73	0.26	4.6	6.1	10	4.3	8.6	8.2	8.2	1.6	9.7	0.25	6.6	0.30	4.6	12.7	45.5	86.8
B-28 (dup)	951002-B28-02	2708-S025	2-Oct-95	0.2	1.1	0.86	1.8	9.5	14.9	6.3	14.1	12.3	9.5	2.4	17.3	0.55	8.8	0.88	9.2	25.7	65.5	135
B-28	951002-B28-07	2708-S025	2-Oct-95	15.0	23.8	3.7	11.2	19.1	33.4	12.6	42.7	39.5	30.2	3.6	66.1	14.0	25.6	102	74.0	110	167	612
B-28	951002-B28-11	2708-S026	2-Oct-95	24.0	0.06	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	2.2	0.04	ND>0.05	ND	2.3
B-29	950922-B29-01	2708-S011	22-Sep-95	0.2	0.40	7.3	3.3	10.5	31.7	11.6	32.5	41.8	19.3	4.8	9.4	0.47	28.4	2.4	3.4	22.8	139	230
B-29	950922-B29-15	2708-S012	22-Sep-95	35.5	9,210	78	1,650	1,540	758	308	571	230	1,810	46.1	8,480	4,530	181	7,400	15,500	6,530	5,214	58,822
B-29	950925-B29-17	2708-S013	25-Sep-95	44.0	1.1	0.33	1.0	0.56	0.45	0.12	0.51	0.30	0.68	0.05	1.6	0.84	0.24	0.77	5.1	2.8	2.6	16.5
B-29	950925-B29-18	2708-S013	25-Sep-95	47.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0 05	0.18	ND>0.05	ND>0.05	ND	0.18
B-30A	950922-B30-01	2708-S010	22-Sep-95	0.2	9.2	13.4	16.0	49.8	110	45.0	100	129	75.4	20.2	111	5.9	100	9.4	37.3	134	500	965
B-30	950922-B30-06	2708-S010	22-Sep-95	11.5	220	228	417	167	167	71.9	182	125	245	16.5	739	310	89.3	1,730	1,260	808	939	6,776

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002574

Table 3b - Summary Of Analytical Results for Soil Samples
PAHs by EPA Method 8270 (SIM)

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																
Soil Boring	Sample Number*	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
B-30	950922-B30-12	2708-S010	22-Sep-95	28.5	15.2	68.8	28.7	14.3	17.4	7.4	22.0	17.7	19.8	1.8	53.3	31.0	11.6	327	126	91.0	94.3	853
B-31	950925-B31-01	2708-S013	25-Sep-95	0.2	0.11	1.3	0.59	2.1	5.4	1.8	4.8	6.8	3.0	0.98	1.6	0.06	4.9	0.30	0.71	3.7	23.0	38.1
B-31	950925-B31-06	2708-S014	25-Sep-95	21.0	1,120	50.6	473	319	321	119	374	364	394	45.1	1,290	422	274	2,880	2,620	1,600	1,846	12,666
B-31	950925-B31-08	2708-S014	25-Sep-95	24.5	0.07	ND>0.05	0.18	0.28	0.35	0.11	0.70	0.27	0.39	0.04	0.88	0.06	0.22	ND>0.05	0.54	1.4	2.1	5.5
B-31	950925-B31-10	2708-S014	25-Sep-95	28.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-31 (dup)	950925-B31-11	2708-S014	25-Sep-95	28.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
B-32	951004-B32-01	2708-S031	4-Oct-95	0.2	0.09	1.7	0.53	2.9	6.9	2.5	7.4	12.4	5.6	1.8	2.7	0.11	7.7	0.82	0.66	7.4	34.8	61.2
B-32	951004-B32-03	2708-S031	4-Oct-95	11.5	990	807	1,190	495	500	292	585	529	824	87.3	2,050	810	373	11,100	4,560	3,580	3,156	28,772
B-32	951004-B32-15	2708-S032	4-Oct-95	38.5	1,330	39.0	1,280	259	285	81.0	386	354	427	52.0	1,180	520	238	11,100	2,440	1,990	1,728	21,961
B-32	951004-B32-18	2708-S032	4-Oct-95	58.5	0.06	ND>0.05	0.06	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.13	0.05	ND>0.05	0.38	0.31	0.21	ND	1.2
B-33	951005-B33-01	2708-S033	5-Oct-95	0.2	1.3	29.1	9.9	34.6	124	44.0	129	202	70.0	32.7	29.5	1.6	141	9.1	10.5	87	575	955
B-33	951005-B33-02	2708-S033	5-Oct-95	2.5	1.7	0.23	0.96	1.9	2.4	0.88	2.8	2.1	2.5	0.29	6.4	0.85	1.5	1.5	4.1	7.4	12	37.5
B-33	951005-B33-03	2708-S034	5-Oct-95	5.5	369	133	263	181	185	72.1	225	152	262	21.3	527	266	108	3,460	1,190	824	1,054	8,238
B-33	951005-B33-14	2708-S034	5-Oct-95	54.0	3.4	ND>1.0	2.1	0.65	0.57	ND>1	0.70	0.62	1.1	ND>1	3.4	1.5	ND>1	37.0	8.6	5.4	3.0	65.0
B-33	951006-B33-18	2708-S035	6-Oct-95	69.0	0.06	0.35	0.12	0.05	0.05	ND>0.05	0.37	0.05	0.06	ND>0.05	0.18	0.12	ND>0.05	3.5	0.47	0.31	0.53	5.7
B-34	950926-B34-01	2708-S015	26-Sep-95	0.2	0.99	0.46	1.5	6.0	10.0	4.5	9.9	9.5	9.6	1.6	11.7	0.44	7.6	1.1	5.6	13.6	49.2	94.1
B-34	950926-B34-05	2708-S015	26-Sep-95	11.5	253	452	1,289	227	256	153	356	318	383	41.0	849	409	223	5,420	1,580	1,290	1,639	13,499
B-35	951005-B35-01	2708-S033	5-Oct-95	0.2	0.14	0.54	0.88	2.2	4.0	1.5	4.1	4.5	4.1	0.59	4.0	0.15	3.0	0.34	2.2	6.7	19.5	38.9
B-35	951005-B35-06	2708-S033	5-Oct-95	22.0	532	1,960	880	613	780	269	954	714	809	91.5	2,600	982	497	20,700	4,890	4,330	4,014	41,602
B-35	951005-B35-10	2708-S033	5-Oct-95	29.0	0.52	0.28	0.27	0.13	0.14	0.07	0.17	0.14	0.18	ND>0.05	0.50	0.28	0.10	4.3	1.4	0.82	0.78	9.3
M-11	951102-M11-01	2708-S047	2-Nov-95	0.2	0.73	0.91	0.82	8.1	18	6.0	10	12	6.9	2.3	12	0.30	9.2	0.37	4.2	14	67.4	106
M-11	951102-M11-09	2708-S047	2-Nov-95	39.0	0.85	0.08	0.21	0.16	0.11	0.05	0.08	0.06	0.13	ND>0.05	0.94	0.65	0.05	1.5	2.1	0.91	9.7	7.9
M-11	951102-M11-10	2708-S047	2-Nov-95	43.5	0.80	0.09	0.40	0.26	0.14	0.07	0.16	0.11	0.26	ND>0.05	1.4	0.65	0.08	2.0	3.1	1.4	0.97	11
MW-01-22	951024-M1-01	2708-S039	24-Oct-95	0.2	ND>0.50	ND>0.50	ND>0.50	0.41	0.66	ND>0.50	0.61	1.0	0.64	ND>0.50	0.71	ND>0.50	0.75	ND>0.50	ND>0.50	1.0	3.1	5.8
MW-01-22	951024-M1-02	2708-S039	24-Oct-95	3.5	ND>0.20	ND>0.20	ND>0.20	0.91	1.5	0.74	1.7	2.3	1.3	0.40	0.79	ND>0.20	1.8	ND>0.20	ND>0.20	1.4	8.4	12.8
MW-01-22	951024-M1-06	2708-S039	24-Oct-95	23.5	ND>0.05	ND>0.05	0.19	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.03	ND>0.05	ND>0.05	ND>0.05	0.15	0.09	ND	0.46
MW-02-32	951106-M2-01	2708-S049	6-Nov-95	0.2	0.05	0.08	0.14	0.73	1.2	0.49	1.1	1.0	0.83	0.16	1.4	ND>0.05	0.69	0.05	0.57	1.8	5.2	10.3
MW-02-32	951106-M2-06	2708-S049	6-Nov-95	24.0	0.20	ND>0.05	ND>0.05	0.04	0.04	ND>0.05	0.04	ND>0.05	0.04	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.08	ND>0.05	ND>0.05	0.15	0.43
MW-03-56	951101-M3-10	2708-S045	1-Nov-95	31.0	0.19	0.14	0.14	0.53	0.83	0.30	0.84	0.96	0.51	0.10	1.4	0.16	0.61	0.65	0.77	2.0	3.7	10.1
MW-03-56	951101-M3-13	2708-S046	1-Nov-95	38.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND

Updated: 7/18/96 RBE
File Name: 2708 Soil Results

NWT 002575

Table 3b - Summary Of Analytical Results for Soil Samples
PAHs by EPA Method 8270 (SIM)

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
Soil Boring	Sample Number*	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
MW-03-56	951101-M3-17	2708-S046	1-Nov-95	53.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
MW-03-56	951101-M3-18	2708-S046	1-Nov-95	53.5 (dup)	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.04	ND>0.05	ND>0.05	0.04	ND>0.05	ND>0.05	0.03	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.04	0.04	0.16
MW-04-57	951030-M4-01	2708-S043	30-Oct-95	0.2	ND>5.0	4.4	2.6	10	26	10	28	35	15	4.0	12	ND>5.0	21	1.7	3.4	22	114	195
MW-04-57	951030-M4-06	2708-S043	30-Oct-95	25.5	65	ND>100	110	190	200	68	210	190	180	24	640	49	ND>100	25	480	830	872	3,261
MW-04-57	951030-M4-15	2708-S044	30-Oct-95	57.0	0.03	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.05	ND>0.05	ND>0.05	0.08	0.03	0.07	ND	0.26
MW-05-32	951027-M5-01	2708-S042	27-Oct-95	0.2	ND>0.05	ND>0.05	ND>0.05	0.13	0.22	0.08	0.15	0.15	0.13	ND>0.05	0.20	ND>0.05	0.11	ND>0.05	0.07	0.19	0.82	1.4
MW-05-32	951027-M5-05	2708-S042	27-Oct-95	15.5	19	15	41	115	170	58	208	153	130	25	330	16	104	8.1	113	437	810	1,942
MW-05-32	951027-M5-07	2708-S042	27-Oct-95	21.5	ND>0.05	ND>0.05	0.07	0.07	0.04	ND>0.05	0.05	0.04	0.09	ND>0.05	0.17	ND>0.05	ND>0.05	ND>0.05	0.15	0.23	0.24	0.91
MW-05-32	951027-M5-10	2708-S042	27-Oct-95	31.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
MW-06-61	951107-M6-01	2708-S050	7-Nov-95	2.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
MW-06-61	951107-M6-08	2708-S050	7-Nov-95	30.0	2,350	25	1,420	340	170	120	190	130	450	25	1,900	990	94	3,650	5,780	2,980	1,389	20,614
MW-06-61	951107-M6-10	2708-S050	7-Nov-95	38.5	0.22	ND>0.05	0.16	0.04	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.07	ND>0.05	0.22	0.10	ND>0.05	0.08	0.60	0.34	0.11	1.8
MW-06-61	951107-M6-11	2708-S050	7-Nov-95	43.0	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.06	ND>0.05	ND	0.06
MW-08-56	951025-M8-01	2708-S040	25-Oct-95	0.2	ND>0.50	3.2	1.8	12.0	39.6	13.8	41.7	56.5	20.5	9.1	6.7	ND>0.50	46.2	2.2	1.4	26.1	203	281
MW-08-56	951025-M8-11	2708-S040	25-Oct-95	44.0	0.74	0.30	0.22	0.17	0.12	0.05	0.15	0.13	0.21	ND>0.05	0.60	0.48	0.08	2.6	1.5	0.71	0.78	8.1
MW-08-56	951025-M8-15	2708-S041	25-Oct-95	55.0	ND>0.05	ND>0.05	0.06	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.07	ND>0.05	ND>0.05	0.31	0.11	0.10	ND	0.64
MW-09-29	951023-M9-01	2708-S037	23-Oct-95	0.2	0.12	0.17	0.31	1.4	2.7	0.88	2.5	2.6	1.9	0.42	2.2	0.06	1.9	0.09	0.96	3.3	11.7	21.5
MW-09-29	951023-M9-04	2708-S037	23-Oct-95	5.0	0.12	1.3	2.0	7.4	20	5.0	14.1	22.6	13.3	2.7	17.9	0.40	16.1	1.2	8.6	30.4	78.5	163
MW-09-29	951023-M9-05	2708-S037	23-Oct-95	11.5	ND>0.05	ND>0.05	0.03	0.03	0.04	ND>0.05	0.03	0.04	0.04	ND>0.05	0.08	ND>0.05	0.03	ND>0.05	0.10	0.12	0.16	0.52
MW-10-61	951108-M10-01	2708-S052	8-Nov-95	0.2	0.83	ND>0.05	1.7	6.7	11	5.1	9.5	6.7	6.3	1.4	11	0.23	5.0	0.08	3.3	9.9	45	78.7
MW-10-61	951108-M10-02	2708-S052	8-Nov-95	0.2 (dup)	1.1	ND>0.05	1.1	10	17	6.2	14	9.0	7.5	2.2	14	0.36	7.2	0.13	5.2	12	64	107
MW-10-61	951108-M10-09	2708-S052	8-Nov-95	28.0	0.04	ND>0.05	0.04	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	0.08	ND>0.05	ND>0.05	0.23	0.22	0.16	ND	0.76
MW-12-36	951023-M12-01	2708-S037	23-Oct-95	0.2	1.5	0.23	2.0	8.5	15.3	5.2	13.3	10.8	12.3	2.2	12.4	0.54	8.7	0.34	5.8	17.1	65.5	116
MW-12-36	951023-M12-06	2708-S038	23-Oct-95	22.0	0.34	ND>0.50	0.99	ND>0.50	ND>0.50	ND>0.50	ND>0.50	ND>0.50	0.27	ND>0.50	0.97	0.40	ND>0.50	0.53	4.0	1.4	0.27	8.6
MW-12-36	951023-M12-07	2708-S038	23-Oct-95	26.5	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND>0.05	ND	ND
Industrial Maximum Allowable Soil Concentration** ->					100,000	#	600,000	1	1	1	1	#	1	1	80,000	80,000	1	8,000	#	60,000	#	#
Soil Cleanup Level** ->					2,000	#	20,000	0.1	0.1	0.1	0.1	#	0.1	0.1	8,000	2,000	0.1	30	#	6,000	#	#

Note:
* = Sample number prefix: 2708-
# = Cleanup level not established
bgs = below ground surface
** = Reference Standards based on Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045).

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram

ND = Not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
BOLD = Detected above Industrial Maximum Allowable Soil Concentration

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002576

TABLE 3c - Summary Of Analytical Results for Soil Samples
Phenols by EPA Method 8270

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Phenols by EPA Method 8270					Analytical Results mg/kg (ppm)															
Soil Boring	Sample Number*	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	4-Chloro-3-methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol	Cresols, Total	4-Methylphenol	2-Nitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Pentachlorophenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	Total Phenols
B-03	950921-B3-05	2708-S007	21-Sep-95	10.5	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>3.3	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND
B-10	950925-B10-04	2708-S013	25-Sep-95	17.5	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>9.9	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND
B-13	951006-B13-03	2708-S035	6-Oct-95	10.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-17	950929-B17-05	2708-S022	29-Sep-95	13.5	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>9.9	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND
B-18	950919-B18-05	2708-S003	19-Sep-95	12.0	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	0.36	ND>0.17	ND>0.17	ND>0.17	0.36
B-19	950919-B19-01	2708-S003	19-Sep-95	0.2	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.33	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND
B-19	950919-B19-03	2708-S004	19-Sep-95	6.5	ND>26	ND>26	ND>26	ND>26	ND>50	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND
B-20	950929-B20-03	2708-S022	29-Sep-95	10.5	ND>26	ND>26	ND>26	ND>26	ND>50	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND
B-22	951003-B22-05	2708-S027	3-Oct-95	13.5	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.33	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND
B-22	951003-B22-09	2708-S028	3-Oct-95	24.0	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>.33	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND>0.17	ND
B-23	951003-B23-08	2708-S029	3-Oct-95	26.5	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>2.0	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND>0.8	ND
B-26	951003-B26-06	2708-S030	4-Oct-95	20.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-27	950920-B27-10	2708-S005	20-Sep-95	23.0	ND>26	ND>26	ND>26	ND>26	ND>50	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>26	ND>23	ND>26	ND
B-28	951002-B28-01	2708-S025	2-Oct-95	0.2	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>9.9	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND>5.1	ND
B-28	951002-B28-07	2708-S025	2-Oct-95	15.0	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-29	950922-B29-15	2708-S012	22-Sep-95	35.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-30	950922-B30-06	2708-S010	22-Sep-95	11.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-31	950925-B31-06	2708-S014	25-Sep-95	21.0	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-33	951005-B33-03	2708-S034	5-Oct-95	5.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
B-33	951005-B33-14	2708-S034	5-Oct-95	54.0	ND>17	ND>17	ND>17	ND>17	ND>33	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND>17	ND
B-35	951005-B35-01	2708-S033	5-Oct-95	0.2	ND>.17	ND>.17	ND>.17	ND>.17	ND>.33	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND>.17	ND
MW-04-57	951030-M4-01	2708-S043	30-Oct-95	0.2	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
MW-04-57	951030-M4-06	2708-S043	30-Oct-95	25.5	ND>51	ND>51	ND>51	ND>51	ND>99	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND>51	ND
MW-10-60	951108-M10-01	2708-S052	8-Nov-95	0.2	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>6.6	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND>3.4	ND
MW-12-34	951023-M12-06	2708-S038	23-Oct-95	22.0	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>3.3	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND>1.7	ND
Industrial Maximum Allowable Soil Concentration** ->					#	#	#	#	#	#	#	#	#	#	#	50	#	#	500	#
Soil Cleanup Level** ->					#	#	#	#	#	#	#	#	#	#	#	5	#	#	2	#

Note: * = Sample number prefix: 2708-
# = Cleanup level not established
bgs = below ground surface
** = Reference Standards based on Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045).

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram

ND = Not detected above detection limit indicated
ppm = parts per million
BOLD = Detected above Industrial Maximum Allowable Soil Concentration

TABLE 3d - Summary Of Analytical Results for Soil Samples
Priority Pollutant Metals by EPA Methods 6010 and 7470

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Total Metals by EPA Method 6010 and 7470					Analytical Results mg/kg (ppm)												
Soil Boring	Sample Number*	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
B-1	950921-B1-01	2708-S009	21-Sep-95	0.2	ND>1.0	**6.6**	ND>1.0	ND>1.0	26	41	60	ND>0.10	21	ND>1.0	ND>1.0	4.1	140
B-1 (dup)	950921-B1-02	2708-S009	21-Sep-95	0.2	6.6	**21**	ND>1.0	1.1	30	60	58	ND>0.10	26	ND>1.0	ND>1.0	7.6	160
B-1	950921-B1-05	2708-S009	21-Sep-95	10.5	ND>1.0	**14**	ND>1.0	3.4	11	80	130	ND>0.10	36	ND>1.0	ND>1.0	3.0	670
B-2	950927-B2-05	2708-S016	27-Sep-95	16.0	ND>1.0	**4.9**	ND>1.0	4.3	12	20	15	ND>0.10	31	ND>1.0	ND>1.0	3.8	3,000
B-3	950921-B3-05	2708-S007	21-Sep-95	10.5	ND>1.0	**7.0**	ND>1.0	ND>1.0	30	36	22	ND>0.10	41	ND>1.0	ND>1.0	5.0	120
Industrial Maximum Allowable Soil Concentration** ->					#	3	1	1,000	1,500	80,000	2,000	600	40,000	#	10,000	#	#
Soil Cleanup Level X 20** ->					#	0.08	0.04	10	200	2,000	40	4	200	#	100	#	#
Soil Cleanup Level** ->					#	0.004	0.002	0.5	10	100	2	0.2	10	#	5	#	#

Note: * = Sample number prefix: 2708-
# = Cleanup level not established
bgs = below ground surface
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ND = Not detected above detection limit indicated
ppm = parts per million

BOLD - Detected above Industrial Maximum Allowable Soil Concentration
** = Reference Standards based on Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045).

TABLE 4a - Summary Of Analytical Results for Groundwater Samples - Temporary Well Points

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Soil Boring Number	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet bgs)	Analytical Results												
					ug/l (ppb)								mg/l (ppm)				
					EPA Method 8020					EPA Method 8270 SIM		EPA Method 8270	EPA Method 418.1	EPA Method 9010	EPA Method 375.4	EPA Method 9030	EPA Method 350.3
					Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	Total Phenols	TPH	Total Cyanide	Sulfate	Total Sulfides	Ammonia
B-01	950921-BW1-01	2708-W003	21-Sep-95	23.0	**6.9**	2.5	3.1	56	69	0.1	176	-	ND>0.5	**7.8**	**1,720**	22.5	29.3
B-05	950925-BW05-01	2708-W005	29-Sep-95	28.0	ND>0.5	0.97	ND>0.5	1.4	2.4	ND	35	-	ND>0.5	ND>0.02	ND>1	ND>0.1	2.71
B-08	950918-BW8-01	2708-W001	18-Sep-95	20.0	ND>0.5	0.85	ND>0.5	0.86	1.7	-	-	-	ND>0.5	-	-	-	-
B-19	950920-BW19-01	2708-W002	20-Sep-95	13.0	-	-	-	-	-	-	-	165	23	-	-	-	-
B-19	950920-BW19-02	2708-W002	20-Sep-95	28.0	**100,000**	**39,000**	**1,600**	**11,000**	151,600	0.7	6,610	-	6.7	-	-	-	-
B-21	951003-BW21-01	2708-W006	3-Oct-95	19.5	ND>0.5	1.2	1.9	3.3	6.4	2.9	726	ND	1.1	-	-	-	-
B-31	950925-BW31-01	2708-W004	25-Sep-95	29.0	3.0	1.6	10	13	28	13	695	-	ND>0.5	ND>0.02	18.5	ND>0.1	-
Reference Standards**					5	1,000	700	10,000	-	-	-	-	-	0.2	400	-	-

Note: * = Sample number prefix: 2708-
bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes

EPA = U.S. Environmental Protection Agency
ND = not detected above detection limit indicated
mg/l = milligrams/liter

ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
BOLD = Detected above Reference Standard

ppm = parts per million
TPH = total petroleum hydrocarbons
ug/l = micrograms/liter

** = Reference standards based on the ODEQ UST Groundwater Cleanup Levels (OAR 340-122-242) or Proposed EPA Maximum Contaminant Levels (MCLs)

TABLE 4b - Summary Of Analytical Results for Groundwater Samples - Temporary Well Points
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270					Analytical Results ug/l (ppb)																
Soil Boring	Sample Number*	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
B-01	950921-BW1-01	2708-W003	21-Sep-95	23.0	7.4	0.22	1.5	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.09	ND>0.1	1.3	4.5	ND>0.1	140	19	1.7	0.09	176
B-05	950925-BW05-01	2708-W005	29-Sep-95	28.0	13	0.14	1.2	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	1.4	9 8	ND>0.1	0.94	6.9	1.4	ND	35
B-19	950920-BW19-02	2708-W002	20-Sep-95	28.0	39	7.7	3.1	**0.26**	0.16	ND>0.1	ND>0.1	ND>0.1	**0.28**	ND>0.1	5.1	20	ND>0.1	**6500**	29	5.6	0.70	6,610
B-21	951003-BW21-01	2708-W006	3-Oct-95	19.5	110	1.83	2.7	**0.53**	**0.66**	**0.27**	**0.34**	**0.37**	**0.79**	0.07	5.0	21	0.27	**560**	17	5.4	2.9	726
B-31	950925-BW31-01	2708-W004	25-Sep-95	29.0	96	2.7	15	**2.4**	**2.1**	**0.97**	**2.4**	**1.6**	**3.9**	0.21	16	29	**1.3**	**420**	76	25	13	695
			Reference Standards** ->		420	#	2,100	0.1	0.2	0.2	0.2	0.2	0.2	0.3	280	280	0.4	28	#	210	#	#

Note:
* = Sample number prefix: 2708-
# = Cleanup level not established
bgs = below ground surface

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated

PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
ug/l = micrograms/liter
BOLD = Detected above Reference Standard

** = Reference Standards based on DEQ groundwater cleanup levels for petroleum underground storage tank (UST) sites

Updated: 7/15/96 RBE
File Name: 2708 Water Results-TWP

NWT 002580

TABLE 4c - Summary Of Analytical Results for Groundwater Samples - Temporary Well Points
Phenols by EPA Method 8270

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Phenols by EPA Method 8270					Analytical Results ug/l (ppb)															
Soil Boring	Sample Number*	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	4-Chloro-3-methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol	Cresols, Total	4-Methylphenol	2-Nitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Pentachlorophenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	Total Phenols
B-19	950920-BW19-02	2708-W002	20-Sep-95	28.0	ND>5.0	ND>5.0	ND>5.0	120	ND>10	ND>5.0	27	ND>5.0	ND>5.0	ND>5.0	ND>5.0	1.5	16	ND>5.0	ND>5.0	165
B-21	951003-BW21-01	2708-W006	3-Oct-95	19.5	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND .
	Reference Standards**				#	#	#	#	#	#	#	#	#	#	#	#	4,000	#	#	#

Note: * = Sample number prefix: 2708-
bgs = below ground surface

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated

ppb = parts per billion
ug/l = micrograms/liter
BOLD = Detected above Reference Standard

** = Reference standards based on EPA Maximum Contaminant Levels (MCLs) and Health Advisories

Table 5a - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
BTEX, Total PAHs, Total Phenols, and Cyanide
December 1995 to Present

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Well Number	Sample Number*	Chain of Custody Number	Sample Date	Analytical Results								
				EPA Method 8020 ug/l (ppb)					EPA Method 8270 SIM ug/l (ppb)		EPA Method 8270 ug/l (ppb)	EPA Method 3010 mg/l (ppm)
				Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	Total Phenols	Total Cyanide
MW01-22	951207-MW1-22-01	2708-W011	7-Dec-95	13	2.0	1.8	3.2	20	93	465	-	1.08
	960319-MW1-22-01	2708-W014	19-Mar-96	3.5	3.5	2.3	23	32	4.7	140	-	0.86
	960618-MW1-22-01	2708-W018	18-Jun-96	2.4	9.5	3.2	15	30	2.2	112	-	1.91
MW02-32	951206-MW2-32-01	2708-W010	6-Dec-95	6.0	ND>0.5	4.2	2.4	13	ND	52	-	0.353
	960318-MW2-32-01	2708-W013	18-Mar-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	4.5	-	0.26
	960618-MW2-32-01	2708-W018	18-Jun-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	2.6	-	0.44
MW03-26	951206-MW3-26-01	2708-W010	6-Dec-95	30	0.98	0.65	1.4	33	21	85	ND	-
	960318-MW3-26-02	2708-W013	18-Mar-96	1,300	5.0	2.2	5.6	1,313	1.7	42	-	0.27
	960618-MW3-26-01	2708-W018	18-Jun-96	2,300	22	ND>10	27	2,349	2.6	48	-	0.25
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	1,200	24	34	90	1,348	2.7	1,385	ND	-
	960319-MW3-56-01	2708-W014	19-Mar-96	730	16	27	66	839	2.3	1,927	-	0.19
	960620-MW3-56-01	2708-W019	20-Jun-96	730	7.1	26	73	836	1.6	1,491	-	0.08
MW04-35	951206-MW4-35-01	2708-W010	6-Dec-95	0.54	ND>0.5	ND>0.5	ND>0.5	0.54	0.69	54	-	0.079
	960318-MW4-35-01	2708-W013	18-Mar-96	17	0.96	ND>0.5	1.3	19	3.2	84	-	0.35
	960318-MW4-35-02	2708-W013	18-Mar-96	18	0.8	ND>0.5	2.1	21	2.4	79	-	-
	960618-MW4-35-01	2708-W018	18-Jun-96	5.9	ND>0.5	ND>0.5	0.61	6.5	2.5	61	ND	0.46
MW04-57	951205-MW4-57-01	2708-W009	5-Dec-95	9,600	72	590	290	10,552	1.7	1,328	-	1.18
	960321-MW4-57-01	2708-W016	21-Mar-96	11,000	ND>50	520	270	11,790	2.3	1,098	-	0.03
	960620-MW4-57-01	2708-W019	20-Jun-96	10,000	ND>200	480	ND>200	10,480			2.8	0.88
MW05-32	951205-MW5-32-01	2708-W009	5-Dec-95	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	7.6	208	-	0.101
	960319-MW5-32-01	2708-W014	19-Mar-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	29.8	269	-	0.11
MW05-32 (dissolved)	960319-MW5-32-01	2708-W014	19-Mar-96	-	-	-	-	-	ND	45	-	-
	960620-MW5-32-01	2708-W019	20-Jun-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	14	83	-	0.05
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	3,000	150	960	740	4,850	7,470	199,570	ND	0.091
	960319-MW6-32-01	2708-W014	19-Mar-96	640	22	400	270	1,332	7	2,346	-	0.21
MW06-32 (dissolved)	960319-MW6-32-01	2708-W014	19-Mar-96	-	-	-	-	-	ND	1,940	-	-
	960617-MW6-32-01	2708-W017	17-Jun-96	410	40	280	410	1,140	16	1,878	-	0.23
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95	6.7	0.71	8.9	5.8	22	8.2	745	ND	0.228
	960319-MW6-61-01	2708-W014	19-Mar-96	11	0.68	9.2	5.3	26	3.3	197	-	0.28
	960620-MW6-61-01	2708-W019	20-Jun-96	8.4	ND>0.5	6.0	3.3	18	4.3	139	-	0.27
MW08-29	951207-MW8-29-01	2708-W011	7-Dec-95	2,100	510	200	320	3,130	315	7,688	129	3.11
	960321-MW8-29-01	2708-W016	21-Mar-96	1,700	380	170	400	2,650	144	7,880	-	2.4
	960619-MW8-29-01	2708-W019	20-Jun-96	-	-	-	-	-	5.4	2,087	-	-
	960619-MW8-29-02	2708-W019	20-Jun-96	1,300	310	170	380	2,160	13	2,166	10	
MW08-56	951207-MW8-56-01	2708-W011	7-Dec-95	13,000	1,700	850	1,300	16,850	156	21,200	-	0.582
	960321-MW8-56-01	2708-W016	21-Mar-96	17,000	820	730	1,600	20,150	361	15,501	-	0.54
	960620-MW8-56-01***	2708-W019	20-Jun-96	17,000	650	740	1,100	19,490	35	1,769	-	0.31
MW09-29	951205-MW9-29-01	2708-W009	5-Dec-95	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	1.3	-	-
	960318-MW9-29-01	2708-W013	18-Mar-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	1.6	-	ND>0.01
	960618-MW9-29-01	2708-W018	18-Jun-96	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	0.15	-	ND>0.01

Table 5a - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
BTEX, Total PAHs, Total Phenols, and Cyanide
December 1995 to Present

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Well Number	Sample Number*	Chain of Custody Number	Sample Date	Analytical Results								
				EPA Method 8020 ug/l (ppb)					EPA Method 8270 SIM ug/l (ppb)		EPA Method 8270 ug/l (ppb)	EPA Method 9010 mg/l (ppm)
				Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	Total Phenols	Total Cyanide
MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	**120,000**	**42,000**	**2,000**	9,200	173,200	18	13,317	3,490	-
	960320-MW10-25-01	2708-W015	20-Mar-96	**32,000**	**38,000**	**3,100**	**13,000**	86,100	5.9	9,126	3,500	0.07
	960617-MW10-25-01	2708-W017	17-Jun-96	**28,000**	**32,000**	**2,500**	8,600	71,100	6.8	10,266	1,820	ND>0.01
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95	**75**	130	26	110	341	0.72	830	ND	-
	960321-MW10-61-01	2708-W016	21-Mar-96	4.1	1.6	2.9	8.5	17	2.6	102	-	ND>0.01
	960620-MW10-61-01	2708-W019	20-Jun-96	0.90	ND>0.5	1.1	1.7	3.7	2.0	46	ND	ND>0.01
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	**25,000**	**5,400**	480	2,800	33,680	20	22,365	3,110	-
	960320-MW11-32-01	2708-W015	20-Mar-96	**24,000**	**4,300**	**970**	2,400	31,670	6.3	14,676	1,650	**0.24**
	960617-MW11-32-01	2708-W017	17-Jun-96	**2,800**	**2,000**	**1,000**	1,940	7,740	14	11,608	960	0.19
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	**95**	410	170	590	1,265	3.7	3,378	-	-
	960321-MW12-36-01	2708-W016	21-Mar-96	**170**	180	110	550	1,010	0.38	2,010	ND	ND>0.01
	960620-MW12-36-01	2708-W019	20-Jun-96	**250**	250	120	440	1,060	0.80	192	-	ND>0.01
Reference Standards**				5	1,000	700	10,000	#	#	#	#	0.2

Note:
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
* = Sample number prefix: 2708-
# = Cleanup level not established
mg/l = milligrams/liter
ppm = parts per million
ug/l = micrograms per liter
ppb = parts per billion
BOLD = Detected above Reference Standard
PAHs = polynuclear aromatic hydrocarbons
BTEX = benzene, toluene, ethylbenzene, and xylenes
** = Reference standards based on the ODEQ UST Groundwater Cleanup Levels (OAR 340-122-242) or EPA Maximum Contaminant Levels (MCLs)
*** = PAH Results for sample 960620-MW-8-56-01 should be considered qualitative due to an apparent laboratory error concerning sample identity

Table 5b - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
PAHs by EPA Method 8270
December 1995 to Present

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																
Well Number	Sample Number	Chain of Custody Number	Sample Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
MW01-22	951207-MW1-22-01	2708-W011	7-Dec-95	11	2.6	52	24	13	4.8	12	9.3	32	1.3	74	16	6.3	39	100	68	93	465
	960319-MW1-22-01	2708-W014	19-Mar-96	10	0.33	4.1	1.2	0.70	0.28	0.64	0.41	1.6	ND>0.1	4.4	7.3	0.29	90	15	4.6	4.7	140
	960618-MW1-22-01	2708-W018	18-Jun-96	7.6	0.26	3.3	0.59	0.33	0.14	0.34	0.21	0.68	ND>0.1	2.5	6.2	0.15	75	12	2.9	2.2	112
MW02-32	951206-MW2-32-01	2708-W010	6-Dec-95	4.0	0.29	0.28	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.48	0.32	ND>0.1	45	0.51	0.67	ND	52
	960318-MW2-32-01	2708-W013	18-Mar-96	4.0	0.16	0.10	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.28	ND	4.5
	960618-MW2-32-01	2708-W018	18-Jun-96	1.5	0.23	0.15	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.22	ND>0.1	0.09	ND>0.1	0.41	ND	2.6
MW03-26	951206-MW3-26-01	2708-W010	6-Dec-95	1.5	2.7	2.3	2.8	4.7	1.5	4.1	3.9	4.6	0.54	8.5	1.2	2.8	30	4.7	9.4	21	85
	960318-MW3-26-02	2708-W013	18-Mar-96	2.5	1.4	1.1	0.29	0.35	0.14	0.39	0.34	0.30	ND>0.1	1.1	0.58	0.24	32	0.36	1.3	1.7	42
	960618-MW3-26-01	2708-W018	18-Jun-96	5.5	2.6	1.5	0.49	0.47	0.17	0.56	0.42	0.55	ND>0.1	1.3	1.3	0.31	30	0.79	1.9	2.6	48
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	51	46	8.1	0.73	0.33	0.14	0.41	0.36	0.85	ND>0.1	7.8	19	0.23	1,200	42	7.8	2.7	1,385
	960319-MW3-56-01	2708-W014	19-Mar-96	56	70	5.6	0.59	0.33	0.13	0.38	0.28	0.73	ND>0.1	6.1	25	0.18	1,700	53	8.3	2.3	1,927
	960620-MW3-56-01	2708-W019	20-Jun-96	47	56	6.4	0.45	0.22	ND>0.1	0.26	0.21	0.51	ND>0.1	5.8	27	0.15	1,300	39	8.1	1.6	1,491
MW04-35	951206-MW4-35-01	2708-W010	6-Dec-95	13	3.0	2.5	0.34	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.35	ND>0.1	9.7	6.1	ND>0.1	2.0	8.1	9.4	0.69	54
	960318-MW4-35-01	2708-W013	18-Mar-96	35	2.7	2.7	0.74	0.50	0.18	0.54	0.42	0.94	ND>0.1	8.4	11	0.28	3.2	7.9	9.9	3.2	84
	960318-MW4-35-02	2708-W013	18-Mar-96	34	2.8	2.8	0.62	0.36	0.14	0.40	0.29	0.70	ND>0.1	8.1	9.2	0.19	2.5	7.9	9.1	2.4	79
	960618-MW4-35-01	2708-W018	18-Jun-96	25	3.5	2.0	0.66	0.37	0.12	0.43	0.30	0.71	ND>0.1	7.8	8.5	0.22	0.59	1.9	9.3	2.5	61
MW04-57	951205-MW4-57-01	2708-W009	5-Dec-95	49	2.2	5.8	0.56	0.22	ND>0.1	0.21	0.14	0.65	ND>0.1	7.8	11	0.09	1,200	42	8.6	1.7	1,328
	960321-MW4-57-01	2708-W016	21-Mar-96	35	1.9	4.9	0.59	0.34	0.12	0.35	0.27	0.71	ND>0.1	6.9	9.2	0.18	1,000	31	6.3	2.3	1,098
	960620-MW4-57-01	2708-W019	20-Jun-96	39	2.8	4.1	0.45	0.19	ND>0.1	0.21	0.15	0.46	ND>0.1	6.5	10	0.11	540	34	8.5	1.4	646
MW05-32	951205-MW5-32-01	2708-W009	5-Dec-95	12	9.2	18	1.8	1.0	0.41	1.1	0.90	2.6	0.12	15	28	0.56	11	88	18	7.6	208
	960319-MW5-32-01	2708-W014	19-Mar-96	4.2	2.1	20	5.7	4.7	1.7	5.5	4.8	8.5	0.61	44	10	3.1	1.0	100	53	30	269
MW05-32 (dissolved)	960319-MW5-32-01	2708-W014	19-Mar-96	2.5	1.1	4.4	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	1.0	5.3	ND>0.1	0.61	29	1.1	ND	45
	960620-MW5-32-01	2708-W019	20-Jun-96	2.0	1.1	9.2	2.6	2.2	0.93	2.70	2.3	3.4	0.34	12	2.1	1.5	0.42	20	20	14	83
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	23,000	220	14,000	2,400	750	280	690	280	3,100	50	22,000	4,600	200	42,000	61,000	25,000	7,470	199,570
	960319-MW6-32-01	2708-W014	19-Mar-96	280	2.6	24	1.9	0.85	0.30	0.79	0.30	2.5	ND>0.1	16	61	0.22	1,800	140	16	6.6	2,346
MW06-32 (dissolved)	960319-MW6-32-01	2708-W014	19-Mar-96	220	2.0	5.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	1.3	42	ND>0.1	1,600	68	1.7	ND	1,940
	960617-MW6-32-01	2708-W017	17-Jun-96	310	2.4	29	4.5	2.4	0.87	2.5	0.90	5.0	0.23	27	82	0.74	1,200	170	40	16	1,878
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95	160	1.4	29	2.7	0.77	0.34	0.73	0.32	3.4	ND>0.1	24	48	0.23	250	200	24	8.2	745
	960319-MW6-61-01	2708-W014	19-Mar-96	29	0.24	10	1.1	0.33	0.13	0.33	0.13	1.4	ND>0.1	13	10	ND>0.1	66	53	13	3.3	197
	960620-MW6-61-01	2708-W019	20-Jun-96	21	0.30	6.1	1.4	0.48	0.25	0.50	0.21	1.5	ND>0.1	9.9	7.5	0.14	44	30	16	4.3	139
MW08-29	951207-MW8-29-01	2708-W011	7-Dec-95	94	200	110	65	34	16	44	36	81	50	230	83	25	6,000	400	220	315	7,688
	960321-MW8-29-01	2708-W016	21-Mar-96	140	260	56	28	23	10	31	23	33	2.9	98	89	16	6,700	270	100	144	7,880
micro-purge	960619-MW8-29-01	2708-W019	20-Jun-96	100	310	15	1.2	0.88	0.30	1.1	0.88	1.2	0.12	15	70	0.61	1,400	150	21	5.4	2,087
	960619-MW8-29-02	2708-W019	20-Jun-96	26	49	5.1	2.5	2.4	0.82	3.0	2.3	2.7	0.30	9.4	14	1.6	2,000	32	15	13	2,166
MW08-56	951207-MW8-56-01	2708-W011	7-Dec-95	130	250	53	25	14	60	17	15	30	ND>2	110	86	10	20,000	290	110	156	21,200
	960321-MW8-56-01	2708-W016	21-Mar-96	220	300	110	68	66	23	74	60	83	7.1	200	130	40	13,300	580	240	361	15,501
	960620-MW8-56-01***	2708-W019	20-Jun-96	28	66	10	6.6	5.7	2.2	7.9	6.0	7.3	0.81	21	17	4.3	1,500	56	30	35	1,769
MW09-29	951205-MW9-29-01	2708-W009	5-Dec-95	ND>0.1	0.10	0.15	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.12	ND>0.1	ND>0.1	0.44	0.37	0.11	ND	1.3

Table 5b - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
PAHs by EPA Method 8270
December 1995 to Present

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																	
Well Number	Sample Number*	Chain of Custody Number	Sample Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
	960318-MW9-29-01	2708-W013	18-Mar-96	0.11	ND>0.1	0.18	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.29	0.15	ND>0.1	ND>0.1	0.60	0.27	ND	1.6
	960618-MW9-29-01	2708-W018	18-Jun-96	ND>0.1	ND>0.1	0.15	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND	0.15
MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	31	88	16	4.0	2.9	1.3	3.4	2.5	4.6	ND>1.0	21	33	1.8	13,000	85	22	18	13,317
	960320-MW10-25-01	2708-W015	20-Mar-96	70	98	11	1.3	1.2	0.55	1.4	0.91	0.78	ND>0.3	8.8	39	0.7	8,800	86	6.7	5.9	9,126
	960617-MW10-25-01	2708-W017	17-Jun-96	75	130	14	1.1	1.2	0.62	1.8	1.10	0.87	0.25	1.6	49	0.95	9,900	82	6.6	6.8	10,266
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95	39	17	12	0.39	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.33	ND>0.1	12	28	ND>0.1	620	90	11	0.72	830
	960321-MW10-61-01	2708-W016	21-Mar-96	5.8	2.2	4.7	0.75	0.34	0.12	0.36	0.28	0.80	ND>0.1	7.3	1.5	0.18	43	28	7.1	2.6	102
	960620-MW10-61-01	2708-W019	20-Jun-96	2.1	0.98	2.2	0.54	0.24	0.12	0.28	0.22	0.68	ND>0.1	4.4	0.22	0.14	13	15	5.4	2.0	46
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	340	340	32	5.5	2.6	1.3	2.8	2.2	6.3	ND>1.0	48	190	1.5	21,000	360	33	20	22,365
	960320-MW11-32-01	2708-W015	20-Mar-96	200	180	20	1.6	1.2	0.49	1.2	0.75	1.3	ND>0.5	16	90	0.54	14,000	150	13	6.3	14,676
	960617-MW11-32-01	2708-W017	17-Jun-96	160	160	19	2.9	2.3	1.0	2.8	1.80	2.8	0.31	19	90	1.40	11,000	120	25	14	11,608
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	400	7.8	21	1.5	0.36	0.17	0.22	0.10	1.4	ND>0.1	28	170	ND>0.1	2,500	230	17	3.7	3,378
	960321-MW12-36-01	2708-W016	21-Mar-96	250	3.3	16	0.38	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.35	ND>0.1	18	110	ND>0.1	1,400	200	12	0.38	2,010
	960620-MW12-36-01	2708-W019	20-Jun-96	160	2.4	11	0.40	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.40	ND>0.1	18	81	ND>0.1	1,200	130	18	0.80	1,621
Reference Standards**				420	#	2,100	0.1	0.2	0.2	0.2	0.2	0.2	0.3	280	280	0.4	28	#	210	#	#

Note:
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
* = Sample number prefix: 2708-
# = Cleanup level not established
** = Reference standards based on the ODEQ UST Groundwater Cleanup Levels (OAR 340-122-242) or EPA Maximum Contaminant Levels (MCLs)
*** = Results for sample 960620-MW-8-56-01 should be considered qualitative due to an apparent laboratory error concerning sample identity with respect to PAH container

ug/l = micrograms per liter
ppb = parts per billion
PAHs = polynuclear aromatic hydrocarbons
BOLD = Detected above Reference Standard

Table 5c - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
Phenols by EPA Method 8270
December 1995 to Present

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Phenols by EPA Method 8270				Analytical Results ug/l (ppb)															
Well Number	Sample Number*	Chain of Custody Number	Sample Date	4-Chloro-3-methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol	Cresols, Total	4-Methylphenol	2-Nitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Pentachlorophenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	Total Phenols
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
MW04-35	960618-MW4-35-01	2708-W018	18-Jun-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
MW04-57	960620-MW4-57-01	2708-W019	20-Jun-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	2.8	ND>5.0	ND>5.0	2.8
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	ND>50	ND>50	ND>50	ND>50	ND>100	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
MW08-29	960321-MW8-29-01	2708-W016	21-Mar-96	ND>50	ND>50	ND>50	69	ND>50	ND>50	29	15	ND>50	ND>50	ND>50	ND>50	16	ND>50	ND>50	114
	960619-MW8-29-02	2708-W019	20-Jun-96	ND>5.0	ND>5.0	ND>5.0	10	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	10
MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	ND>50	ND>50	ND>50	490	ND>100	ND>50	1,600	930	ND>50	ND>50	ND>50	ND>50	470	ND>50	ND>50	2,560
	960320-MW10-25-01	2708-W015	20-Mar-96	ND>20	ND>20	ND>20	760	ND>20	ND>20	1,300	810	ND>20	ND>20	ND>20	ND>20	630	ND>20	ND>20	2,690
	960617-MW10-25-01	2708-W017	17-Jun-96	ND>500	ND>500	ND>500	440	ND>1000	ND>500	1,100	670	ND>500	ND>500	ND>500	ND>500	280	ND>500	ND>500	1,820
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
	960620-MW10-61-01	2708-W019	20-Jun-96	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>10.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	ND>50	ND>50	ND>50	1,200	ND>100	ND>50	1,200	590	ND>50	ND>50	ND>50	ND>50	120	ND>50	ND>50	2,520
	960320-MW11-32-01	2708-W015	20-Mar-96	ND>20	ND>20	ND>20	820	ND>20	ND>20	540	230	ND>20	ND>20	ND>20	ND>20	60	ND>20	ND>20	1,420
	960617-MW11-32-01	2708-W017	17-Jun-96	ND>500	ND>500	ND>500	540	ND>1,000	ND>500	420	170	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	ND>500	960
MW12-36	960321-MW12-36-01	2708-W016	21-Mar-96	ND>5	ND>5	ND>5	ND>5	ND>10	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND>5	ND
Reference Standards**				#	#	#	#	#	#	#	#	#	#	#	#	4,000	#	#	#

Note: * = Sample number prefix: 2708-
= Cleanup level not established
** = Reference standards based on EPA Maximum Contaminant Levels (MCLs) and Health Advisories
BOLD = Detected above Reference Standard

EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated

ppb = parts per billion
ug/l = micrograms/liter

Updated: 7/15/96 RBE
File Name: 2708 GW Results-All

Table 5d - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
Priority Pollutant Metals by EPA Methods 6010, 200.7 and 7000 Series
December 1995 to Present
Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Priority Pollutant Metals by EPA Methods 6010, 7000 and 200 Series				Analytical Results mg/l (ppm)															
Well Number	Sample Number*	Chain of Custody Number	Sample Date	Antimony	Arsenic	Beryllium	Cadmium	Dissolved Cadmium	Chromium	Copper	Lead	Dissolved Lead	Mercury	Nickel	Dissolved Nickel	Selenium	Silver	Thallium	Zinc
MW01-22	951207-MW1-22-01	2708-W011	7-Dec-95	-	-	-	-	-	-	-	**0.041**	ND>0.005	-	-	-	-	-	-	-
	960319-MW1-22-01	2708-W014	19-Mar-96	ND>0.005	ND>0.005	ND>0.002	ND>0.002	-	0.010	ND>0.005	0.007	ND>0.005	ND>0.0002	**0.14**	**0.23**	ND>0.0002	ND>0.0002	ND>0.01	0.066
	960618-MW1-22-01	2708-W018	18-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	0.039	-	-	-	-	0.024
MW02-32	951206-MW2-32-01	2708-W010	6-Dec-95	-	-	-	-	-	-	-	ND>0.005	-	-	-	-	-	-	-	-
	960618-MW2-32-01	2708-W018	18-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	0.008	-	-	-	-	ND>0.005
MW03-26	951206-MW3-26-01	2708-W010	6-Dec-95	-	-	-	-	-	-	-	0.007	ND>0.005	-	-	-	-	-	-	-
	960318-MW3-26-02	2708-W013	18-Mar-96	-	ND>0.005	-	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	-	**0.36**	**0.40**	-	-	-	0.005
	960618-MW3-26-01	2708-W018	18-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	**0.33**	-	-	-	-	0.014
MW03-56	951206-MW3-56-01	2708-W010	6-Dec-95	ND>0.005	ND>0.005	ND>0.002	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	ND>0.0002	0.007	-	ND>0.005	ND>0.005	ND>0.01	0.005
	960319-MW3-56-01	2708-W014	19-Mar-96	-	ND>0.005	-	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	-	0.013	-	-	-	-	ND>0.005
MW04-35	951206-MW4-35-01	2708-W010	6-Dec-95	-	-	-	-	-	-	-	ND>0.005	-	-	-	-	-	-	-	-
	960618-MW4-35-01	2708-W018	18-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	ND>0.005
MW04-57	951205-MW4-57-01	2708-W009	5-Dec-95	-	-	-	-	-	-	-	ND>0.005	-	-	-	-	-	-	-	-
	960321-MW4-57-01	2708-W016	21-Mar-96	-	0.005	-	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	ND>0.005
	960620-MW4-57-02	2708-W019	20-Jun-96	-	0.007	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	0.005	-	-	-	-	ND>0.005
MW05-32	951205-MW5-32-01	2708-W009	5-Dec-95	-	-	-	-	-	-	-	ND>0.005	-	-	-	-	-	-	-	-
	960620-MW5-32-01	2708-W019	20-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	ND>0.005
MW06-32	951207-MW6-32-01	2708-W011	7-Dec-95	ND>0.005	0.015	ND>0.002	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	ND>0.0002	ND>0.005	-	ND>0.005	ND>0.005	ND>0.01	ND>0.005
	960319-MW6-32-01	2708-W014	19-Mar-96	-	0.011	-	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	0.005
	960617-MW6-32-01	2708-W017	17-Jun-96	-	0.011	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	ND>0.005
MW06-61	951206-MW6-61-01	2708-W010	6-Dec-95	-	-	-	-	-	-	-	ND>0.005	-	-	-	-	-	-	-	-
	960319-MW6-61-01	2708-W014	19-Mar-96	ND>0.005	ND>0.005	-	ND>0.005	-	0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	0.015
	960620-MW6-61-01	2708-W019	20-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	ND>0.005
MW08-29	951207-MW8-29-01	2708-W011	7-Dec-95	ND>0.005	ND>0.005	ND>0.002	ND>0.002	-	0.031	0.023	0.011	-	ND>0.0002	0.075	-	ND>0.005	ND>0.005	ND>0.01	0.30
	960321-MW8-29-01	2708-W016	21-Mar-96	-	ND>0.005	-	ND>0.005	-	0.008	0.005	ND>0.005	-	-	0.015	-	-	-	-	0.26
	960619-MW8-29-02	2708-W019	20-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	0.008	-	-	-	-	0.014
MW08-56	951207-MW8-56-01	2708-W011	7-Dec-95	ND>0.005	ND>0.005	ND>0.002	ND>0.002	-	0.048	0.009	ND>0.005	-	ND>0.0002	0.035	-	ND>0.005	ND>0.005	ND>0.01	0.27
	960321-MW8-56-01	2708-W016	21-Mar-96	-	ND>0.005	-	ND>0.002	-	0.021	0.009	ND>0.005	-	-	0.020	-	-	-	-	0.24
	960620-MW8-56-01	2708-W019	20-Jun-96	-	ND>0.005	-	-	-	ND>0.005	0.150	ND>0.005	-	-	0.017	-	-	-	-	0.100
MW09-29	951205-MW9-29-01	2708-W009	5-Dec-95	-	-	-	-	-	-	-	**0.022**	-	-	-	-	-	-	-	-
	960318-MW9-29-01	2708-W013	18-Mar-96	ND>0.005	ND>0.005	ND>0.002	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	ND>0.0002	ND>0.005	-	ND>0.005	ND>0.005	ND>0.01	ND>0.005
	960618-MW9-29-01	2708-W018	18-Jun-96	-	0.01	-	-	-	0.23	0.30	0.008	-	-	**0.16**	-	-	-	-	0.097

Updated: 7/15/96 RBE
File Name: 2708 GW Results-All

NWT 002587

Table 5d - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
Priority Pollutant Metals by EPA Methods 6010, 200.7 and 7000 Series
December 1995 to Present
Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

MW10-25	951207-MW10-25-01	2708-W011	7-Dec-95	ND>0.005	0.034	ND>0.002	0.005	-	0.11	ND>0.005	ND>0.005	-	ND>0.0002	0.29	-	ND>0.005	ND>0.005	ND>0.01	0.95
	960320-MW10-25-01	2708-W015	20-Mar-96	-	0.035	-	0.005	ND>0.002	0.089	ND>0.005	ND>0.01	-	-	0.28	0.30	-	-	-	0.86
	960617-MW10-25-01	2708-W017	17-Jun-96	-	0.028	-	-	-	0.043	ND>0.005	ND>0.005	-	-	0.20	-	-	-	-	0.48
MW10-61	951206-MW10-61-01	2708-W010	6-Dec-95	-	-	-	-	-	-	-	ND>0.005	-	-	-	-	-	-	-	-
	960321-MW10-61-01	2708-W016	21-Mar-96	-	0.005	-	ND>0.002	-	0.027	0.009	ND>0.005	-	-	0.022	-	-	-	-	0.025
	960620-MW10-61-01	2708-W019	20-Jun-96	-	ND>0.005	-	-	-	ND>0.005	ND>0.005	ND>0.005	-	-	0.007	-	-	-	-	0.008
MW11-32	951207-MW11-32-01	2708-W011	7-Dec-95	ND>0.005	ND>0.005	ND>0.002	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	ND>0.0002	ND>0.005	-	ND>0.005	ND>0.005	ND>0.01	ND>0.005
	960320-MW11-32-01	2708-W015	20-Mar-96	-	ND>0.005	-	ND>0.002	-	ND>0.005	ND>0.005	ND>0.005	-	-	ND>0.005	-	-	-	-	0.008
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	ND>0.005	ND>0.005	ND>0.002	ND>0.002	-	ND>0.005	0.006	ND>0.005	-	ND>0.0002	ND>0.005	-	ND>0.005	ND>0.005	ND>0.01	0.012
Reference Standards**				0.006	0.05	0.004	0.005	0.005	0.1	1.0	0.015	0.005	0.002	0.1	0.1	0.05	0.1	0.002	5.0

Note: DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
* = Sample number prefix: 2708-
** = Reference standards based on the ODEQ UST Groundwater Cleanup Levels (OAR 340-122-242) or EPA Maximum Contaminant Levels (MCLs)

ppm = parts per million
mg/l = milligrams/liter
ND = Not detected above detection limit indicated
BOLD = Detected above Reference Standard

.able 5e - Summary Of Analytical Results for Groundwater Samples - Monitoring Wells
)etected Volatiles by EPA Method 8260
)ecember 1995 to Present

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
ortland, Oregon

Detected Volatiles by EPA Method 8260				Analytical Results ug/l (ppb)															
Well Number	Sample Number*	Chain of Custody Number	Sample Date	Benzene	Toluene	Ethyl benzene	m,p-Xylene	o-Xylene	Styrene	Isopropylbenzene	N-Propylbenzene	Sec-butylbenzene	Tetrachloroethene	1,3,5-Trimethylbenzene	1,2,4-Trimethylbenzene	1,2,3-Trimethylbenzene	p-Isopropyltoluene	Napthalene
MW11-32	960320-MW11-32-01	2708-W015	20-Mar-96	**16,700**	**3,300**	620	840	400	ND>2	42	18	9.0	2.2	79	250	110	35	**8,600**
	960617-MW11-32-01	2708-W017	17-Jun-96	**2,800**	**2,000**	**1000**	1,300	640	ND>5	70	17	10	ND>5	82	260	100	ND>5	**4,100**
	960617-MW11-32-02	2708-W017	17-Jun-96	**4,100**	**2,600**	**960**	1,200	580	ND>10	59	14	8.8	ND>10	70	220	86	ND>10	**5,600**
MW12-36	951207-MW12-36-01	2708-W011	7-Dec-95	**92**	510	150	460	170	100	ND>50	ND>50	ND>50	ND>50	57	88	36	ND>50	**2,300**
	960321-MW12-36-01	2708-W016	21-Mar-96	**210**	220	140	310	180	**130**	ND>10	ND>10	ND>10	ND>10	37	51	22	ND>10	**1,900**
	960620-MW12-36-01	2708-W019	20-Jun-96	**250**	250	120	280	160	**140**	ND>10	ND>10	ND>10	ND>10	13	42	16	ND>10	**1,500**
MW4-57	960321-MW4-57-01	2708-W016	21-Mar-96	**3,700**	35	540	80	140	ND>10	ND>10	ND>10	ND>10	ND>10	13	19	22	ND>10	**1,700**
MW5-32	951205-MW5-32-01	2708-W009	5-Dec-95	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	11
MW8-56	951207-MW8-56-01	2708-W011	7-Dec-95	**18,600**	**1,400**	590	600	200	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	110	ND>100	ND>100	**13,300**
Reference Standards**				5	1,000	700	10,000	10,000	100	#	#	#	5	#	#	#	#	28

Note: DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
* = Sample number prefix: 2708-
# = Cleanup level not established
** = Reference standards based on the ODEQ UST Groundwater Cleanup Levels (OAR 340-122-242), EPA Maximum Contaminant Levels (MCLs) and Health Advisories

ppb = parts per billion
ug/l=micrograms per liter
ND = Not detected above detection limit indicated
BOLD = Detected above Reference Standard

Updated: 7/15/96 RBE
File Name: 2708 GW Results-All

HAHN AND ASSOCIATES, INC.

NWT 002589

TABLE 6 - Summary of Aquifer Characteristic Data: Slug Testing Results

Remedial Investigation
Former Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Monitoring Well	Date Installed	Screen Interval (feet msl)	Aquifer Zone Monitored	Aquifer Type (from boring log)	Calculated Hydraulic Conductivity (feet/day) (feet/day)	Effective Porosity (estimated)	Average Hydraulic Gradient	Seepage Velocity (feet/day)
MW-1-22	24-Oct-95	21.0 to 11.0	unconfined / shallow	gravely to silty sands (fill)	0.35	0.2	0.017	0.030
MW-2-32	6-Nov-95	14.3 to 4.3	unconfined / shallow	silty sands and fine sands (fill)	3.4	0.2	0.017	0.289
MW-3-26	1-Nov-95	16.2 to 6.2	unconfined / shallow	sandy gravels and silts (fill)	0.31	0.2	0.017	0.026
MW-3-56	1-Nov-95	-13.8 to -23.8	semi-confined / intermediate	medium grained sands	1.3	0.2	0.016	0.102
MW-4-35	31-Oct-95	7.7 to -2.3	unconfined / shallow	silts and sands (fill)	26	0.2	0.017	2.20
MW-4-57	30-Oct-95	-14.3 to -24.3	semi-confined / intermediate	medium grained sands	0.86	0.2	0.016	0.068
MW-5-32	27-Oct-95	4.1 to -5.9	unconfined / shallow	sands and silty sands (fill)	0.46	0.2	0.017	0.039
MW-6-32	9-Nov-95	14.8 to 4.8	unconfined / shallow	medium grained sands (fill)	-	0.2	0.017	-
MW-6-61	7-Nov-95	-14.2 to -24.2	semi-confined / intermediate	fine grained sands and silts	1.5	0.2	0.016	0.120
MW-8-29	26-Oct-95	18.5 to 8.5	unconfined / shallow	lampblack, tarry gravels and silts (fill)	0.0067	0.1	0.017	0.00114
MW-8-56	25-Oct-95	-8.5 to -18.5	semi-confined / intermediate	fine grained sands	0.08	0.2	0.016	0.0065
MW-9-29	23-Oct-95	19.9 to 9.9	unconfined / shallow	fine grained sands (fill)	0.28	0.2	0.017	0.023
MW-10-25	9-Nov-95	22.5 to 12.5	unconfined / shallow	tarry silts, fine grained sands (fill)	-	0.1	0.017	-
MW-10-61	8-Nov-95	-13.5 to -23.5	semi-confined / intermediate	fine grained sands and silty sands	0.23	0.2	0.016	0.018
MW-11-32	3-Nov-95	14.4 to 4.4	unconfined / shallow	silt and medium grained sands	-	0.2	0.017	-
MW-12-36	23-Oct-95	10.9 to 0.9	unconfined / shallow	fine grained sands	0.62	0.2	0.017	0.053

TABLE 7a - Summary Of Analytical Results for Sediment Samples: On-Site Ponds, Ditch, and Willamette River
TPH, BTEX, Total PAHs, Total Phenols, Total Organic Carbon, and Lead

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

Soil Boring Number	Sample Number*	Chain of Custody Number	Sample Date	Depth (feet bgs)	Analytical Results mg/kg (ppm)													
					ODEQ Method TPH-HCID			ODEQ Method TPH-G	ODEQ Method TPH-418.1M	EPA Method 8270 SIM		EPA Method 8020					EPA Method 415.1	EPA Method 6010
					Gasoline	Diesel	Oil	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Organic Carbon	Total Lead
SD-1	960130-SD1-01	2708-SD010	30-Jan-96	0.5	ND>20	Detected	Detected	-	140	1,063	1,935	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	**90,700**	14
SD-2	960130-SD2-01	2708-SD010	30-Jan-96	0.5	-	-	-	16	**1,200**	3,722	21,665	ND>0.3	ND>0.3	ND>0.3	0.34	0.34	**134,000**	6.8
SD-3	960130-SD3-01	2708-SD010	30-Jan-96	0.5	-	-	-	ND>10	**1,100**	2,628	10,670	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	**75,500**	18
SD-4	960123-SD4-01	2708-SD003	23-Jan-96	0.5	ND>20	Detected	Detected	-	91	33	165	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	17,000	32
SD-4	960123-SD4-11	2708-SD003	23-Jan-96	9.5	ND>20	ND>50	ND>100	-	-	0.10	0.15	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	2.3
SD-5	960123-SD5-01	2708-SD003	23-Jan-96	0.5	ND>20	ND>50	ND>100	-	-	50	118	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	18,500	9.3
SD-5	960123-SD5-09	2708-SD004	23-Jan-96	8.0	-	-	-	ND>10	160	307	1,154	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	20
SD-6	960123-SD6-01	2708-SD004	23-Jan-96	0.5	ND>20	Detected	Detected	-	240	44.2	101	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	5,400	25
SD-6	960123-SD6-09	2708-SD005	23-Jan-96	8.0	ND>20	ND>50	ND>100	-	-	0.73	2.2	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	10
SD-7	960123-SD7-01	2708-SD006	23-Jan-96	0.5	Detected	Detected	Detected	**300**	**5,100**	5,048	26,408	**22**	4.2	10	18	54.2	**120,000**	35
SD-7	960123-SD7-05	2708-SD006	23-Jan-96	8.5	ND>20	ND>50	ND>100	-	-	2.5	10.9	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	2.8
SD-8	960123-SD8-01	2708-SD006	23-Jan-96	0.5	ND>20	ND>50	ND>100	-	-	300	875	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	**41,000**	47
SD-8	960123-SD8-10	2708-SD007	23-Jan-96	9.0	-	-	-	44	**910**	556	3,254	ND>0.3	ND>0.3	1.3	1.3	2.6	-	26
SD-9	960124-SD9-01	2708-SD007	24-Jan-96	0.5	ND>20	ND>50	ND>100	-	-	60	125	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	34,000	20
SD-9	960124-SD9-02 (Dup)	2708-SD007	24-Jan-96	0.5	-	-	-	-	-	44	94	-	-	-	-	-	28,000	-
SD-9	960124-SD9-06	2708-SD008	24-Jan-96	4.5	-	-	-	**110**	380	833	5,471	1.8	ND>0.3	6.2	6.0	14.0	-	10
SD-10	960123-SD10-01	2708-SD008	23-Jan-96	0.5	ND>20	ND>50	ND>100	-	-	8.0	283	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	9,600	2.8
SD-10	960123-SD10-09	2708-SD008	23-Jan-96	7.5	ND>20	Detected	ND>100	-	290	4.1	9.6	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	7.8
SD-11	960123-SD11-01	2708-SD008	23-Jan-96	0.5	-	-	-	ND>10	9.6	1.6	5.6	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	830	5.1
SD-11	960123-SD11-03	2708-SD009	23-Jan-96	2.0	ND>20	-	-	-	280	58	569	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	6.3
SD-12	960124-SD12-01	2708-SD002	24-Jan-96	0.5	ND>20	ND>50	ND>100	-	-	0.23	0.72	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	5,000	10
SD-12	960124-SD12-04	2708-SD002	24-Jan-96	3.0	ND>20	ND>50	ND>100	-	-	3.3	8.4	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	6.6
SD-13	960124-SD13-01	2708-SD001	24-Jan-96	0.5	ND>20	ND>50	ND>100	-	-	0.70	1.4	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	4,800	13
SD-14	960124-SD14-01	2708-SD005	24-Jan-96	0.5	ND>20	Detected	ND>100	-	96	0.10	0.15	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	8,000	13
SD-14	960124-SD14-09	2708-SD005	24-Jan-96	8.0	-	-	-	-	-	1	2	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	-	2.6
Reference Standards**					-	-	-	80	500	-	-	2.0	80	100	800	-	40,000	2,000

Note:
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
HCID = hydrocarbon identification
TPH = total petroleum hydrocarbons
PAHs = polynuclear aromatic hydrocarbons

mg/kg = milligrams/kilogram
ppm = parts per million
ND = not detected above detection limit indicated
ODEQ = Oregon Department of Environmental Quality

* = Sample number prefix: 2708-
# = Detected hydrocarbons in the diesel range appear to be due to a high concentration of oil hydrocarbons.
** = TPH standards based on the ODEQ UST Level 2 Soil Cleanup Standards (OAR 340-122-335);
Other standards based on Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045).
BOLD = Detected above Reference Standard

TABLE 7b - Summary Of Analytical Results for Sediment Samples: On-Site Ponds, Ditch, and Willamette River
PAHs by EPA Method 8270 (SIM)

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
Soil Boring	Sample Number*	Chain of Custody No.	Sample Date	Sample Depth (feet bgs)	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
SD-1	960130-SD1-01	2708-SD010	30-Jan-96	0.5	5.7	41.3	24	141	246	76	205	226	215	28.9	255	ND>5	151	8.1	14.7	297	1,063	1,935
SD-2	960130-SD2-01	2708-SD010	30-Jan-96	0.5	1,408	194	1,030	688	695	262	729	594	899	68.6	3,006	1,038	380	1,437	6,001	3,235	3,722	21,665
SD-3	960130-SD3-01	2708-SD010	30-Jan-96	0.5	397	104	419	458	498	182	472	422	693	48.1	2,013	304	269	12.8	2,230	2,140	2,620	10,662
SD-4	960123-SD4-01	2708-SD003	23-Jan-96	0.5	5.9	0.59	4.9	5.6	6.8	2.7	5.6	6.1	7.8	0.65	19.9	4.8	3.8	32.2	34.6	23.0	33	164.94
SD-4	960123-SD4-11	2708-SD003	23-Jan-96	9.5	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND	ND
SD-5	960123-SD5-01	2708-SD003	23-Jan-96	0.5	4.3	ND>50	4.0	8.4	9.3	3.0	11	9.9	11	1.3	13	2.0	5.8	1.6	15	18	50	118
SD-5	960123-SD5-09	2708-SD004	23-Jan-96	8.0	45.8	2.3	63.4	52.7	56.8	20.6	64.5	47.1	72.5	6.6	174	28.9	32.9	6.5	266	213	307	1,154
SD-6	960123-SD6-01	2708-SD004	23-Jan-96	0.5	1.3	0.65	2.0	6.6	9.4	3.7	9.7	8.0	8.8	0.86	18.2	0.75	5.1	0.37	3.5	22.5	44	101
SD-6	960123-SD6-09	2708-SD005	23-Jan-96	8.0	0.05	ND>50	0.07	0.10	0.14	0.06	0.17	0.21	0.15	ND>50	0.34	ND>50	0.12	0.06	0.26	0.47	0.73	2.2
SD-7	960123-SD7-01	2708-SD006	23-Jan-96	0.5	1,600	140	1,100	840	930	350	1,000	820	1,300	98	3,000	800	530	5,100	5,400	3,400	5,048	26,408
SD-7	960123-SD7-05	2708-SD006	23-Jan-96	8.5	0.25	0.24	0.51	0.37	0.45	0.18	0.52	0.49	0.64	ND>75	1.4	0.24	0.3	1.4	2.1	1.8	2.5	11
SD-8	960123-SD8-01	2708-SD006	23-Jan-96	0.5	21	6.7	28	49	59	21	69	57	58	6.9	160	12	37	3.9	96	190	300	875
SD-8	960123-SD8-10	2708-SD007	23-Jan-96	9.0	170	13	190	120	100	36	110	75	140	10	340	120	48	580	770	440	564	3,262
SD-9	960124-SD9-01	2708-SD007	24-Jan-96	0.5	1.6	1.5	2.6	8.7	12	4.5	14	12	11	1.4	18	0.83	7.9	0.81	8.1	20	60	125
SD-9	960124-SD9-02 (Dup)	2708-SD007	24-Jan-96	0.5	1.1	0.88	1.5	6.5	8.6	3.3	10	9.6	8.8	1.1	14	0.45	5.9	0.73	5.1	16	44	94
SD-9	960124-SD9-06	2708-SD008	24-Jan-96	4.5	460	28	230	150	160	57	180	140	180	16	540	190	90	1,500	1,000	550	833	5,471
SD-10	960123-SD10-01	2708-SD008	23-Jan-96	0.5	16	190	5.5	2.1	1.3	0.5	1.1	0.69	2.4	0.10	12	11	0.46	0.10	31	9.1	8.0	283
SD-10	960123-SD10-09	2708-SD008	23-Jan-96	7.5	0.10	0.09	0.18	0.64	0.82	0.29	0.84	0.67	1.0	0.09	1.5	ND>68	0.45	ND>68	1.0	1.9	4.1	9.6
SD-11	960123-SD11-01	2708-SD008	23-Jan-96	0.5	0.34	ND>66	0.21	0.25	0.32	0.12	0.32	0.33	0.38	ND>66	0.87	0.39	0.21	ND>66	1.1	0.78	1.6	5.6
SD-11	960123-SD11-03	2708-SD009	23-Jan-96	2.0	40	0.38	58	17	8.1	3.7	5.3	1.6	16	ND>.74	100	66	1.3	ND>.74	260	74	51	651
SD-12	960124-SD12-01	2708-SD002	24-Jan-96	0.5	ND>50	ND>50	ND>50	ND>50	0.067	ND>50	0.06	0.11	0.05	ND>50	0.13	ND>50	0.06	ND>50	0.06	0.19	0.23	0.72
SD-12	960124-SD12-04	2708-SD002	24-Jan-96	3.0	0.055	0.05	0.13	0.38	0.66	0.22	0.83	1.2	0.53	0.06	1.1	ND>50	0.59	0.06	0.39	2.1	3.3	8.4
SD-13	960124-SD13-01	2708-SD001	24-Jan-96	0.5	ND>50	ND>50	0.044	0.097	0.15	0.07	0.13	0.14	0.17	ND>50	0.2	ND>50	0.09	ND>50	0.08	0.21	0.70	1.4
SD-14	960124-SD14-01	2708-SD005	24-Jan-96	0.5	ND>50	ND>50	ND>50	ND>50	0.05	ND>50	0.05	0.05	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50	0.10	0.15
SD-14	960124-SD14-09	2708-SD005	24-Jan-96	8.0	ND>50	ND>50	0.07	0.16	0.12	0.054	0.13	0.06	0.18	ND>50	0.22	ND>50	0.05	ND>50	0.12	0.31	0.69	1.5
Industrial Maximum Allowable Soil Concentration** ->					100,000	#	600,000	1	1	1	1	#	1	1	80,000	80,000	1	8,000	#	60,000	#	#
Soil Cleanup Level** ->					2,000	#	20,000	0.1	0.1	0.1	0.1	#	0.1	0.1	8,000	2,000	0.1	30	#	6,000	#	#

Note:
* = Sample number prefix: 2708-
# = Cleanup level not established
bgs = below ground surface

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram

ND = Not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million

** = Reference Standards based on Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045).

BOLD = Detected above Industrial Maximum Allowable Soil Concentrations

Updated: 7/15/96 RBE
File Name: 2708 Soil Results

NWT 002592

TABLE 8a - Summary Of Analytical Results for On-Site Surface Water Samples
BTEX, PAHs, TPH, and Lead

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Sample Location	Sample Number*	Chain of Custody Number	Sample Date	Analytical Results								
				ug/l (ppb)							mg/l (ppm)	
				EPA Method 8020					EPA Method 8270 SIM		EPA Method 418.1	EPA Method 6010
				Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs	TPH	Dissolved Lead
SW1	960130-SW1-01	2708-W012	30-Jan-96	0.92	ND>0.5	ND>0.5	ND>0.5	0.92	6.6	12.1	ND>0.5	ND>0.005
SW2	960130-SW2-01	2708-W012	30-Jan-96	3.1	ND>0.5	0.8	2.1	6.0	0.24	23.7	ND>0.5	ND>0.005
SW3	960130-SW3-01	2708-W012	30-Jan-96	0.92	ND>0.5	ND>0.5	ND>0.5	0.92	0.8	16.3	ND>0.5	ND>0.005
SW4	960130-SW4-01	2708-W012	30-Jan-96	**110**	9.0	0.55	ND>0.5	120	0.55	4.7	ND>0.5	ND>0.005
SW5	960130-SW5-01	2708-W012	30-Jan-96	**6.2**	0.75	ND>0.5	ND>0.5	7.0	0.62	20.1	22	ND>0.005
SW5	960130-SW1-02	2708-W012	30-Jan-96	-	-	-	-	-	0.69	23	-	ND>0.005
Reference Standards**				5	1,000	700	10,000	#	#	#	#	0.005

Note:
* = Sample number prefix: 2708-
# = Cleanup level not established
BTEX = benzene, toluene, ethylbenzene, and xylenes
TPH = total petroleum hydrocarbons

EPA = U.S. Environmental Protection Agency
ND = not detected above detection limit indicated
mg/l = milligrams/liter
ug/l = micrograms/liter

ODEQ = Oregon Department of Environmental Quality
PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
ppm = parts per million
BOLD = Detected above Reference Standard

** = Reference standards based on the ODEQ UST Groundwater Cleanup Levels (OAR 340-122-242) or EPA Maximum Contaminant Levels (MCLs)

TABLE 8b - Summary Of Analytical Results for On-Site Surface Water Samples
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																
Sample Location	Sample Number*	Chain of Custody Number	Sample Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
SW1	960130-SW1-01	2708-W012	30-Jan-96	ND>0.3	0.60	0.87	**0.75**	**1.8**	**0.64**	**1.1**	**1.80**	**1.1**	ND>0.3	0.90	ND>0.3	**1.2**	ND>0.3	ND>0.3	1.3	6.6	12
SW2	960130-SW2-01	2708-W012	30-Jan-96	2.9	0.30	0.40	ND>0.1	0.13	ND>0.1	ND>0.1	0.10	0.11	ND>0.1	0.85	1.2	ND>0.1	16	0.96	0.71	0.24	24
SW3	960130-SW3-01	2708-W012	30-Jan-96	2.8	0.48	0.56	**0.11**	0.19	ND>0.1	0.13	0.17	**0.21**	ND>0.1	1.1	1.3	0.12	7.2	1.1	0.86	0.76	16
SW4	960130-SW4-01	2708-W012	30-Jan-96	0.31	ND>0.1	ND>0.1	ND>0.1	0.17	ND>0.1	0.12	0.18	0.15	ND>0.1	0.28	0.22	0.11	2.5	0.40	0.28	0.55	4.7
SW5	960130-SW5-01	2708-W012	30-Jan-96	1.1	0.31	ND>0.1	0.10	0.16	ND>0.1	0.11	0.14	0.15	ND>0.1	0.32	0.41	0.10	16	0.88	0.32	0.62	20
SW5	960130-SW1-02	2708-W012	30-Jan-96	1.2	0.35	0.16	**0.11**	0.18	ND>0.1	0.12	0.17	0.16	ND>0.1	0.30	0.44	0.12	18	1.0	0.28	0.69	23
Reference Standards**				420	#	2,100	0.1	0.2	0.2	0.2	0.2	0.2	0.3	280	280	0.4	28	#	210	#	#

Note: * = Sample number prefix: 2708-
= Cleanup level not established

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated

PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
ug/l = micrograms/liter
BOLD = Detected above Reference Standard

** = Reference Standards based on DEQ Groundwater Cleanup Levels for petroleum underground storage tank (UST) sites

Updated: 7/15/96 RBE
File Name: 2708 Water Results-Surface

NWT 002594

Table 9a - Summary Of Analytical Results for Quality Assurance / Quality Control Samples
Soil and Water Sampling Activities

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Well Sample Type	Sample Number*	Chain of Custody Number	Sample Date	Comment	Analytical Results ug/l (ppb)						
					EPA Method 8202					EPA Method 8270 SIM	
					Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Carcinogenic PAHs	Total PAHs
Trip Blank	950920-Trip Blank	2708-W002	20-Sep-95	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Trip Blank	950925-Trip Blank	2708-W004	25-Sep-95	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Trip Blank	950929-BW00-01	2708-W005	29-Sep-95	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Trip Blank	951003-BW00-01	2708-W006	3-Oct-95	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Trip Blank	951005-BW00-01	2708-W007	5-Oct-95	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Equipment Blank	951005-BW32-01	2708-W007	5-Oct-95	Deionized water through decontaminated split spoon after sampling tar zone at boring B-32	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	1.6	10.0
Equipment Blank	951005-BW35-01	2708-W007	5-Oct-95	Deionized water through decontaminated split spoon after sampling tar zone at boring B-35	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	0.22	3.1
Equipment Blank	951206-MW00-01	2708-W010	6-Dec-95	Deionized water through decontaminated pump after sampling MW10-57, and prior to sampling MW-6-61	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	ND	2.7
Trip Blank	951206-MW00-02	2708-W010	6-Dec-95	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Equipment Blank	951207-MW00-01	2708-W011	7-Dec-95	Deionized water through decontaminated pump after sampling MW-8-56, and prior to sampling MW-1-22	0.52	1.2	ND>0.5	ND>0.5	1.7	0.92	6.7
Field Blank	960130-SW0-01	2708-W012	30-Jan-96	Deionized water poured directly into sample container: On shore, upwind of SW-1 location	ND>0.5	1.2	ND>0.5	1.3	2.5	0.21	5.18
Trip Blank	960130-SW0-02	2708-W012	30-Jan-96	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Equipment Blank	960318-MW7-01	2708-W013	18-Mar-96	Deionized water through decontaminated pump prior to sampling MW-9-29	-	-	-	-	-	ND	0.7
Equipment Blank	960318-MW7-02	2708-W013	18-Mar-96	Deionized water through decontaminated pump after sampling MW-4-35, and prior to sampling MW-3-26	ND>0.5	1.5	ND>0.5	1.2	2.7	ND	0.9
Trip Blank	960319-MW7-03	2708-W014	19-Mar-96	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Equipment Blank	960321-MW7-04	2708-W016	21-Mar-96	Deionized water through decontaminated pump after sampling MW-8-29, and prior to sampling MW-10-61	ND>0.5	1.2	ND>0.5	1.0	ND	0.50	6.1
Trip Blank	960321-MW7-05	2708-W016	21-Mar-96	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Equipment Blank	960618-MW-7-01		18-Jun-96	Deionized water through decontaminated pump prior to sampling MW-9-29	-	-	-	-	-	1.30	2.5
Trip Blank	960618-MW-7-02		18-Jun-96	-	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	-	-
Equipment Blank	960618-MW-7-03		18-Jun-96	Deionized water through decontaminated pump prior to sampling MW-5-32	ND>0.5	ND>0.5	ND>0.5	ND>0.5	ND	0.29	0.71
Equipment Blank	960620-MW-7-04***		20-Jun-96	Deionized water through decontaminated pump prior to sampling MW-8-56	ND>0.5	0.59	ND>0.5	ND>0.5	0.59	0.21	5.2
Reference Standards**					5	1,000	700	10,000	-	-	-

Note:
* = Sample number prefix: 2708-
bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
PAHs = polynuclear aromatic hydrocarbons
** = Reference standards based on the ODEQ UST Groundwater Cleanup Levels (OAR 340-122-242) or Proposed EPA Maximum Contaminant Levels (MCLs)
*** = Due to Laboratory error, results of this sample were switched with, and reported as, sample MW-8-56-01

EPA = U.S. Environmental Protection Agency
ND = not detected above detection limit indicated
ug/l = micrograms/liter
ppb = parts per billion

Table 9b - Summary Of Analytical Results for Quality Assurance / Quality Control Samples
PAHs by EPA Method 8270

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
Portland, Oregon

Project #2708

PAHs by EPA Method 8270				Analytical Results ug/l (ppb)																	
Sample Type	Sample Number*	Chain of Custody Number	Sample Date	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Chrysene	Dibenzo (ah) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total PAHs
Trip Blank	950920-Trip Blank	2708-W002	20-Sep-95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Blank	950925-Trip Blank	2708-W004	25-Sep-95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Blank	950929-BW00-01	2708-W005	29-Sep-95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Blank	951003-BW00-01	2708-W006	3-Oct-95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Blank	951005-BW00-01	2708-W007	5-Oct-95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Blank	951005-BW32-01	2708-W007	5-Oct-95	0.09	0.08	0.38	0.36	0.25	0.15	0.36	0.18	0.33	ND>0.1	1.7	0.19	0.13	0.63	3.1	2.2	1.6	10
Equipment Blank	951005-BW35-01	2708-W007	5-Oct-95	ND>0.1	ND>0.1	0.18	0.10	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.12	ND>0.1	0.49	0.12	ND>0.1	0.23	1.1	0.78	0.22	3.1
Equipment Blank	951206-MW00-01	2708-W010	6-Dec-95	0.14	0.14	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.33	0.84	ND>0.1	0.26	0.84	0.31	ND	2.7
Trip Blank	951206-MW00-02	2708-W010	6-Dec-95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Blank	951207-MW00-01	2708-W011	7-Dec-95	0.19	0.14	0.28	0.21	0.16	ND>0.1	0.16	0.16	0.29	ND>0.1	0.89	0.22	0.10	1.6	1.5	0.96	0.92	6.7
Field Blank	960130-SW0-01	2708-W012	30-Jan-96	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND	ND
Equipment Blank	960318-MW7-01	2708-W013	18-Mar-96	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.20	ND>0.1	ND>0.1	ND>0.1	0.3	0.20	ND	0.7
Equipment Blank	960318-MW7-02	2708-W013	18-Mar-96	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.28	ND>0.1	ND>0.1	0.17	0.22	0.22	ND	0.9
Trip Blank	960319-MW7-03	2708-W014	19-Mar-96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Blank	960321-MW7-04	2708-W016	21-Mar-96	0.25	0.27	0.10	0.11	0.13	ND>0.1	0.11	ND>0.1	0.15	ND>0.1	0.48	0.23	ND>0.1	2.9	1.2	0.43	0.50	6.1
Trip Blank	960321-MW7-05	2708-W016	21-Mar-96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Blank	960618-MW-7-01		18-Jun-96	ND>0.1	ND>0.1	ND>0.1	0.21	0.29	0.11	0.24	0.22	0.26	ND>0.1	0.34	ND>0.1	0.17	0.11	0.19	0.28	1.3	2.5
Trip Blank	960618-MW-7-02		18-Jun-96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Blank	960618-MW-7-03		18-Jun-96	ND>0.1	ND>0.1	ND>0.1	0.09	0.11	ND>0.1	ND>0.1	0.09	0.09	ND>0.1	0.15	ND>0.1	ND>0.1	ND>0.1	ND>0.1	0.18	0.29	0.71
Equipment Blank	960620-MW-7-04***		20-Jun-96	0.14	0.20	ND>0.1	ND>0.1	0.10	ND>0.1	ND>0.1	ND>0.1	0.11	ND>0.1	0.41	0.14	ND>0.1	2.70	0.93	0.59	0.21	5.2
Reference Standards**				420	#	2,100	0.1	0.2	0.2	0.2	0.2	0.2	0.3	280	280	0.4	28	#	210	#	#

Note:
* = Sample number prefix: 2708-
# = Cleanup level not established
bgs = below ground surface

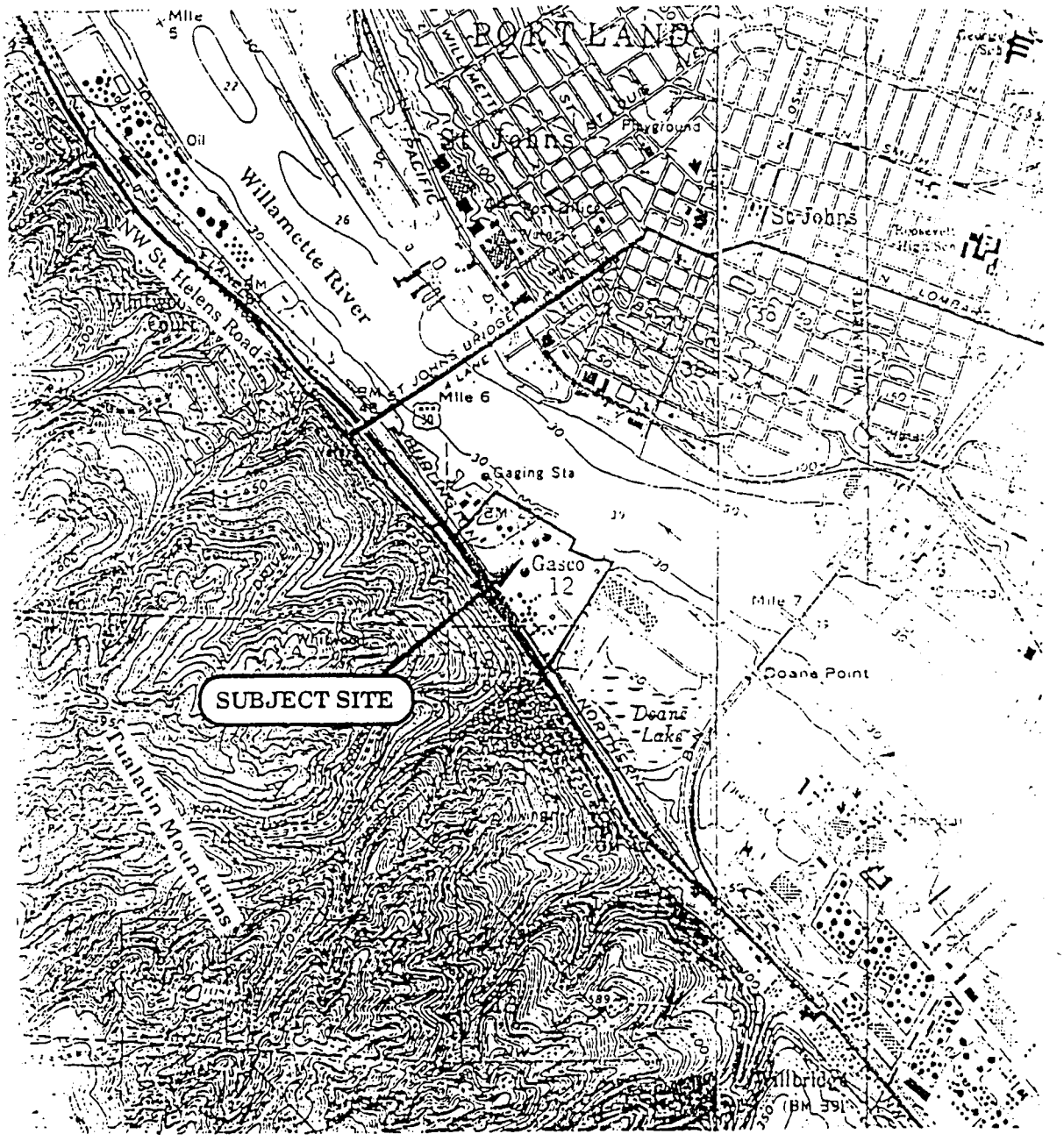
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
ND = Not detected above detection limit indicated

PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
ug/l = micrograms/liter

BOLD = Detected above Reference Standard
** = Reference Standards based on DEQ groundwater cleanup levels for petroleum underground storage tank (UST) sites
*** = Due to Laboratory error, results of this sample were switched with, and reported as, sample MW-8-56-01

Updated: 7/17/96 RBE
File Name: 2708 GW Results-12/95

NWT 002596



Note: Base Map from Linnton (1984) and Portland (1977), Oregon, USGS 7.5 Minute Quadrangles

Project # 2708 July 1996	**HAHN AND ASSOCIATES** **INCORPORATED** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	**SITE LOCATION MAP** RI/FS Northwest Natural Gas Company Gasco Facility 7540 NW St. Helens Road Portland, Oregon	**FIGURE** **1**

LEGEND

- Site Boundary
- Lease Boundary
- Existing Structure or Feature
- Railroad Tracks

N

0 150 300

Approximate Scale in Feet

Willamette River

Ditch

Wacker Siltronic

Pacific Northern Oil Company Lease Area

Oil Tank

Oil Tank

Oil Tank

Oil Tank

Oil Tank

PNO Office

Pond

Pond

Pond

LNG Containment Basin

LNG Tank

Pencil Pitch Storage

Storeroom

Koppers Company, Inc. Lease Area

Office

NW Natural Gas Co. LNG Plant

Gasco Office

U.S. Army Corps of Engineers

NW St. Helens Road

Figure 2

Site Map

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES
INCORPORATED
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

LEGEND

- Site Boundary
- Lease Boundary
- Existing Structure or Feature
- Former Structure or Feature
- Railroad Tracks

N

0 150 300

Approximate Scale in Feet

Willamette River

Ditch

Unknown Tank

Former Settling Pond

Wacker Siltronic

Lampblack Storage Area

Oil Tank

Oil Tank

Oil Tank

Pacific Northern Oil Company Lease Area

Pond

Pond

Pond

Propane Tanks

Oil Tank

Oxide Building

Oil Tank

Oil Tank

PNO Office

Briquette Storage Shed

LNG Containment Basin

Koppers Land Treatment Area

Coke Ovens

Spent Oxide Storage Area

Oxide Purifier Area

LNG Tank

Thickener

Briquette Plant

Thickener

Naphthalene Plant

Pencil Pitch Storage

Storeroom

Pitch Bay

Pitch Pans

Generator Building

Still

Koppers Company, Inc. Lease Area

U.S. Army Corps of Engineers

Storage Holder

Gasco Office

Wash Room

Machinery Building

Retort Area

NW Natural Gas Co. LNG Plant

Relief Holder

High BTU Gas Holder

Pitch Plant

Office

Pitch Pans

Still

Light Oil Plant

Tar Loading

Propane Tanks

NW St. Helens Road

Figure 3

Historical Features Map

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES
INCORPORATED
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

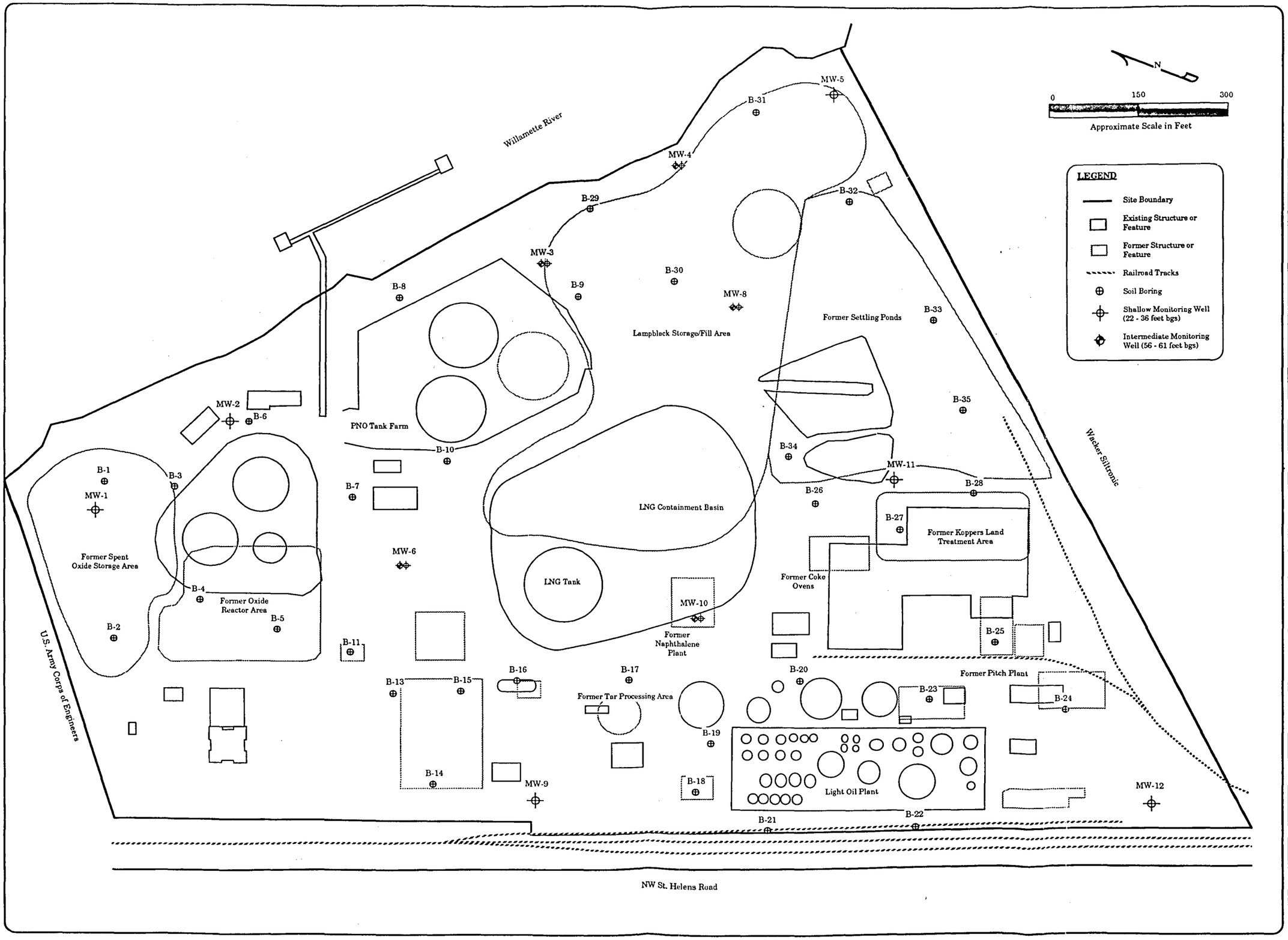


Figure 4

Soil Boring and Monitoring Well Location Map

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

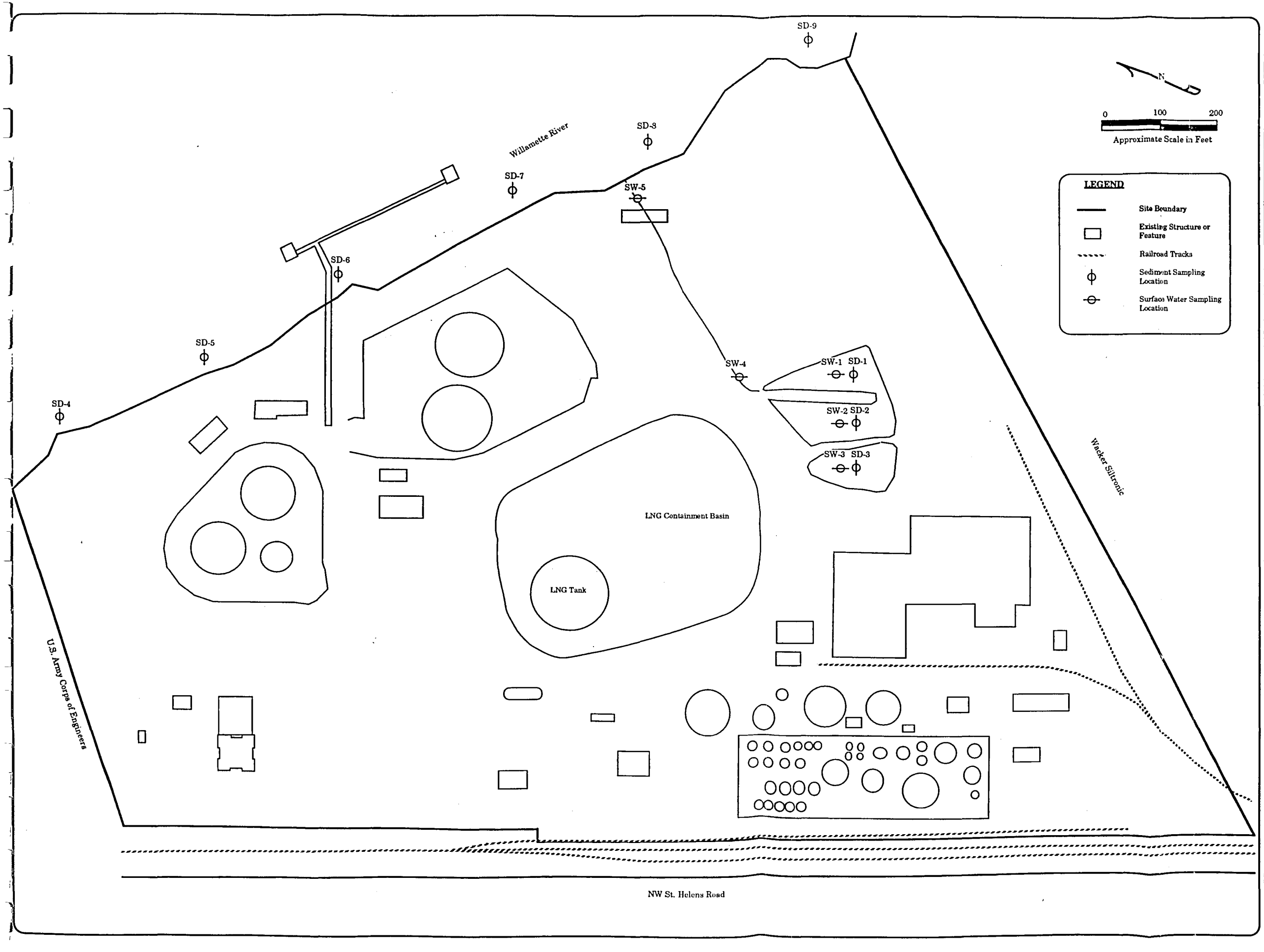


Figure 5

Site Sediment and Surface Water Sampling Location Map

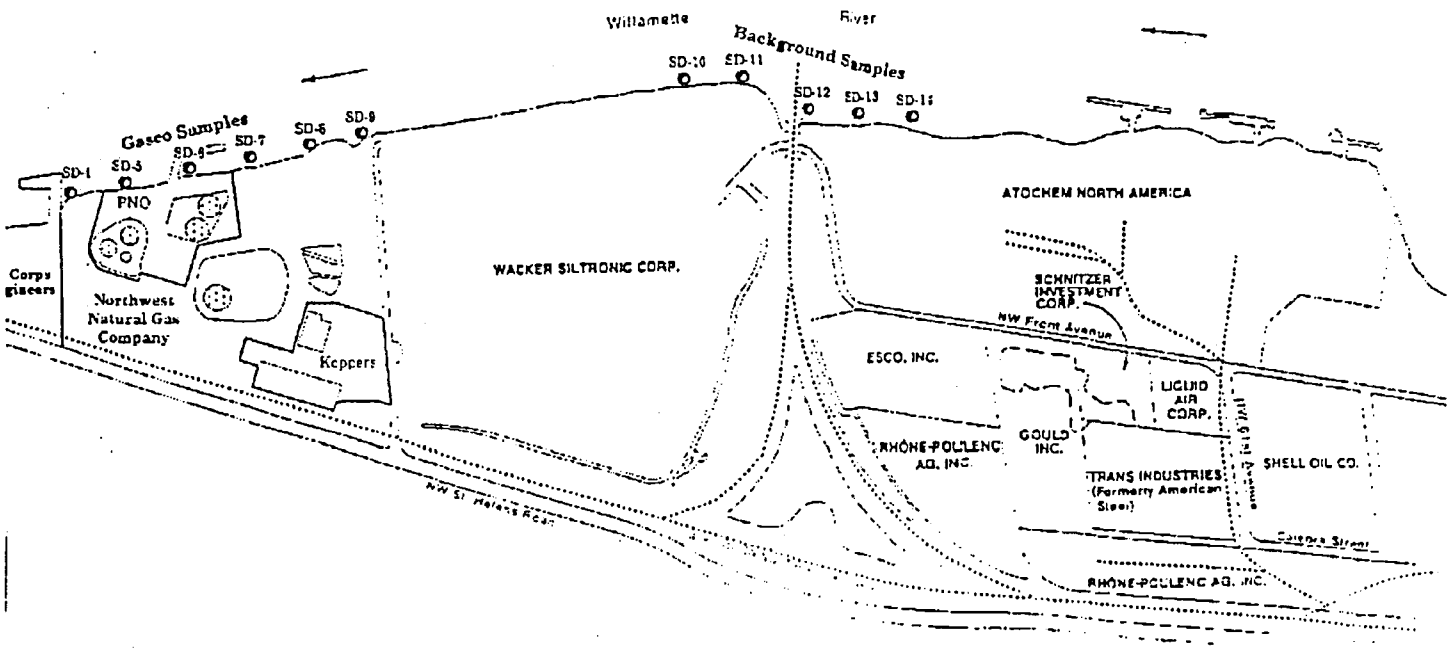
RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

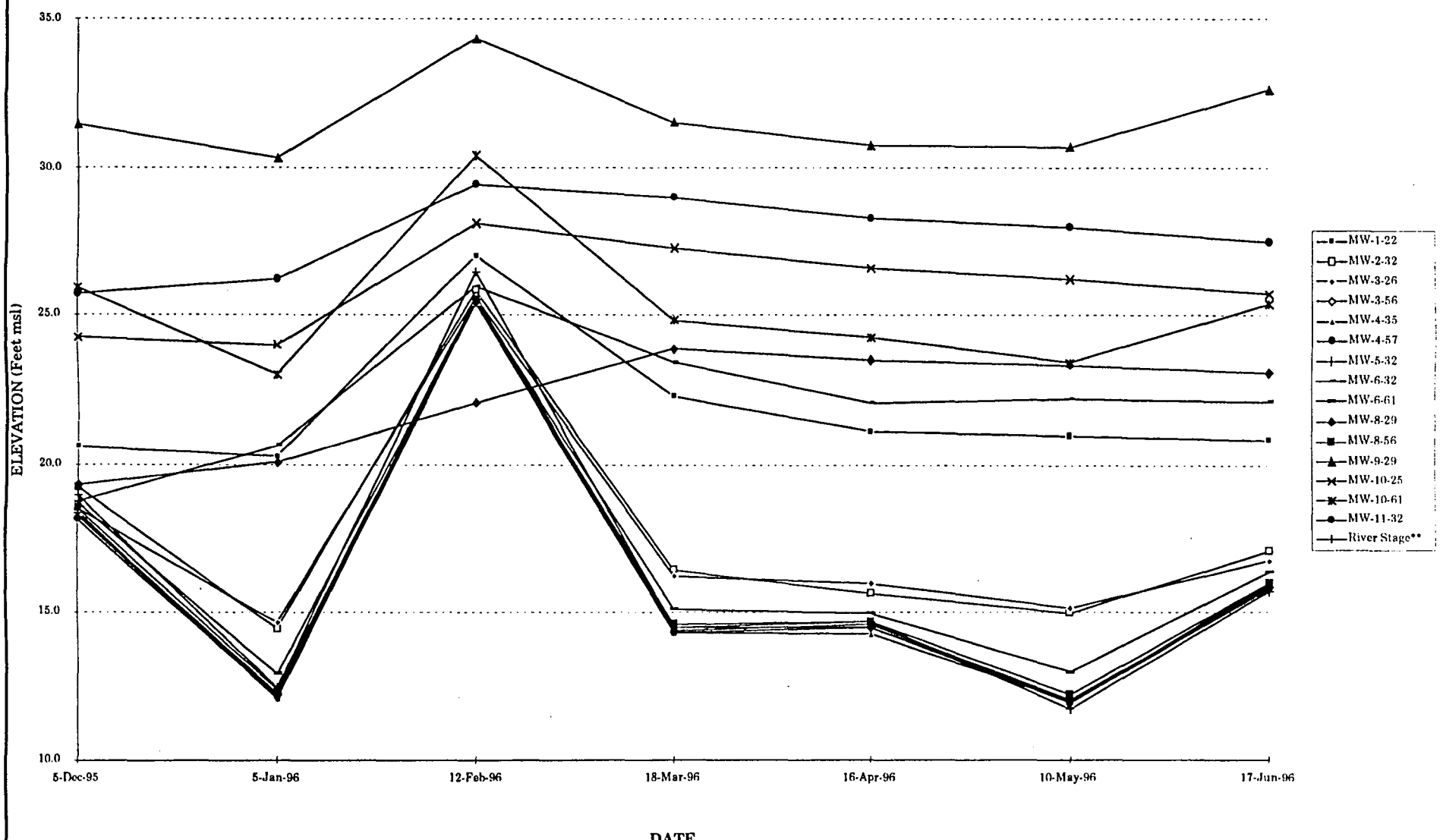
Project #2708

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Background Sediment Sampling Locations	FIGURE
July 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	6



Note: Base Map from Geraghty & Miller, Inc. Hydrogeological Investigation of the Doane Lake Area, February 1991

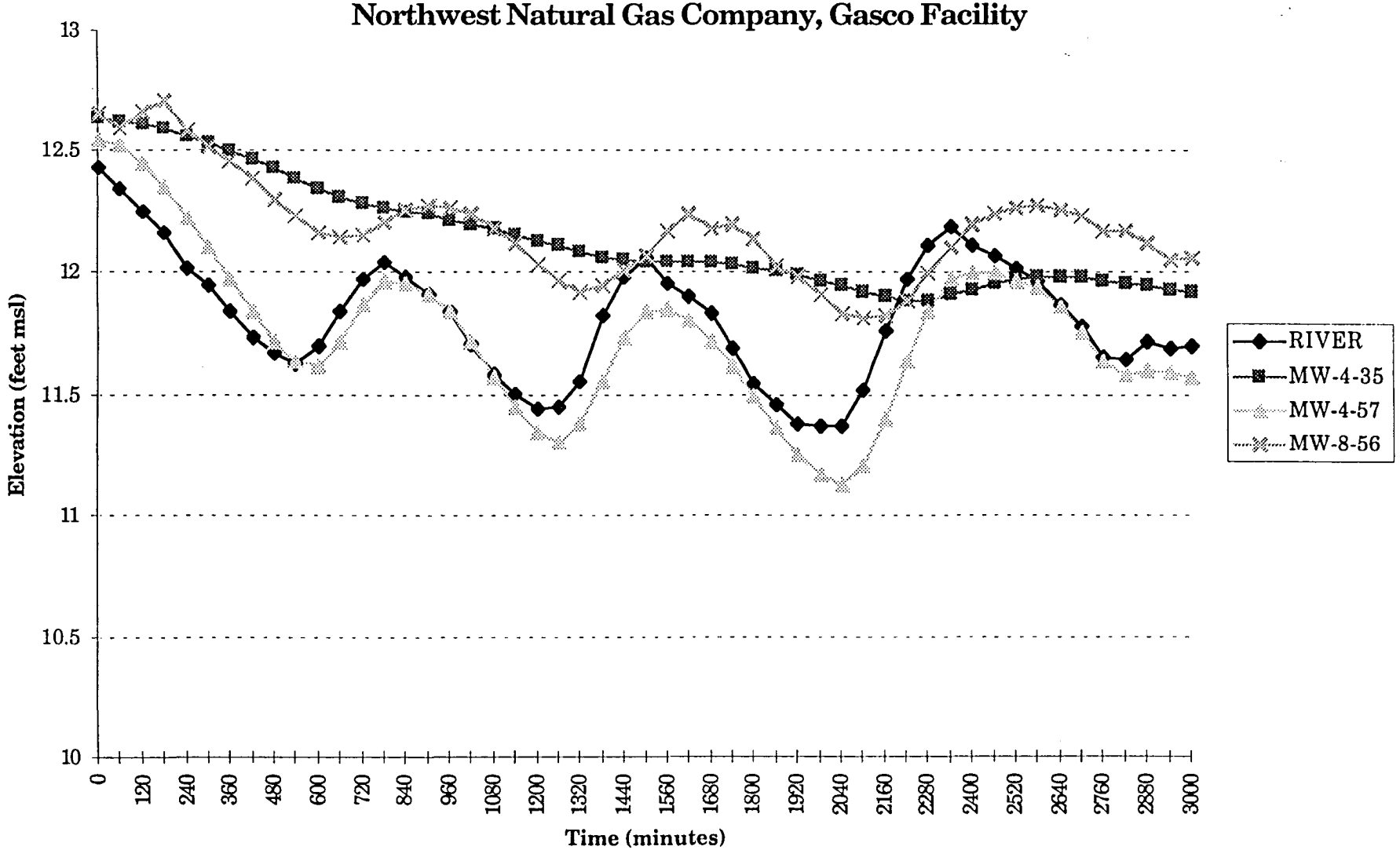
Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Hydrograph: All Wells	FIGURE 7
July 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



NWT 002603

Project #2708	HAHN AND ASSOCIATES INCORPORATED	48-Hour Water Level Test Hydrograph	FIGURE
July 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	8

Continuous Water Level Monitoring Event
Wells MW-4-35, MW-4-57, MW-8-56, and the Willammette River
Northwest Natural Gas Company, Gasco Facility



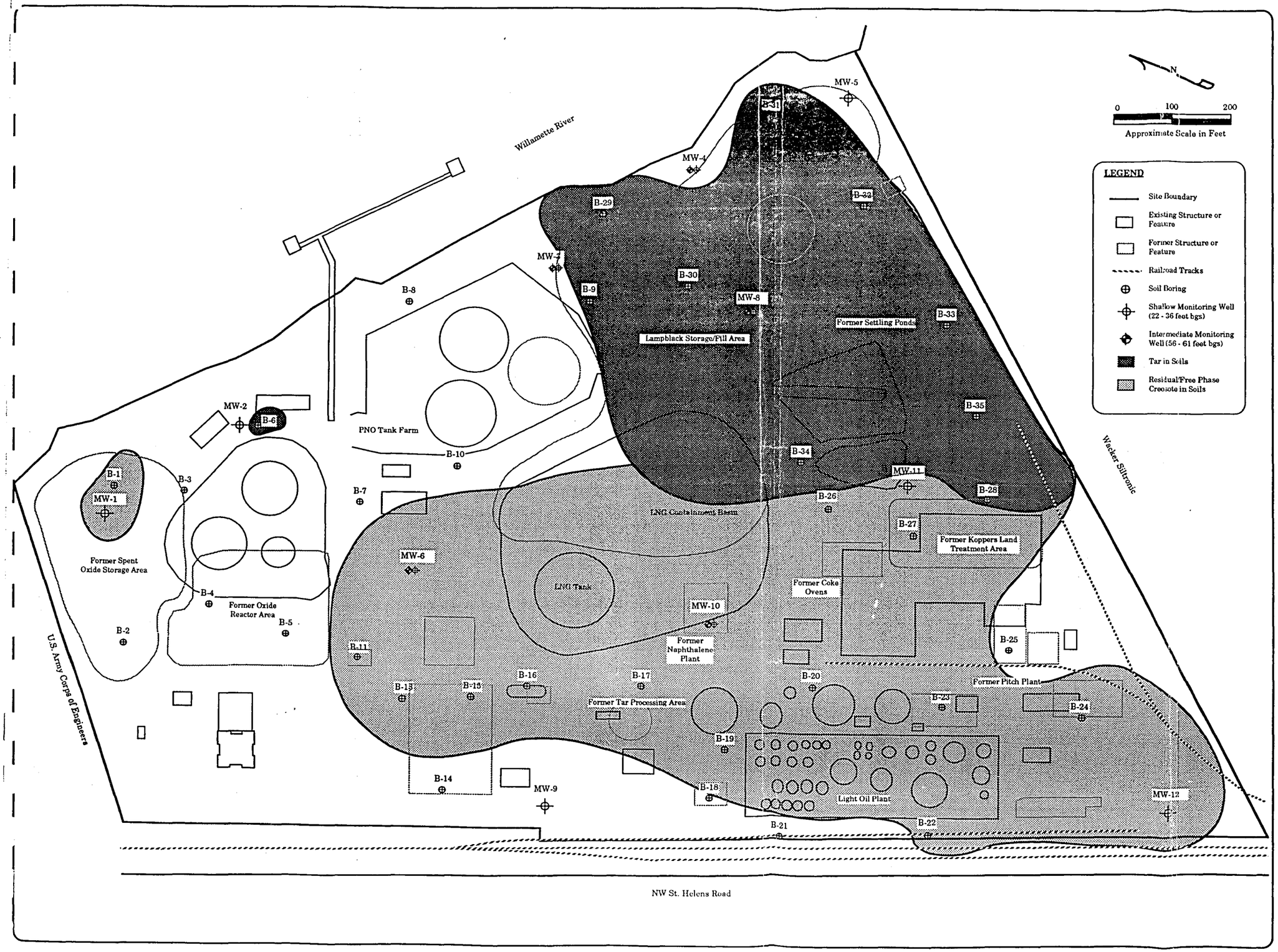


Figure 9

Generalized Areas of Residual Tar/Creosote in Subsurface Soils

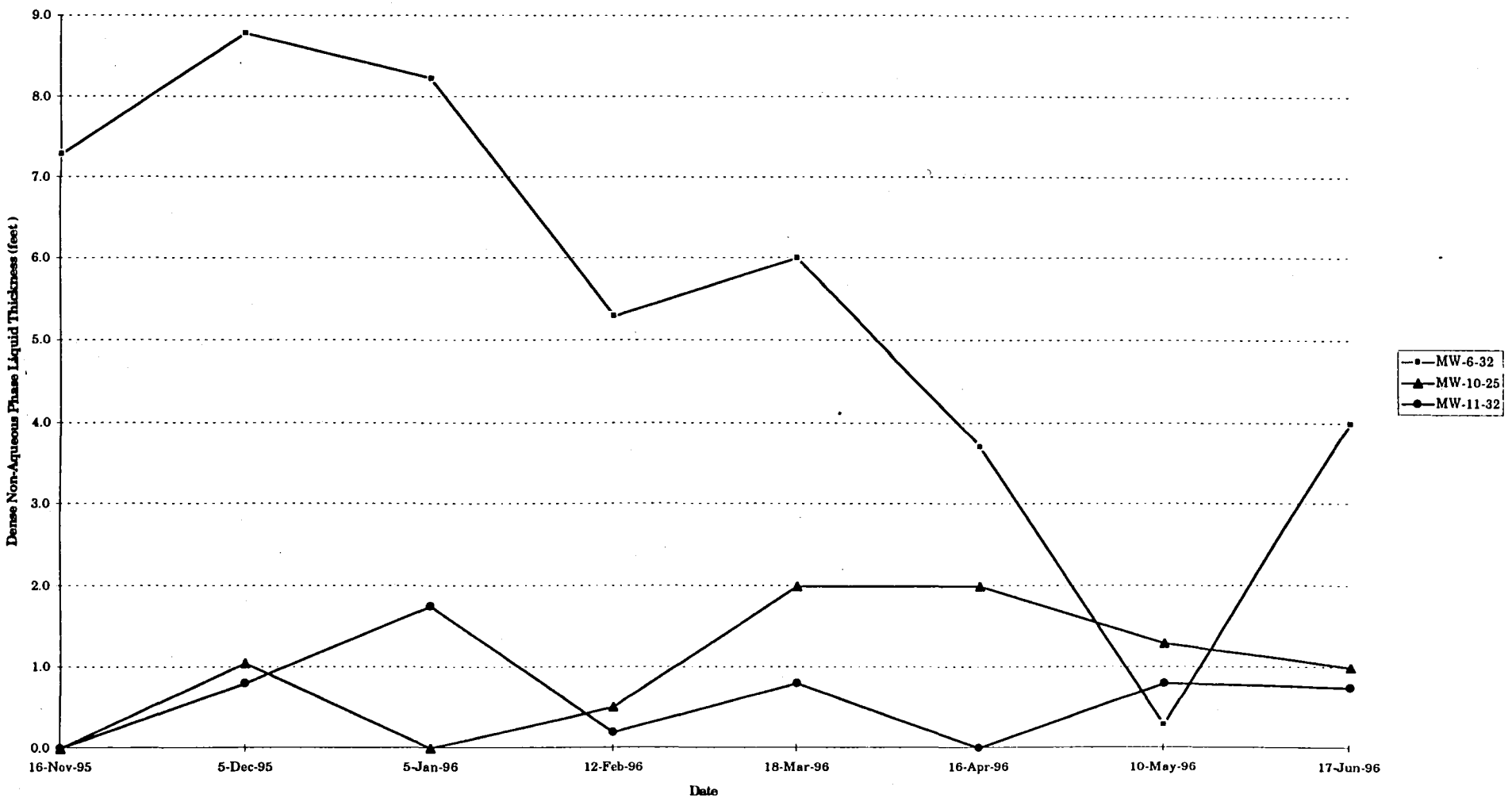
RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Free Product Thickness Graph: MW-6-32, MW-10-25; MW-11-32	FIGURE 10
July 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



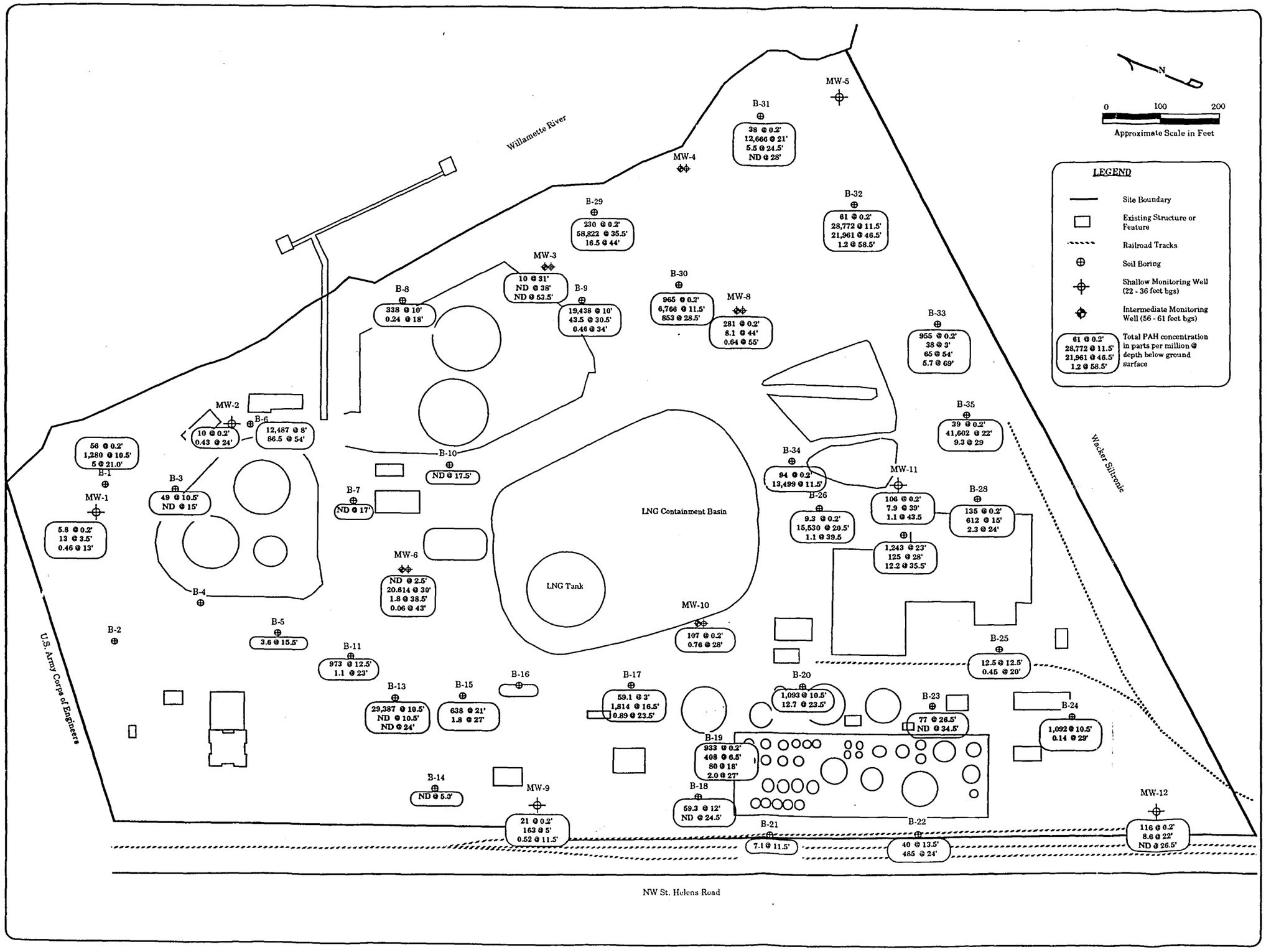


Figure 11

Soil Sampling Results Map: Total Polynuclear Aromatic Hydrocarbons

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

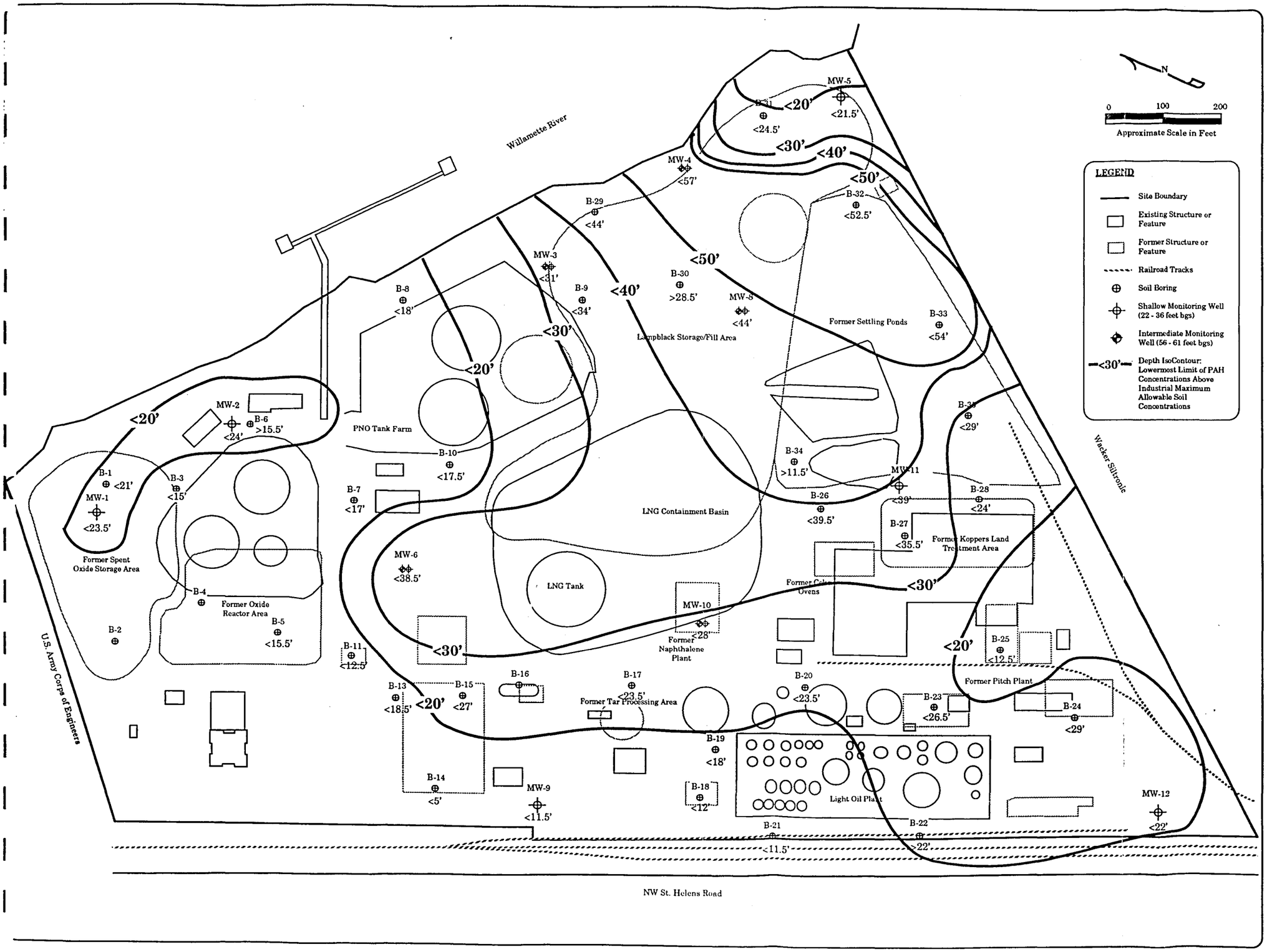


Figure 12

Iso-Contour Map: Depth to Lowermost Limit of PAH Concentrations in Soil that Exceed Industrial Standards

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

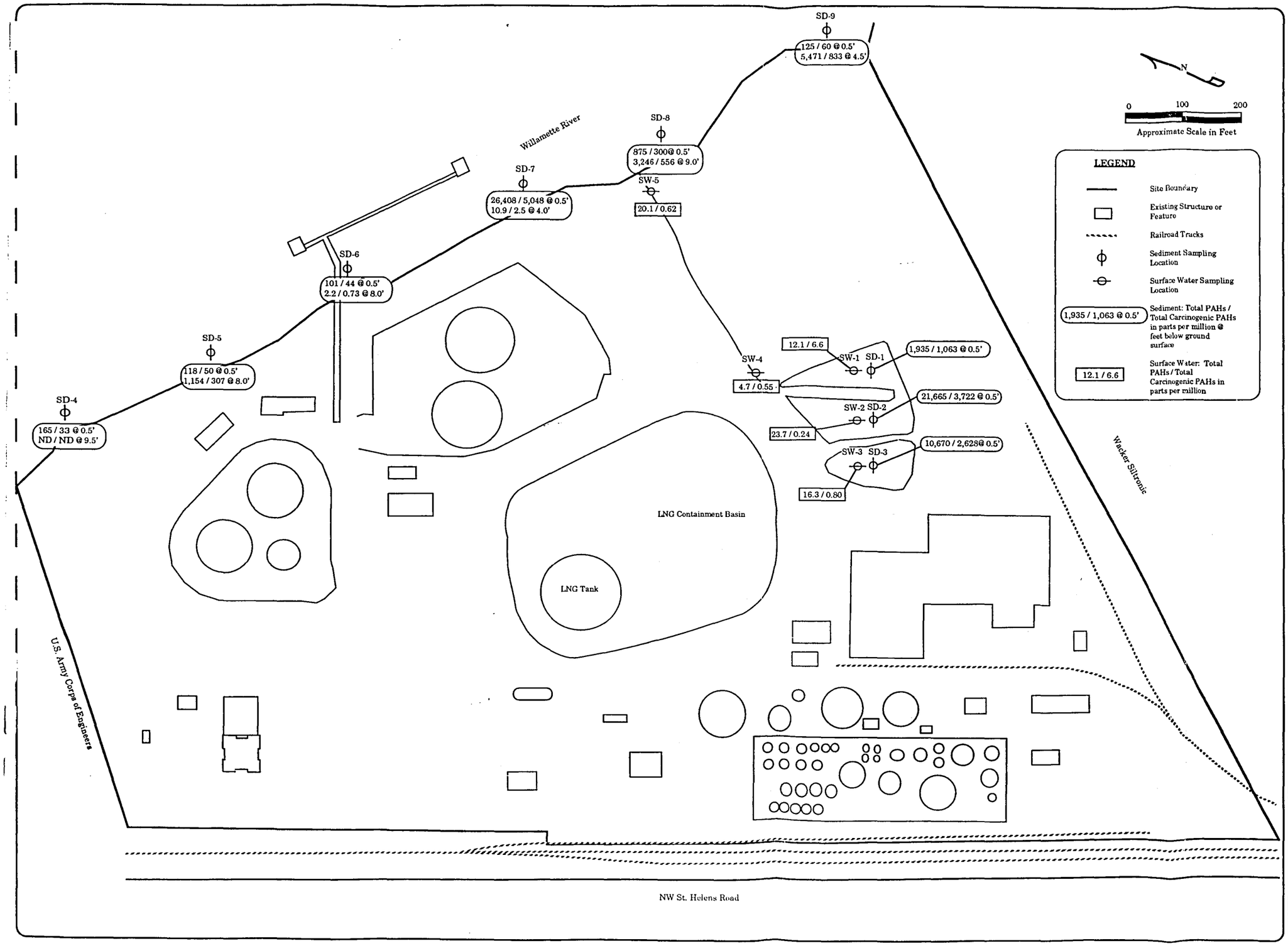


Figure 13

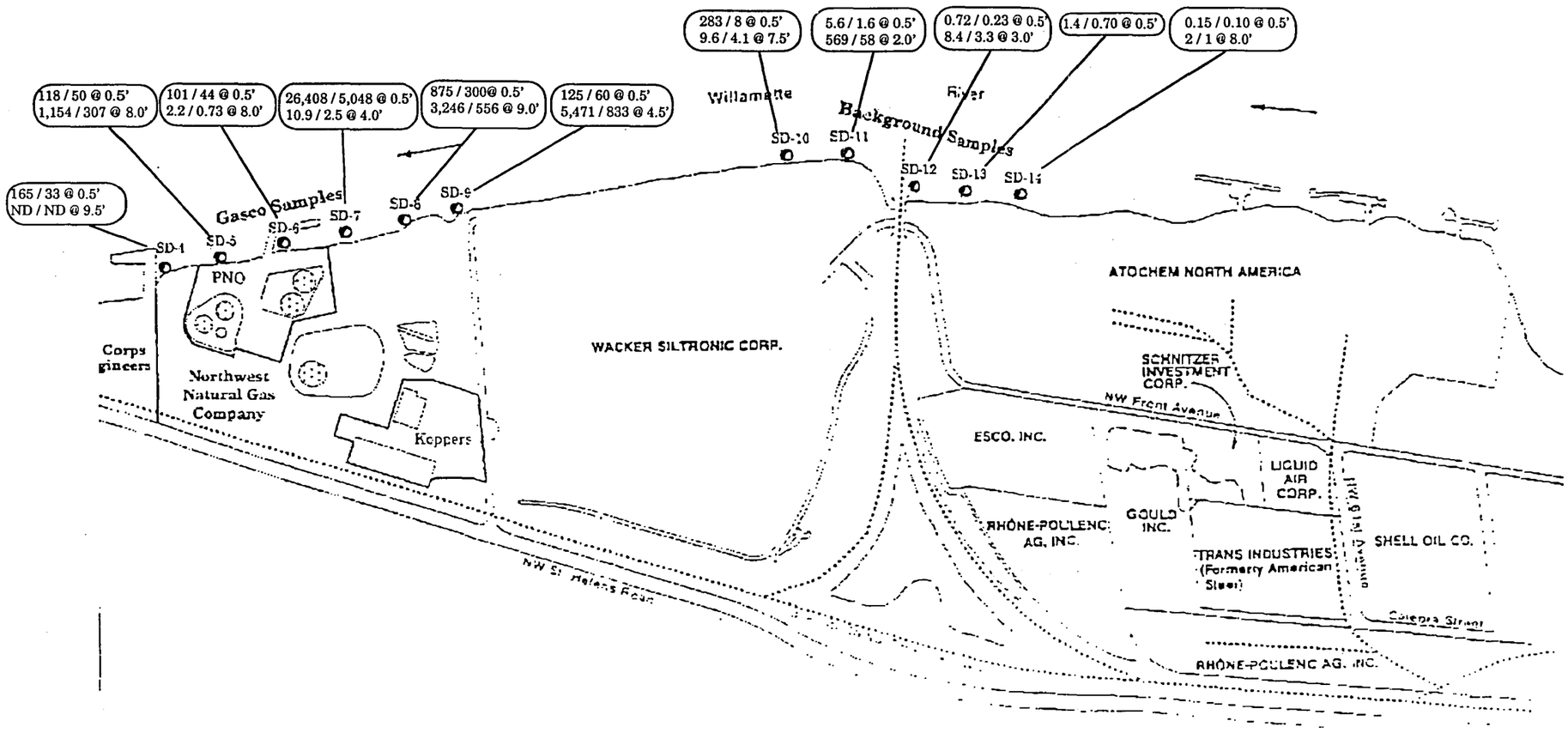
Sediment and Surface Water Analytical Results Map: PAHs

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708



LEGEND

118 / 50 @ 0.5' 1,154 / 307 @ 8.0'	Total PAHs / Total Carcinogenic PAHs in parts per million (ppm) @ feet below ground surface
ND	Not Detected
O	Sediment Boring Location
Bold Type	Individual PAH detected at a concentration exceeding Reference Level

N

0 600 1,200

Approximate Scale in Feet

Note: Base Map from Geraghty & Miller, Inc. Hydrogeological Investigation of the Doane Lake Area, February 1991

Figure 14

Willamette River: Site and Background Locations - PAHs

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
484 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

APPENDIX A

Soil Boring Logs

NWT 002611

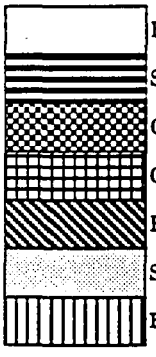
KEY TO BORING LOGS

Soil classification in this report is based upon visual and manual field observations which include moisture, consistency, plasticity and grading estimates and should not be construed to imply field or laboratory testing unless presented herein. Soils are classified in accordance with the Unified Soil Classification System. Stratigraphic boundaries are approximate representations only. No warranty is provided as to the continuity of soil strata between borings.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COURSE GRAINED SOILS More Than Half is Larger Than #200 Sieve	GRAVELS More Than Half the Course Fraction is Larger Than No. 4 Sieve Size	Clean Gravels With Little or No Fines	GW	Well Graded Gravels, Gravel-Sand Mixtures
			GP	Poorly Graded Gravels, Gravel-Sand Mixtures
		Gravels With Over 12% Fines	GM	Silty Gravels, Poorly Graded Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, Poorly Graded Gravel-Sand-Clay Mixtures
	SANDS More Than Half the Course Fraction is Smaller Than No. 4 Sieve Size	Clean Sands With Little or No Fines	SW	Well Graded Sands, Gravelly Sands
			SP	Poorly Graded Sands, Gravelly Sands
		Sands With Over 12% Fines	SM	Silty Sands, Poorly Graded Sand-Silt Mixtures
			SC	Clayey Sands, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More Than Half is Smaller Than #200 Sieve	SILTS AND CLAYS Liquid Limit Less Than 50%		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands, or Clayey Silts with Slight Plasticity
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Clays and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit Greater Than 50%		MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Clays of Medium to High Plasticity, Organic Silts
HIGHLY ORGANIC SOILS			Pt	Peat and Other Highly Organic Soils

LEGEND FOR BORING LOGS



- Blank Casing
- Slotted Screen
- Cement Grout
- Concrete
- Bentonite
- Sand Pack
- Fill Material

ABBREVIATIONS

NA	Not Applicable
ND	Not Detected Above Detection Limit
NS	Not Sampled
PAH	Polynuclear Aromatic Hydrocarbons
ppm	Parts Per Million
SPT	Standard Penetration Test
▽	Measured Static Water Level in Well
▼	Estimated Water Level During Drilling

Updated: 7/17/96 RBE
File: Boring Log Key

HAHN AND ASSOCIATES, INC.

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-1**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 13:55	DRILL FINISH Time: 15:35
	SAMPLING METHOD:	3" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/21/95	Date: 9/21/95
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
	B1-01	13:45	5.6	13					SM	Silty SAND with some Gravel - brown, dry (surface sample)
	B1-02 Dup	13:50	Dup	56			1			
					50/5"	90	2		GP	Sandy GRAVEL - brown, dry, very dense
							3			
							4			
	B1-03	14:05	8.2	-	21	100				
					10	10	5		ML	Sandy SILT - brown to yellow, moist, very stiff, slightly plastic, no hydrocarbon odor, no sheen
					14	0				
							6			
					9	100	7			Sandy SILT - brown to yellow, moist, stiff, slightly plastic, slight hydrocarbon odor, no sheen
	B1-04	14:10		-	6	100				
			4.7		5	60	8			
							9			Concrete encountered at 8.5 to 10 feet bgs.
3/4" Bentonite Chips								9/21/95		
							10			
					2	100			SM	Silty SAND with Gravel - wet, medium dense, very strong hydrocarbon odor, sheen, hard black material (lampblack?) from 11 to 11.5 feet bgs
	B1-05	14:30		1,280	27	100	11			
			44.6		38	50				
					2	100	12			
	B1-06	14:35		-	6	100				Silty GRAVEL - olive gray, wet, dense, strong hydrocarbon odor, no sheen
			26.5		28	100	13			
									GM	
							14			
					16	0				
					22	0	15			
					25	0				
							16			
					4	100	17			
	B1-07	14:50	16.8	-	40	60				SAND - black, wet, medium dense, poorly graded, strong hydrocarbon odor, no sheen, appears to be saturated with oily substance
					4	0	18		SP	
							19			
					6	100				
	B1-08	14:57	22.3	-	6	100	20			

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	30.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

NWT 002613

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-1**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 13:55 Date: 9/21/95	DRILL FINISH Time: 15:35 Date: 9/21/95
	SAMPLING METHOD:	3" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips					6	40	21		SP	SAND - black, wet, dense, strong hydrocarbon odor, wood fragments present at sand-silt boundary
	B1-09	15:20		21						
			24.6				22			Continuous core barrel sampling device used to collect soil samples from 20.5 to 24.5 feet bgs
							23			
									ML	
	B1-10	15:30	20.6	-			24			SILT with some Sand - olive gray, wet, slightly plastic, mild petroleum hydrocarbon odor, no sheen
							25			
							26			Installed a 2-inch diameter 0.010-inch slotted stainless steel well screen at 20 to 23 feet bgs. Purged twelve gallons of water using a peristaltic pump prior to groundwater sampling. GROUNDWATER SAMPLE (2708-950921-BW1-01) collected at 17:30 hrs, 9/21/95. Well point was removed prior to abandonment.
							27			
							28			
							29			Drilled to 25 feet bgs Sampled to 24.5 feet bgs
							30			
							31			* Sample Number Prefix is 2708-950921-
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	30.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER** **B-2**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:50	DRILL FINISH Time: 10:15
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/27/95	Date: 9/27/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION	
3/4" Bentonite Chips	B2-01	8:50	4.7	-			1		SM	Silty SAND with Gravel - brown, moist, organic matter (surface sample)	
							2				
							3				
							4			Silty SAND with some Gravel - green to gray, moist, no sheen, organic matter (pieces of wood)	
	B2-02	9:05		-			5				
			5.5				6				
	B2-03	9:10		-			7		SM	Silty SAND with some Gravel - green to gray, mottled, slight hydrocarbon odor, slight sheen, tar (pieces of asphalt)	
			3.9				8				
							9				
							10				
							11		GM	Sandy GRAVEL with Silt - moist, no sheen, large pieces of brick, possible pieces of lampblack (hydrophobic material)	
							12				
							13				
							14				
	B2-04	9:25		-			15		SP	SAND - brown, moist, poorly graded, medium grained, moderate hydrocarbon odor, no sheen	
			2.5				16			SAND - black, moist, moderate hydrocarbon odor, no sheen, hydrophobic black powder is present, thin layer of silt at 15.5 feet bgs (15-17 feet bgs)	
	B2-05	9:35	2.2	-			17				
	B2-06	9:38	2.7	-			18	9/27/95			
							19		SP	SAND - gray to green, moist, no sheen, black powder is no longer present in sample (17-17.5 feet bgs)	
							20				

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.3 feet msl
TOP OF CASING ELEVATION:	Not Applicable

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-2**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 8:50 Date: 9/27/95	DRILL FINISH Time: 10:15 Date: 9/27/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.3 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B2-07	9:42	5.9	-			21		SP	SAND - gray to green, wet, poorly graded, medium grained, strong hydrocarbon odor, no sheen, (20-22 feet bgs)
							22			
							23			SAND - as above, no hydrocarbon odor, no sheen (22-24 feet bgs)
	B2-08	9:50	3.1	-			24			
							25		SP	Heaving sands encountered at 25 feet bgs - re-drill out hole to remove.
							26			
	B2-09	10:10	3.2	-			27			SAND - gray to green, wet, poorly graded, medium grained, no hydrocarbon odor, no sheen
							28			
							29			Drilled to 27.5 feet bgs Sampled to 27 feet bgs
							30			* Sample Number Prefix is 2708-950927-
							31			
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002616

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-3**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: Split Spoon DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.	DRILL START Time: 10:30 Date: 9/21/95	DRILL FINISH Time: 12:30 Date: 9/21/95	

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: 34.1 feet msl
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B3-01	10:30		-					GP	Sandy GRAVEL - dry, road fill (surface sample)
			2.4				1			
									SP	
							2			
					10	100				
	B3-02	10:35		-	12	100	3			SAND with some Gravel - brown, moist, medium dense, poorly graded, fine to medium grained, no hydrocarbon odor, no sheen
			7.0		17	100				
							4			
					9	100	5			
	B3-03	10:40	7.4	-	10	70				SAND with some Gravel - brown, moist, medium dense, poorly graded, slight hydrocarbon odor, no sheen
					17	0	6			
									SP	
							7			
					10	100				
	B3-04	10:45		-	18	100	8			SAND - brown with gray mottling, moist, medium dense, slight hydrocarbon odor, no sheen
					18	0				
							9			
					12	100	10			
					21	100				SAND - brown, moist, medium dense, fine grained black sand at lower 4 inches of sample, black material has hydrocarbon odor and is hydrophobic (lampblack)
	B3-05	11:00	8.3	49	34	60	11			
									SP	
							12			
	B3-06	11:10	4.0	-	44	60				SAND - brown, moist, dense, large piece of wood stained black stuck in end of spoon - sands directly surrounding wood are coated black, slight hydrocarbon odor, no sheen
					27	0	13			
					34	0				
							14			
					13	100	15			
	B3-07	11:20		ND	16	100				SAND - brown, dry, medium dense, poorly graded, no hydrocarbon odor, no sheen
			8.0		13	100	16			
									SP	
							17			
					4	100				
	B3-08	11:30		-	9	100	18	9/21/95		SAND - green to gray, moist to wet, stiff, poorly graded, moderate hydrocarbon odor, no sheen
			5.3		9	100				
							19			
					14	100	20			

NWT 002617

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-3**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:30	DRILL FINISH Time: 12:30
	SAMPLING METHOD:	Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/21/95	Date: 9/21/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B3-09	11:40		-	17	100			SP	SAND - green to gray, wet, medium dense, poorly graded, strong hydrocarbon odor, no sheen
			2.0		17	50	21			
							22			
					3	100				SAND - green to gray, wet, medium dense, poorly graded, strong hydrocarbon odor, no sheen, Clayey SILT in bottom 6 inches of core
	B3-10	12:00		-	12	100	23			
			22.0		14	100				
							24			
					4	100	25		ML	Clayey SILT, green to gray, wet, loose, plastic, strong hydrocarbon odor, no sheen
	B3-11	12:05		-	6	100				
			29.1		10	100	26			
							27			
					4	100			SP	SAND - green to gray, wet, stiff, poorly graded, fine grained, slight hydrocarbon odor, no sheen
	B3-12	12:24		-	5	100	28			
			4.5		5	100				
							29			
							30			
							31			Drilled to 28.5 feet bgs Sampled to 28.5 feet bgs
							32			* Sample Number Prefix is 2708-950921-
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002618

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-4**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:20 Date: 9/21/95	DRILL FINISH Time: 9:40 Date: 9/21/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	SOIL DESCRIPTION
3/4" Bentonite Chips	B4-01	8:15	0.3	-	1	Sandy GRAVEL - dry, roadbed material (surface sample)
					2	
					3	
	B4-02	8:30		-	4	SAND with some Gravel - brown, dry, non-plastic, poorly graded, no hydrocarbon odor, no sheen
			8.9		5	
					6	
					7	
	B4-03	8:40		-	8	SAND with some Gravel - as above
			7.1		9	
					10	
					11	
	B4-04	8:55		-	12	SAND with some Gravel - as above, moist
			7.7		13	
					14	
					15	
					16	
	B4-05	9:05		-	17	SAND with some Gravel - as above
			15.0		18	
					19	
					20	

GROUNDWATER: 9/21/95

STRATA (USCS): GP; SP; SP; SP; SP

NWT 002619

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-4**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 8:20 Date: 9/21/95	DRILL FINISH Time: 9:40 Date: 9/21/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B4-06	9:15	5.3	-			21		SP	SAND with some Gravel - as above, moist to wet
							22			
							23			
							24		SP	
							25			
							26			
	B4-07	9:25	2.5	-			27			SAND with some Gravel - as above, green to gray, wet, (25-27 feet bgs)
							28			
	B4-08	9:30	2.0	-			29		ML	Clayey SILT - gray, moist, stiff, plastic, no hydrocarbon odor, no sheen (27-30 feet bgs)
							30			
							31			
							32			Drilled to 30 feet bgs Sampled to 29.5 feet bgs
							33			
							34			* Sample Number Prefix is 2708-950921-
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002620

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-5**			
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	4" OD Core Barrel	Time: 13:35	Time: 14:50
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/28/95	Date: 9/28/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B5-01	13:30	1.4	-			1		SP	Silty SAND with some Gravel - brown, wet, no hydrocarbon odor, no sheen, (surface)
							2			
							3			
	B5-02	13:40	3.9	-			4			SAND with some Gravel - brown, slightly moist, loose, non-plastic, poorly graded, medium grained, no hydrocarbon odor, no sheen
							5			
							6			
	B5-03	13:50	3.3	-			7			SAND with some Gravel - as above, moist
							8			
							9		SP	
							10			
							11			
							12			
	B5-04	14:00	3.8	-			13			SAND with some Gravel - as above, moist
							14			
							15			
	B5-05	14:08	4.3	3.6			16			SAND with some Gravel - as above, hydrocarbon odor, (15-17 feet bgs)
							17			
	B5-06	14:10	4.9	-			18		ML	SILT - green to gray, moist, hydrocarbon odor, sheen, wood fragments, (17-17.5 feet bgs)
	B5-07	14:12	3.6	-			19	9/28/95	SP	SAND - green to gray, moist, loose, slight hydrocarbon odor, no sheen, (17.5-19 feet bgs)
							20			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-5**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:35 Date: 9/28/95	DRILL FINISH Time: 14:50 Date: 9/28/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B5-08	14:15	3.5	-	21–25	SP	SAND - green to gray, wet, loose, medium grained, no hydrocarbon odor, no sheen
					25–28	SP	Installed a 2-inch diameter 0.010-inch slotted stainless steel well screen at 25 to 28 feet bgs. Purged 5 gallons of water using a peristaltic pump prior to groundwater sampling. GROUNDWATER SAMPLE (2708-950929-BW5-01) collected at 8:00 hrs, 9/28/95. Well point was removed prior to abandonment.
	B5-09	14:35	3.5	-	28–29	SP	SAND - as above, alternating thin sand and silt beds in 4 inch layer above massive silt
	B5-10	14:40	3.1	-	29–30	ML	SILT with some Clay - green to gray, moist, stiff, plastic, no hydrocarbon odor, no sheen
					31–40		Drilled to 30 feet bgs Sampled to 30 feet bgs * Sample Number Prefix is 2708-950928-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-6**			
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	3"OD Split Spoon/4" OD Core Barrel	Time: 11:15	Time: 12:35
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/27/95	Date: 9/27/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.7 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	Recovery (%) or Sample Interval	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Concrete							1		GP	GRAVEL - old pavement at surface
							2		SP	
					15	100	3			SAND - brown, slightly moist, medium dense, poorly graded, fine to medium grained, no hydrocarbon odor, no sheen, (2.5-3 feet bgs)
	B6-01	11:20		-	30	100				
			4.8		24	50	4			Sandy GRAVEL - black, dense, pieces of lampblack (hydrophobic in water), no hydrocarbon odor, no sheen, (3-4 feet bgs)
							5		GP	
					9	10				
					4	0	6			Sandy GRAVEL - gray, moist, loose, no hydrocarbon odor, no sheen
					2	0				
							7			
									SP	
					13	100	8			
	B6-02	11:30	38.5	12,487	12	50				SAND with Gravel and Brick - black, moist, medium dense, grains stuck together by tarry substance, strong hydrocarbon odor, strong sheen
					10	0	9			
							10			
					7	10				
					11	0	11			Large Rock in end of sampler - blue matrix, concoidal fracture, specimen retained
					13	0				
							12		SP	
					5	50	13			Weathered Brick in end of tube - moist, stiff, no hydrocarbon odor, no sheen
					5	0				
					5	0	14			
							15			
					6	100				
	B6-03	12:00		87	16	100	16			SAND - brown, slightly moist, loose, fine to medium grained, gravels from 16-16.5 feet bgs, no hydrocarbon odor, no sheen
			8.0		9	80				
							17		SP	
							18			
	B6-04	12:10		-						
			7.2				19			SAND - as above, no gravel
								9/27/95		
							20			

3/4" Bentonite Chips

NWT 002623

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-6**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 3"OD Split Spoon/4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.	DRILL START Time: 11:15 Date: 9/27/95	DRILL FINISH Time: 12:35 Date: 9/27/95

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: 34.7 feet msl
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	Recovery (%) or Sample Interval	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		SP	
	B6-05	12:20		-			22			SAND - green to gray, wet, poorly graded, fine to medium graded, no hydrocarbon odor, no sheen
			9.4				23			
	B6-06	12:25		-			24			Sandy SILT - green to gray, stiff, slightly plastic, slight organic odor (anaerobic degradation), no sheen, sand content decreasing with depth
			8.3				25		ML	
							26			
	B6-07	12:30		-			27			Sandy SILT - green to gray, wet, slightly plastic, no hydrocarbon odor, no sheen
			9.2				28		ML	
	B6-08	12:35		-			29			
			9.8				30			
							31			Drilled to 30 feet bgs Sampled to 29.5 feet bgs
							32			* Sample Number Prefix is 2708-950927-
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002624

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-7**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:30	DRILL FINISH Time: 14:30
	SAMPLING METHOD:	3" OD Split Spoon/4"OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/27/95	Date: 9/27/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT(blows/6 in) or Core Interval	RECOVERY (%) or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Concrete									Concrete	
							1			
							2		SP	
							3			
					4	100				
	B7-01	13:35		-	6	100				SAND - brown, slightly moist, loose, poorly graded, fine to medium grained, no hydrocarbon odor, no sheen
			3.9		5	100	4			
							5			
					5	100				
	B7-02	13:45		-	5	100	6			SAND - as above
			5.0		5	100	7			
							8		SP	
	B7-03	13:50								SAND - as above, some pebbles, moist, no hydrocarbon odor, slight sheen
			4.6				9			
							10			
3/4" Bentonite Chips							11			
							12			
	B7-04	13:55		-						SAND - as above, moist, no hydrocarbon odor, slight sheen
			6.0				13			
							14			
							15			
							16			
							17		SP	
	B7-05	14:02		ND						SAND - as above, moist, no hydrocarbon odor, no sheen
			7.7				18			
							19			
							20			

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-7**		
PROJECT:	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
Northwest Natural Gas Co.	SAMPLING METHOD:	3" OD Split Spoon/4"OD Core Barrel	Time:	Time:
Gasco Facility	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger	13:30	14:30
Portland, Oregon	EQUIPMENT TYPE	B-59 Mobile Drill	Date:	Date:
PROJECT #: 2708	DRILLER:	Brad James	9/27/95	9/27/95
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT(blows/6 in) or Core Interval	RECOVERY (%) or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B7-06	14:10	8.4	-			21	9/27/95	SP	SAND - brown, wet, poorly graded, medium grained, slight hydrocarbon odor, no sheen, (20-21 feet bgs)
	B7-07	14:12	6.6	-			23			SAND - green to gray, wet, poorly graded, medium grained, no hydrocarbon odor, no sheen, (21-25 feet bgs)
	B7-08	14:20	5.2	-			28		SP	SAND - as above
	B7-09	14:30	6.4	-			30		ML	SILT - green to gray, moist, stiff, plastic, no hydrocarbon odor, no sheen, some brown organic matter

Drilled to 30 feet bgs
Sampled to 29.5 feet bgs

* Sample Number Prefix is 2708-950927-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-8**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 9:30	DRILL FINISH Time: 12:10
	SAMPLING METHOD:	1.5" / 3" OD Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/18/95	Date: 9/18/95
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
							1			
							2			
									GM	
					5	100	3			Silty GRAVEL - brown, moist, loose, non-plastic, slightly graded, no hydrocarbon odor or discoloration, spotty sheen
	B8-01	9:35	9.3	-	6	50				
					8	0	4			
							5			
	B8-02	9:42		-	4	100				
			-		7	0	6			Silty GRAVEL - brown, dry, loose, non-plastic, slightly graded, no hydrocarbon odor or discoloration, spotty sheen
					9	0			GM	
							7			
	B8-03	9:44	-	-	9	70	8			Silty GRAVEL - as above, wet, medium dense
					18	0				
					23	0	9			
							10			
3/4" Bentonite Chips	B8-04	9:50		338	17	100			GM	Sandy GRAVEL - brown, moist, medium dense, non-plastic, poorly graded, no hydrocarbon odor, no sheen, large pieces of slag in sampling tube
			7.5		23	20	11			
					17	0		9/18/95		
							12			
	B8-05	10:00	8.0	-	11	100	13			
	B8-06 Dup	10:02			10	20				SAND - gray, wet, medium dense, non-plastic, poorly graded, fine grained, mild hydrocarbon odor, no sheen
					8	0	14			
										Note: Change to 1.5" Split Spoon sampling device
							15			
					3	100			SP	
	B8-07	10:05		-	4	100	16			SAND - gray, wet, loose, non-plastic, poorly graded, medium grained, mild hydrocarbon odor, no sheen
			7.3		6	50				
							17			
					3	100	18			
	B8-08	10:15		0.24	3	100				Sandy SILT - gray, wet, soft, slightly plastic, no hydrocarbon odor, no sheen
			6.5		3	100	19		ML	
							20			

NWT 002627

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-8**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 9:30	DRILL FINISH Time: 12:10
	SAMPLING METHOD:	1.5" / 3" OD Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/18/95	Date: 9/18/95
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	23.0
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips					1	100				
	B8-09	10:20		-	1	100	21			SAND - gray, wet, very loose, non-plastic, poorly graded, moderate petroleum hydrocarbon odor, slight sheen
			6.1		2	100			SP	
							22			
					2	100	23			
					2	100				
	B8-10	11:45	5.1	-	4	100	24		SM	Silty SAND - dark gray, wet, very loose, non-plastic, poorly graded, fine grained, mild petroleum hydrocarbon odor
							25			
					1	100				
					2	100	26			Silty SAND - as above
	B8-11	12:00	4.1	-	3	100				
							27			
										Installed a 2-inch diameter 0.010-inch slotted stainless steel well screen at 20.5 to 23.5 feet bgs. Purged two gallons of water using a peristaltic pump prior to groundwater sampling. GROUNDWATER SAMPLE (2708-950918-BW8-01) collected at 11:30 hrs, 9/18/95. Well point was removed prior to abandonment.
							28			
							29			
							30			
							31			Drilled to 26.5 feet bgs Sampled to 26.5 feet bgs
							32			
							33			* Sample Number Prefix is 2708-950918-
							34			
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002628

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-9**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 14:50	DRILL FINISH Time: 16:40
	SAMPLING METHOD:	1.5" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/18/95	Date: 9/18/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	31.6 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY (%) or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							1			
							2		SP	See boring log B-9A for 0 to 5 foot soil description.
							3			
							4			
							5			
	B9-01	14:50		-	8	100				SAND with some Gravel - black, dry, medium dense, very strong petroleum hydrocarbon odor, all pores filled with tar-like substance throughout
			8:10		10	20	6			
					11	0				
							7			
					18	10	8			SAND with some Gravel - as above, dense, large piece of gravel in end of sampler
					33	0				
					21	0	9		SP	
							10			
	B9-02	15:00	897	19,438	18	100				SAND with some Gravel - as above, moist, dense
					13	0	11			
					23	0				
							12			
	B9-03	15:10	278.0	-	16	100	13			Silty SAND with some Gravel - brown, moist, medium dense, poorly graded, strong petroleum hydrocarbon odor, some tar-like blebs
					6	0				
					17	0	14			
									SM	
							15			
	B9-04	15:20	118	-	4	100				Silty SAND with Gravel - brown with black mottles, dry, medium dense, tar-like substance mottled throughout, strong petroleum hydrocarbon odor
					7	0	16			
					11	0				
							17			
	B9-05	15:30	211	-	13	100	18			
					50?3"	5		9/18/95	SP	SAND with some Gravel - black, very dense, possible lampblack
							19			
	B9-06	15:40	363	-	3	100	20			

NWT 002629

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-9**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 14:50	DRILL FINISH Time: 16:40
	SAMPLING METHOD:	1.5" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/18/95	Date: 9/18/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY (%) or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
					4	0				SAND - black, wet, very loose, poorly graded, fine to medium grained, slight petroleum hydrocarbon odor
					4	0	21			
							22			
					2	100				SAND with some Gravel - black, wet, very loose, slightly graded, medium grained, strong petroleum hydrocarbon odor, strong sheen
	B9-07	1	100	-	3	100	23			
					6	100			SP	
							24			
							25			
3/4" Bentonite Chips							26			
							27			
							28			
	B9-08	16:10	504	-						Silty SAND - gray to black, wet, mild petroleum hydrocarbon odor, sheen
							29		SM	
							30			
	B9-09	16:20	33.1	43.5			31			Silty SAND - dark gray, wet, poorly sorted, petroleum hydrocarbon odor, slight sheen
							32			
							33			
							34		SP	
	B9-10	16:21	9.1	0.46						SAND - green to gray, wet, poorly graded, fine grained, no petroleum hydrocarbon odor, no sheen
							35			
							36			
							37			Drilled to 35 feet bgs Sampled to 35 feet bgs
							38			
							39			* Sample Number Prefix is 2708-950918-
							40			

NWT 002630

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-9A**		
PROJECT:	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
Northwest Natural Gas Co.	SAMPLING METHOD:	4" OD Core Barrel	Time:	Time:
Gasco Facility	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger	14:00	14:20
Portland, Oregon	EQUIPMENT TYPE	B-59 Mobile Drill	Date:	Date:
PROJECT #: 2708	DRILLER:	Brad James	9/18/95	9/18/95
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
Bentonite Chips							1		SP
	B9A-01	14:00		-					
	B9A-02	14:02	614	-			2		
	B9A-03	14:05	274	-			3		
							4		
							5		
							6		
							7		
							8		
							9		
							10		
							11		
							12		
							13		
							14		
							15		
							16		
							17		
							18		
							19		
							20		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	31.6 feet msl
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

Gravelly SAND - black, dry, strong petroleum hydrocarbon odor, saturated with tar-like substance throughout

Note: Stopped drilling at 14:20 due to lack of soil recovery from 5 to 15 feet bgs. Relocate to boring B-9.

Drilled to 15 feet bgs
Sampled to 3 feet bgs

*Sample prefix is 2708-950918-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-10**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time:	DRILL FINISH Time:
	SAMPLING METHOD:	4" OD Core Barrel	11:50	12:50
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	9/25/95	9/25/95

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.2 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							1			
							2		SP	
							3			
	B10-01	12:10		-			4			SAND - brown, dry, poorly graded, medium grained, no hydrocarbon odor, no sheen
			102.0				5			
							6			
							7			
	B10-02	12:20		-						SAND with some Pebbles - brown, moist, poorly graded, medium grained, no hydrocarbon odor, no sheen
			164.0				8		SP	
							9			
							10			
							11			
							12			
	B10-03	12:30		-						SAND - brown, slightly moist, poorly graded, medium grained, no hydrocarbon odor, no sheen, slight froth via sheen test
			165.0				13		SP	
							14			
							15			
							16			
							17			SAND - brown, moist, poorly graded, medium grained, no hydrocarbon odor, no sheen
	B10-04	12:40		ND			18			
			127.0				19		SP	
							20			

NWT 002632

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-10**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 11:50	DRILL FINISH Time: 12:50
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/25/95	Date: 9/25/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
3/4" Bentonite Chips	B10-05	12:50	167.0	-			21–25	9/25/95	SP

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.2 feet msl
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

SAND - green to gray, wet, poorly graded, medium grained, no hydrocarbon odor, no sheen

Drilled to 25 feet bgs
Sampled to 24 feet bgs

* Sample Number Prefix is 2708-950925-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-11**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:30	DRILL FINISH Time: 11:40
	SAMPLING METHOD:	3" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/28/95	Date: 9/28/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B11-01	10:30		-						Silty SAND with Gravel - brown, moist, no hydrocarbon odor, no sheen
			9.2				1			
							2		SP	
					8	100	3			SAND - brown, slightly moist, medium dense, poorly graded, medium grained, no hydrocarbon odor, no sheen
	B11-01	10:40		-	15	100				
			7.2		18	70	4			
							5			
					8	100				
	B11-03	10:42		-	13	100	6			SAND - dark gray, moist, medium dense, poorly graded, medium grained, hydrocarbon odor, sheen
			20		13	95				
							7		SP	
	B11-04	10:45		-			8			SAND - dark gray, moist, loose, poorly graded, medium grained, hydrocarbon odor, sheen
			21.6							
							9			
	B11-05	10:48		-						SAND - as above, gray to black, strong hydrocarbon odor, strong sheen
			119				10			
							11			
							12		SP	
	B11-06	10:55		973			13			SAND - as above, strong hydrocarbon odor, strong sheen
			260							
							14			
							15			
							16			
							17		SP	
							18			
	B11-07	11:00		-				9/28/95		SAND - as above, moist to wet, strong hydrocarbon odor, strong sheen, brown product and froth formed when water was added to sample
			97				19			
							20			

NWT 002634

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER** **B-11**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 3" OD Split Spoon/4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.	DRILL START Time: 10:30 Date: 9/28/95	DRILL FINISH Time: 11:40 Date: 9/28/95

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: Not Surveyed
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		SP	
	B11-08	11:10		-						SAND - as above, wet, (froth no longer present)
			17.1				22			
							23			
	B11-09	11:15		1.1						SAND - as above, no hydrocarbon odor, no sheen
			2.1				24			
							25			
							26		SP	
	B11-10	11:20		-						SAND - as above, hydrocarbon odor and sheen from 25' to 27' bgs
			0.4				27			
							28			
	B11-11	11:25		-			29			SAND - as above, no hydrocarbon odor, no sheen
			0.7							
	B11-12	11:30		-			30			SILT - green to gray, moist, stiff, no hydrocarbon odor, no sheen
			0.5				31		ML	
	B11-13	11:40		-						SILT - as above
			0				32			
							33			
							34			Drilled to 32 feet bgs Sampled to 32 feet bgs
							35			* Sample Number Prefix is 2708-950921-
							36			
							37			
							38			
							39			
							40			

NWT 002635

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-13**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 12:10 Date: 10/6/95	DRILL FINISH Time: 13:00 Date: 10/6/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.4 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B13-01	12:15	285.0	-	1–5	SP	SAND - brown, moist, loose, poorly graded, medium grained, no hydrocarbon odor, no sheen
	B13-02	12:27	300.0	-	6–10	SP	SAND - olive gray, moist to wet, saturated with hydrocarbon product, strong sheen throughout core
	B13-03	12:33	368.0	29,378	11	SP	SAND - black, wet, loose, saturated with hydrocarbon product, wood fragments at sand/silt interface
					12	ML	Sandy SILT - olive gray, moist, hydrocarbon odor, slight sheen, roots present, (11-11.5 feet bgs)
	B13-04	12:37	226.0	-	13–15	SP	SAND - olive gray, moist, loose, poorly graded, medium grained, no hydrocarbon odor, no sheen
	B13-05 Dup	12:39	203.0	-			
	B13-06	12:44	552.0	-	16–18	ML	SILT - green with brown mottling, orange spots present throughout, stiff, black tar fingering through via root zones
	B13-07	12:50	124.0	ND	19–20	ML	SILT - as above, black tar fingers not present, no sheen

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-13**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 12:10	DRILL FINISH Time: 13:00
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/6/95	Date: 10/6/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.4 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21	10/6/95	ML	SILT - brown, moist, stiff, slightly plastic, no hydrocarbon odor, no sheen
							22			
							23		SP	SAND - brown, wet, poorly graded, no hydrocarbon odor, no sheen
	B13-08	12:55	124.0	-					ML	SILT - brown, moist, stiff, slightly plastic, no hydrocarbon odor, no sheen
	B13-09 Dup	12:58	98.1	-			24			
	B13-10	13:00	112.0	ND					SP	SAND - brown, wet, loose, poorly graded, fine grained, ho hydrocarbon odor, no sheen
							25			
							26			
							27			
							28			
							29			
							30			
							31			
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

Drilled to 25 feet bgs
Sampled to 24.5 feet bgs

* Sample Number Prefix is 2708-951006-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-14**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:25 Date: 9/28/95	DRILL FINISH Time: 9:30 Date: 9/28/95
	SAMPLING METHOD:	3" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B14-01	8:20	4.6	-			1	9/28/95	SM	Silty SAND with Gravel - brown, moist (surface sample)
							2			
					11	100	3		SP	Silty SAND with Gravel - olive gray, moist, dense, hydrocarbon odor, sheen
	B14-02	8:30		-	23	100				
			8.4		35	90	4			
							5		ML	Sandy SILT - brown, moist, stiff, slightly plastic, no hydrocarbon odor, no sheen
					5	100				
	B14-03	8:35		ND	8	100	6			
			3.0		13	95				
							7			
					6	100	8		SP	SAND - olive gray, moist, loose, poorly graded, fine grained, no hydrocarbon odor, no sheen
	B14-04	8:40		-	6	100				
			3.4		7	90	9			
							10			
							11			SAND - as above, (10-11 feet bgs)
	B14-05	9:00		-						
			4.1				12		ML	SILT - brown, moist, stiff, slightly plastic, no hydrocarbon odor, no sheen, (11-12 feet bgs)
							13		SP	SAND - olive gray, moist, medium dense, poorly graded, fine grained, no hydrocarbon odor, no sheen, (12-13 feet bgs)
	B14-06	9:05		-						SILT - brown, moist, very stiff, slightly plastic, no hydrocarbon odor, no sheen
			4.6				14		ML	
							15			
							16			Sandy SILT - brown and tan mottled, moist, no hydrocarbon odor, no sheen, (piece of bark present)
	B14-07	9:20		-						
			3.7				17		SP	SAND with some Silt - brown, wet, medium dense, poorly graded, fine grained, no hydrocarbon odor, no sheen (16.5-17.5 feet bgs)
	B14-08	9:25		-						
			4.8				18		ML	SILT - brown, moist, stiff, no hydrocarbon odor, no sheen, (17.5-18 feet bgs)
	B14-09	9:30		-					SP	
			4.9				19			SAND - brown, wet, poorly graded, fine grained, no hydrocarbon odor, no sheen, (18-19 feet bgs)
							20			

NWT 002638

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-14**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 8:25 Date: 9/28/95	DRILL FINISH Time: 9:30 Date: 9/28/95
	SAMPLING METHOD:	3" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
							21		
							22		
							23		
							24		
							25		
							26		
							27		
							28		
							29		
							30		
							31		
							32		
							33		
							34		
							35		
							36		
							37		
							38		
							39		
							40		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

Drilled to 20 feet bgs
Sampled to 19 feet bgs

* Sample Number Prefix is 2708-950928-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-15**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:45	DRILL FINISH Time: 15:05
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/6/95	Date: 10/6/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.5 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							1		SP	SAND - brown, moist, loose, poorly graded, medium grained, no hydrocarbon odor, no sheen, (2.5-5 feet bgs)
							2			
							3		SP	
							4			
	B15-01	13:57		-						
			97.0				5			
							6			Silty SAND with Gravel - olive gray, moist, hydrocarbon odor, sheen, (5-6 feet bgs - brick in end of sampler)
							7			(Switch to 1.5" OD Split Spoon sampling device)
									SM	
					50/5"	60	8			Silty SAND - olive gray, moist, hydrocarbon odor, sheen, (7.5-8 feet bgs - wood fragment in end of sampler)
							9			
							10			(Switch back to 4" OD Core Barrel sampling device)
							11			
	B15-02	14:17		-						SILT - green, moist, firm, no hydrocarbon odor, no sheen, rootlets throughout, (10-15 feet bgs)
			21.1				12			
							13			
									ML	
	B15-03	14:20		-			14			
			59.9							
							15			
							16	10/6/95		SILT - as above (15-15.5 feet bgs)
							17			Sandy SILT - green with black patches of hydrocarbon product, moist, hydrocarbon odor, sheen, (15.5-17.5 feet bgs)
	B15-04	14:25		-			18			SILT - wet, soft, saturated with product (17.5-18.5 feet bgs)
			83.1						ML	
							19			SILT - green, hydrocarbon odor, sheen, (18.5-20 feet bgs)
							20			

NWT 002640

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-15**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER: Rob Ede SAMPLING METHOD: 4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James	DRILL START Time: 13:45 Date: 10/6/95	DRILL FINISH Time: 15:05 Date: 10/6/95
PROJECT #: 2708	DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.		

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: 35.5 feet msl
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		ML	SILT - green, moist, firm, hydrocarbon odor, no sheen, (20-21 feet bgs
	B15-05	14:33		638					SM	Silty SAND - olive gray, wet, poorly graded, fine grained, hydrocarbon odor, sheen, (21-21.5 feet bgs)
			97.6				22			
							23		ML	SILT - brown and olive mottled, fingers of black oily substance in rootlet zones, (21.5-25 feet bgs)
							24			
	B15-06	14:38		-						
			-				25			
							26		SM	SAND - olive gray, wet, loose, no hydrocarbon odor, no sheen, (25-27 feet bgs)
	B15-07	14:57		-						Sandy SILT - olive gray, moist, stiff, hydrocarbon odor, no sheen, (27-27.5 feet bgs)
			15.8				27			SAND - olive gray, wet, loose, fine grained, no hydrocarbon odor, no sheen, (27.5-29 feet bgs)
	B15-08	15:00		1.8					ML	
			13.6				28		SP	SILT - brown, moist no hydrocarbon odor, no sheen, (29-29.5 feet bgs)
							29			SAND - brown, wet, loose, fine grained, no hydrocarbon odor, no sheen, (29.5-30 feet bgs)
	B15-09	15:04		-					ML	
			31.3				30		SP	
							31			
							32			
							33			Drilled to 30 feet bgs Sampled to 30 feet bgs
							34			* Sample Number Prefix is 2708-951006-
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002641

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-17**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:55	DRILL FINISH Time: 10:40
	SAMPLING METHOD:	1.5" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/29/95	Date: 9/29/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							1		SM	Surface - GRAVEL fill (surface)
							2			
					2	100	3			Silty SAND - brown, moist, no sheen
	B17-01	10:00		59	2	100				
			421		2	90	4			
							5		ML	
							6			Sandy SILT - olive gray, moist, firm, no sheen
	B17-02	10:10		-						
			603				7			
							8			
									SP	SAND - olive gray, moist, poorly graded, medium grained, no sheen
	B17-03	10:12		-			9			
			213				10			
							11			SAND - olive gray, poorly graded, strong sheen, brown product and froth when water added to sample, some wood fragments
	B17-04	10:20		-						
			1409				12			
							13			
							14			
							15			
							16		SP	
	B17-05	10:30		1,814			17			SAND - as above, wet, saturated with brown, oily product
			1478				18			
							19	9/29/95		
							20			

NWT 002642

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-17**			
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	1.5" OD Split Spoon/4" OD Core Barrel	Time: 9:55	Time: 10:40
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/29/95	Date: 9/29/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		SP	SAND - as above, wet, contains brown product, strong sheen, many roots at sand/silt interface
	B17-06	10:35		-			22			
			145				23			
	B17-07	10:40		0.89			24		ML	SILT - olive gray, moist, very stiff, no hydrocarbon odor, no sheen, some brown root casts
			65.8				25			
							26			
							27			Drilled to 25 feet bgs Sampled to 24 feet bgs
							28			
							29			* Sample Number Prefix is 2708-950929-
							30			
							31			
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-18**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER: Rob Ede SAMPLING METHOD: Split Spoon DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James	DRILL START Time: 10:05 DRILL FINISH Time: 11:45 Date: 9/19/95	
PROJECT #: 2708	DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.		

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: Not Surveyed
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
							1			Sandy GRAVEL - dry, road fill (surface)
							2			
	B18-01	10:15	74	-	50/5"	80	3		ML	Sandy SILT - brown and olive gray, moist, hard, slightly plastic, slight sheen
							4			
					8	100				
	B18-02	10:20	1772	-	11	100	5			SILT - brown, gray mottling, moist, stiff, plastic, no sheen
					14	100				
							6			
					4	100	7		SM	Silty SAND with Clay - brown, moist, loose, plastic, slight sheen
	B18-03	10:30		-	7	100				
			2500		8	50	8			
							9			
					4	100				
3/4" Bentonite Chips	B18-04	10:35		-	4	100	10			Sandy SILT with some Clay - brown, moist, medium stiff, poorly graded, slightly plastic, slight sheen
			2500+		6	100			ML	
							11			
					2	100	12			Sandy SILT - as above
	B18-05	10:40		59.3	5	100				
			2500+		6	100	13			
								9/19/95		
							14			
					2	100				SAND - brown, wet, very loose, poorly graded, fine grained, sheen observed on surface of core
	B18-06	10:50		-	2	100	15	▼		
			2500+		4	100				
							16			
					4	100	17		SP	
	B18-07	11:00		-	5	100				SAND - as above
			2500+		5	100	18			
							19			
					4	100				SAND - olive gray, wet, loose, poorly graded, slight sheen on core
	B18-08	11:05		-	6	100	20			

NWT 002644

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-18**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:05	DRILL FINISH Time: 11:45
	SAMPLING METHOD:	Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/19/95	Date: 9/19/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips			224		7	100	21			
					3	100	22		SP	SAND - as above, no sheen
	B18-09	11:10		-	8	100				
			2500+		12	100	23			
							24			
					7	100				
	B18-10	11:30		ND	17	100	25			SAND - as above
			14.4		14	100	26		SP	
					12	100	27			SAND - as above
	B18-11	11:40			21	100				
			24.0		16	100	28			
							29			
							30			Drilled to 28 feet bgs Sampled to 28 feet bgs
							31			* Sample Number Prefix is 2708-950919-
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002645

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-19**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 13:30 Date: 9/19/95	DRILL FINISH Time: 9:30 Date: 9/20/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.4
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B19-01	13:10	34.0	933	1	ML	Sandy SILT - brown, dry, (surface - just below sod root zone)
					2		
					3	SP	
					4		
	B19-02	13:40	382.0	-	5		SAND - black, moist, well graded, fine grained, grains appear to be coated with oily substance, sheen evident
					6		
	B19-03	13:55	623.0	408	7		SAND - as above
					8	SP	
					9		Installed a 2-inch diameter 0.010-inch slotted stainless steel well screen at 10 to 13 feet bgs. Purged zero gallons of water prior to groundwater sampling. GROUNDWATER SAMPLE (2708-950920-BW19-01) collected at 8:15 hrs, 9/20/95. Well point was removed and drilling was resumed.
					10		
					11	ML	Clayey SILT - brown, dry, very stiff, slight sheen
					12		
	B19-04	14:10	2500+	-	13	SP	SAND - black, moist to wet, poorly graded, sheen
					14		
	B19-05	14:20	2500+	-	15		
					16		
	B19-06	14:30	2500+	-	17	ML	SILT - brown, dry, stiff, no sheen
					18		
	B19-07	8:50	2500+	80	19		Sandy SILT - olive gray, moist, poorly graded, fine grained, no sheen
					20		

9/20/95

NWT 002646

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-19**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time:	DRILL FINISH Time:
	SAMPLING METHOD:	4" OD Core Barrel	13:30	9:30
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	9/19/95	9/20/95

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.4
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		ML	Sandy SILT - as above, wet
							22			
							23			
							24			
							25			Installed a 2-inch diameter 0.010-inch slotted stainless steel well screen at 25 to 28 feet bgs. Purged eight gallons of water using a peristaltic pump prior to groundwater sampling. GROUNDWATER SAMPLE (2708-950920-BW19-02) collected at 12:05 hrs, 9/20/95. Well point was removed prior to abandonment.
							26			
							27		SP	
	B19-08	9:22	717.0	2.0			28			Silty SAND - brown, wet, poorly graded, fine grained, coarsening downward
							29			
							30			Drilled to 29 feet bgs Sampled to 29 feet bgs
							31			
							32			* Sample Number Prefix is 2708-950919- for samples B19-01 to B19-06. Sample Number Prefix is 2708-950920- for samples B19-07 and B19-08.
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

NWT 002647

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-20**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 1.5" OD Split Spoon/4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.	DRILL START Time: 14:00 Date: 9/29/95	DRILL FINISH Time: 15:00 Date: 9/29/95

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: 35.4 feet msl
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Asphalt							1		Asphalt	Asphalt (surface)
							2		SP	
					5	100	3			
	B20-01	14:05		-	5	100				SAND - brown, moist, loose, poorly graded, no sheen
			355		5	50	4			
							5			
							6			SAND - as above, large rock in sand at depth of 7.5 feet bgs
							7			
	B20-02	14:10		-			8		SP	
			1166				9			SAND - olive gray, moist, poorly graded, medium grained, no sheen
							10			
3/4" Bentonite Chips	B20-03	14:15		1,093			11			SAND - gray, wet, poorly graded, saturated with hydrocarbon product, metallic sheen, (10-11 feet bgs)
			2500+				12			
	B20-04	14:20		-						SAND - brown, moist, poorly graded, fine grained, no product saturation, sheen is present, (11-13 feet bgs)
			2500+				13			
							14			
							15			
							16		SP	
							17	9/29/95		SAND - olive gray, moist to wet, sheen
	B20-05	14:25		-			18			
			1270				19			
							20			

NWT 002648

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-20**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 14:00	DRILL FINISH Time: 15:00
	SAMPLING METHOD:	1.5" OD Split Spoon/4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/29/95	Date: 9/29/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	SPT (blows/6 in) or Core Interval	RECOVERY or INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		SP	SAND - brown to metallic gray, wet, strong sheen
							22			
	B20-06	14:30		-			23			
			2500+						ML	SILT - brown, very stiff, brown pockets of organic material
	B20-07	14:35		13			24			
			1010				25			
							26			Drilled to 25 feet bgs Sampled to 24 feet bgs
							27			
							28			* Sample Number Prefix is 2708-950929-
							29			
							30			
							31			
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.4 feet msl
TOP OF CASING ELEVATION:	Not Applicable

NWT 002649

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-21**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:50	DRILL FINISH Time: 9:40
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/3/95	Date: 10/3/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	38.0
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B21-01	9:00	3.4	-	1–5	ML	SILT - brown and green mottled, slightly moist, stiff, roots present, slight sheen
	B21-02	9:05	2.3	-	6–8	ML	SILT - as above, moist
	B21-03	9:10	1.7	-	9–10	SP	Silty SAND -brown, moist to wet, medium dense, poorly graded, fine grained, no sheen
	B21-04	9:15	34.2	-	11–12	ML	Sandy SILT - brown with olive gray mottling, moist, firm, slight sheen
	B21-05	9:20	23.2	-	13–15	SP / SM	SAND - brown, wet, loose, poorly graded, fine grained, no sheen Silty SAND - brown, moist, medium dense, fine grained, no sheen
	B21-06	9:30	1.5	-	16–17	SP	SAND - brown, wet, loose, poorly graded, fine grained, no sheen
	B21-07	9:35	1.5	-	18–20	SP	Installed a 2-inch diameter 0.010-inch slotted stainless steel well screen from 15.5 to 19.5 feet bgs. Purged five gallons of water using a peristaltic pump prior to groundwater sampling. GROUNDWATER SAMPLE (2708-951003-BW21-01) collected at 10:48 hrs, 10/3/95. Well point was removed prior to abandonment.

GROUNDWATER 10/3/95

NWT 002650

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER** **B-21**			
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	4" OD Core Barrel	Time:	Time:
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger	8:50	9:40
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	10/3/95	10/3/95

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
							21		
							22		
							23		
							24		
							25		
							26		
							27		
							28		
							29		
							30		
							31		
							32		
							33		
							34		
							35		
							36		
							37		
							38		
							39		
							40		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	38.0
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

Drilled to 30 feet bgs
Sampled to 29.5 feet bgs

* Sample Number Prefix is 2708-951003-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-22**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 12:00 Date: 10/3/95	DRILL FINISH Time: 13:00 Date: 10/3/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	37.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B22-01	12:05	81.8	-	1–5	ML	SILT with Sand and Gravel - moist to wet, oily substance present, strong sheen, metal wire present
	B22-02	12:12	212.0	-	6–7		SILT - green with brown mottling, stiff, strong sheen
	B23-03	12:15	253.0	-	8–10	ML	
	B22-04	12:25	18.6	-	11–13		Sandy SILT - brown, moist, stiff, strong sheen
	B22-05	12:30	18.4	40	14–15		Sandy SILT - olive gray to green, moist to wet, stiff, strong sheen
	B22-06	12:35	15.8	-	16–17	ML	SILT - olive gray, moist, stiff, strong sheen, black oily product throughout core)
	B22-07	12:40	4.8	-	18–20		

GROUNDWATER: 10/3/95

NWT 002652

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-22**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.		DRILL START Time: 12:00 Date: 10/3/95	DRILL FINISH Time: 13:00 Date: 10/3/95

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B22-08	12:45	53.2	-	21	ML	SILT - as above, moist to wet, pockets of brown product within core
					22	SP	
					23		SAND - olive gray, wet, fine grained, black product at 24-25 feet bgs, (see photo 14)
					24		
	B22-09	12:50	16.0	485	25		
					26	ML	Sandy SILT - brown, moist, stiff, no sheen
	B22-10	12:55	8.7	-	27		SAND - brown, wet, loose, poorly graded, fine grained, muscovite present, no sheen
					28	SP	
	B22-11	1:00	8.4	-	29		
					30		Drilled to 30 feet bgs Sampled to 29.5 feet bgs
					31		* Sample Number Prefix is 2708-951003-
					32		
					33		
					34		
					35		
					36		
					37		
					38		
					39		
					40		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	37.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

NWT 002653

HAHN & ASSOCIATES, INC.	SOIL BORING NUMBER B-23			
434 NW Sixth Avenue Portland, Oregon (503) 796-0717	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	4" OD Core Barrel	Time: 14:17	Time: 15:40
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/3/95	Date: 10/3/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
Asphalt					1	Asphalt	Asphalt
					2	Concrete	Concrete
					3		
					4		
					5		
					6		
	B23-01	14:38					
			190.0	-	7	SP	SAND - brown, moist, loose, poorly graded, medium grained, slight sheen
					8		
3/4" Bentonite Chips					9		
					10		
	B23-02	14:47	2500+	-	11		
					12	ML	Sandy SILT - green with brown mottling, moist to wet, stiff, lower 6 inches of core is saturated with product, strong sheen
	B23-03	14:50	1439	-	13		
					14		
					15		
					16		
	B23-04	14:57		-			
			9.7		17		Sandy SILT - green with brown mottling, stiff, roots present, saturated with product 15-17 feet bgs, strong sheen
					18		
	B23-05	15:00		-		ML	
			589.0		19		
					20		

GROUNDWATER: 10/3/95

NWT 002654

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER** **B-23**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.	DRILL START Time: 14:17 Date: 10/3/95	DRILL FINISH Time: 15:40 Date: 10/3/95

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: 35.1 feet msl
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B23-06	15:05	2500+	-			21		ML	SILT - brown with orange spots, moist, very stiff, sheen
	B23-07	15:10	682.0	-			25			
	B23-08	15:20	2500+	77			27		SP	SAND with some Silt - wet, fine grained, brown oily product present, sheen
	B23-09	15:25	822.0	-			30		ML	Sandy SILT - brown, moist, stiff, strong sheen
	B23-10	15:30	108.0	-			32			
	B23-11	15:35	292.0	-			34		SP	SAND - olive gray, wet, loose, fine grained, no sheen
	B23-12	15:38		ND			35		ML	SILT - brown, moist, stiff, no sheen
							36			Drilled to 35 feet bgs Sampled to 35 feet bgs
							37			* Sample Number Prefix is 2708-951003-
							38			
							39			
							40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-24**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:15 Date: 10/2/95	DRILL FINISH Time: 10:15 Date: 10/2/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.5 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							1		Concrete	Sidewalk at surface.
							2			
							3		SP	Lampblack - black, dry, hydrophobic, no sheen (2.5-3.0 feet bgs)
	B24-01	9:23	211.0	-	9 7	100 100	4			SAND - brown, dry, loose, poorly graded, medium grained, no sheen, (3-4 feet bgs)
					9	100	5			
							6			
	B24-02	9:30		-			7			SAND - as above, some pebbles, moist, no sheen, (5-10 feet bgs)
			40.0				8			
							9		SP	
							10			
	B24-03	9:40		1,092			11			SAND - olive gray, moist, loose, black droplets of tar-like substance at base of sand, wood chips present (10-11.5 feet bgs)
			1406				12			
	B24-04	9:45		-			13			Sandy SILT - olive gray, moist, slightly plastic, slight sheen, (11.5-15 feet bgs)
			71.1				14	10/2/95		
							15			
							16		ML	
	B24-05	9:50		-			17			Sandy SILT - olive gray to green, moist, stiff, strong sheen, (15-20 feet bgs)
			636.0				18			
							19			
	B24-06	9:53		-			20			
			796							

NWT 002656

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-24**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 9:15 Date: 10/2/95	DRILL FINISH Time: 10:15 Date: 10/2/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.5 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		ML	Sandy SILT - brown with green mottles, moist, sheen on core - smeared from above, (20-22 feet bgs)
	B24-07	10:00		-						
			390				22			
							23		SP	SAND - brown, wet, loose, poorly graded, fine grained, no sheen (22-23 feet bgs)
	B24-08	10:03		-			24		ML	Sandy SILT -brown with green mottles, moist, no sheen (23-24 feet bgs)
			907				25			
							26			
	B24-09	10:05		-						
			1654				27		SP	SAND - brown, wet, loose, poorly graded, no sheen (24-30 feet bgs), 2 inch Silt zone at 27 feet bgs
							28			
							29			
	B24-10	10:10	834	0.14			30			Drilled to 30 feet bgs Sampled to 29.5 feet bgs
							31			* Sample Number Prefix is 2708-951002-
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-25**		
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	4" OD Core Barrel	Time:	Time:
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger	12:05	12:45
	EQUIPMENT TYPE	B-59 Mobile Drill	Date:	Date:
	DRILLER:	Brad James	10/2/95	10/2/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.0 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips					1	Asphalt	Asphalt at surface.
					2		
					3	SP	
	B25-01	12:15		-			SAND - brown to gray, moist, loose, poorly graded, medium grained, slight sheen, (2-5 feet bgs)
			262		4		
					5		
					6		
	B25-02	12:20		-	7		SAND - as above, moist, large piece of decayed wood in end of sampler, slight sheen, (5-10 feet bgs)
			85.2		8		
					9	SP	
					10		
					11		
					12	10/2/95	
	B25-03	12:30		12.5	13		SAND - as above, wet at 14 feet bgs, strong sheen, brown froth appears via sheen test, (10-15 feet bgs)
			90.6		14		
					15		
					16		
					17		SAND - as above, wet, strong sheen and froth to depth of 17 feet bgs, no sheen from 17-18.5 feet bgs
					18		
	B25-04	12:35		-	19	ML	SILT - olive gray, moist, no sheen (18-20 feet bgs)
			92.7		20		

NWT 002658

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-25**	
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.	DRILL START Time: 12:05 Date: 10/2/95	DRILL FINISH Time: 12:45 Date: 10/2/95

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B25-05	12:40		0.45						
			191				21		ML	Sandy SILT - olive gray, wet, slightly stiff, slightly plastic, no sheen, (20-22 feet bgs)
							22			
							23			
	B25-06	12:43		-						
			24.4				24		ML	SILT - olive gray with brown/orange spots, moist, stiff, plastic, no sheen, (22-25 feet bgs)
							25			
							26			
							27			
							28			
							29			
							30			Drilled to 25 feet bgs Sampled to 24 feet bgs
							31			* Sample Number Prefix is 2708-951002-
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-26**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:20	DRILL FINISH Time: 10:20
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/4/95	Date: 10/4/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B26-01	8:15	753	9.3			1		SM	Silty SAND with Gravel - brown, moist, no hydrocarbon odor
							2			
							3		SP	Lampblack - black, hydrophobic, slight sheen, slight hydrocarbon odor
	B26-02	8:30	1191	-			4			
							5			
					33	10	6			Brick in end of sampler, also pieces of hardened tar
					34	0				
					19	0	7			
							8			
	B26-03	8:45		-						
			771				9		SP	SAND - olive gray, moist, loose, medium grained, strong hydrocarbon odor, sheen
							10			
							11			
	B26-04	8:55		-			12			
			997				13			SAND - olive gray, moist, loose, medium grained, strong sheen, brown froth via sheen test, hydrocarbon odor
							14			
							15	10/4/95		
							16			
	B26-05	9:08		-			17		SP	SAND - olive gray, wet, loose, poorly graded, medium grained, saturated with product, strong sheen on sampler
			1611				18			
							19			
							20			

NWT 002660

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-27**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 12:40	DRILL FINISH Time: 13:30
	SAMPLING METHOD:	Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/20/95	Date: 9/20/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch									
CASING DIAMETER:	Not Applicable									
SURFACE ELEVATION:	37.0 feet msl									
TOP OF CASING ELEVATION:	Not Applicable									

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B27-01	12:15		-			1		GP	Sandy GRAVEL - brown, dry, fill (surface)
							2			
	B27-02	12:50		-	13	100	3			
			7.6		17	0			SM	Silty SAND - brown, dry, dense, pieces of coal? present, no petroleum odor, no sheen
					18	0	4			
							5			
					16	100			SP	SAND - brown, dry, medium dense, poorly graded, fine grained, some coal in upper 6 inches, no sheen, black colored hydrophobic particulates float via sheen test (lampblack?)
	B27-03	12:55		-	16	100	6			
			6.5		20	50				
							7			
					10	100	8			
	B27-04	13:00		-	10	100				SAND - black, moist, medium dense, poorly graded, fine grained, strong petroleum hydrocarbon odor, sheen via sheen test
			21.5		12	50	9			
							10			
					4	100				SAND - as above, loose, strong petroleum hydrocarbon odor, sheen via sheen test
	B27-05	13:03		-	8	70	11			
					8	0				
							12		SP	
					6	100	13			SAND - as above, strong petroleum hydrocarbon odor, sheen via sheen test
	B27-06	13:05		-	10	100		9/20/95		
			36.4		13	50	14			
							15	▼		
					4	100				SAND - olive gray to black, wet, loose, petroleum hydrocarbon odor, slight sheen via sheen test
	B27-07	13:10		-	6	100	16			
			13.2		8	60				
							17		SP	
					2	100	18			
	B27-08	13:15		-	4	100				SAND - as above, slight petroleum hydrocarbon odor, no sheen via sheen test
			35.2		7	100	19			
							20			

NWT 002661

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-27**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 12:40	DRILL FINISH Time: 13:30
	SAMPLING METHOD:	Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/20/95	Date: 9/20/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	37.0 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
					11	100				
	B27-09	13:30		-	24	100	21			SAND - black, wet, dense, sheen on core, sheen via sheen test
			2031		16	100			SP	
							22			
					2	100	23			SAND - black, wet, loose, saturated with oily substance, (22.5-23.5 feet bgs)
	B27-10	13:40		1,243	3	100				
			2500+		3	100	24		ML	SILT - brown, wet, medium stiff, plastic, sheen via sheen test, (23.5-24 feet bgs)
							25			
					2	100			SP	SAND with some Silt - black, wet, loose, sheen on sampler, (25-25.5 feet bgs)
	B27-11	13:45		-	2	100	26			
			392		2	50				SILT with some Clay - brown, wet, soft, plastic, sheen via sheen test, (25.5-26.5 feet bgs)
							27			
					4	100	28		ML	
	B27-12	13:55		125	5	100				Clayey SILT - brown, moist, medium stiff, plastic, no sheen via sheen test
			120		5	70	29			
							30			
					3	100				
	B27-13	14:05		-	3	100	31			Clayey SILT - as above, slight sheen via sheen test, (outside of core smeared with petroleum product from shallower depths)
			861		5	100				
							32			
					3	100	33		ML	
	B27-14	14:15		-	4	100				Clayey SILT - olive gray, moist, soft, sheen via sheen test, (outside of core smeared with petroleum product from shallower depths)
			714		5	10	34			
							35			
					3	100				
	B27-15	14:40		12.2	3	80	36			SILT - olive gray, moist, soft, no petroleum hydrocarbon odor, no sheen via sheen test
			254		3	0				
							37			
							38			
							39			
							40			

3/4" Bentonite Chips

Drilled to 36.5 feet bgs
Sampled to 36.5 feet bgs

* Sample Number Prefix is 2708-950920-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-28**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 14:00	DRILL FINISH Time: 15:00
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/2/95	Date: 10/2/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.4 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B28-01	13:45	614	87	1	SP	Silty SAND with Gravel - brown, moist, fine grained, non plastic, no hydrocarbon odor, no sheen via sheen test (surface)
	B28-02	13:47	105	135	2		
					3		
	B28-03	14:10	95.4	-	4		SAND with some Gravel and Lampblack - (black, very solid/hard pieces that are hydrophobic), slight hydrocarbon odor, no sheen via sheen test, (2.5-5 feet bgs)
					5		
					6	GM	GRAVEL with Lampblack - black, dry, lampblack is hydrophobic, no hydrocarbon odor, no sheen via sheen test, (5-10 feet bgs)
	B28-04	14:15	111	-	7		
					8		
					9		
					10		
	B28-05	14:20	36.2	-	11		GRAVEL with Lampblack - sticky, tar-like pieces present, hard, with sheen on surface, strong hydrocarbon odor (10-12 feet bgs)
					12		
	B28-06	14:25	71.4	-	13		
					14	SP	SAND - olive gray, moist, loose, poorly graded, strong hydrocarbon odor, sheen via sheen test, (12-15 feet bgs)
					15		
	B28-07	14:30	372	612	16	SM ML	SAND with some SILT - olive gray, wet, saturated with product, metallic sheen, (15-15.5 feet bgs) Sandy SILT - brown, moist, no sheen, (15.5-16 feet bgs)
					17		
					18	SP	SAND - olive gray, wet, loose, poorly graded, medium grained, no sheen via sheen test, (16-20 feet bgs)
	B28-08	14:35	53.7	-	19		
					20		

GROUNDWATER: 10/2/95

NWT 002663

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-28**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 14:00	DRILL FINISH Time: 15:00
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/2/95	Date: 10/2/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
3/4" Bentonite Chips	B28-09	14:45	236	-			21		ML
	B28-10	14:50	462	-			22		
	B28-11	14:53	261	2.3			23		
							24		
							25		
							26		
							27		
							28		
							29		
							30		
							31		
							32		
							33		
							34		
							35		
							36		
							37		
							38		
							39		
							40		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.4 feet msl
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

Sandy SILT - olive gray with brown, metallic luster, saturated with product, strong sheen via sheen test (20-22 feet bgs)

Sandy SILT - as above, brown with brown/orange blebs, no sheen via sheen test, (22-23.5 feet bgs)

Sandy SILT - as above, olive gray, wet, saturated with product, (23.5-25 feet bgs)

Drilled to 25 feet bgs
Sampled to 24.5 feet bgs

* Sample Number Prefix is 2708-951002-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-29**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER: Roger Brown SAMPLING METHOD: Split Spoon DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James	DRILL START Time: 14:15 Date: 9/22/95	DRILL FINISH Time: 9:30 Date: 9/25/95
PROJECT #: 2708	DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.		

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: 31.1 feet msl
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B29-01	14:08	-	230	-	-	1			Silty GRAVEL - brown, dry, fill, no sheen via sheen test (surface)
							2			
					27	100	3			Sandy Silty GRAVEL - gray/brown, damp, dense, non-plastic, well graded, no hydrocarbon odor, no sheen via sheen test
	B29-02	14:18			27	100			GM	
					32	0	4			
							5			
	B29-03				6	100				Sandy Silty GRAVEL - as above, no hydrocarbon odor, no sheen via sheen test
		14:22			9	0	6			
					5	0				
							7			
					11	100	8			Sandy GRAVEL with Silt - dark gray, moist to wet, medium dense, non-plastic, well graded, possible petroleum hydrocarbon odor, no sheen via sheen test
	B29-04	14:26			5	60			GW	
					11	0	9			
							10			
	B29-05				3	100				Silty Sandy GRAVEL - brown, wet, dense, slightly plastic, well graded, no petroleum hydrocarbon odor, no sheen via sheen test
		14:30			13	20	11			
					20	0				
							12		GM	
	B29-06	14:35			11	100	13			Silty Sandy GRAVEL - as above, slight naphthalene odor, turning to dark gray at 13.2 feet, no sheen via sheen test
					14	20				
					30	0	14			
							15			
					5	100				SILT with some Sand and Gravel - brown, moist, stiff, slightly plastic, possible petroleum hydrocarbon odor, no sheen via sheen test
	B29-07	15:05			8	100	16			
					12	100				
							17		ML	
					6	100	18			SILT with some Sand and Gravel - as above, more Gravel, brown with slight odor to 18.25 feet bgs, dark gray with distinct odor to 19 feet bgs with wood fragments and occasional tar globs, no sheen via sheen test
	B29-08	15:11			12	100				
					15	100	19			
							20			

NWT 002665

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-29**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Roger Brown	DRILL START Time: 14:15	DRILL FINISH Time: 9:30
	SAMPLING METHOD:	Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/22/95	Date: 9/25/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	31.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
					12	100				
	B29-09	15:17			13	100	21		ML	Gravelly SILT - gray/brown with gray mottling, moist, very stiff, slightly plastic, slight petroleum hydrocarbon odor, no sheen via sheen test, tip of core is black
					15	100				
							22		ML + tar	Gravelly SILT - black, moist, strong hydrocarbon odor, sheen via sheen test, tarry globs (22.5-22.75 feet bgs)
	B29-10A				-	100	23			SILT - gray with red-brown mottling, non-plastic, slight hydrocarbon odor (22.75-23 feet bgs)
		15:23			-	100				
	B29-10				-	100	24			SAND - dark gray, moist to wet, poorly graded (23-24 feet bgs)
									SP	
							25			
					3	100			tar	SILT and SAND - as above , tarry (25-25.25 feet bgs)
	B29-11	15:30			9	100	26		ML	SILT - gray, as above (25.25-26.25 feet bgs)
					12	100			tar	SILT and SAND - black, tarry, hydrocarbon odor, sheen via sheen test (26.25-27 feet bgs)
							27			
									ML	SILT - olive-gray with red-brown mottling, medium stiff, organic matter or root zones with brown product in them, petroleum hydrocarbon odor, sheen via sheen test, brown product present (27.5-29 feet bgs)
					3	100	28			
	B29-12	15:40			5	100				
					6	100	29			
								9/22/95		
							30			
3/4" Bentonite Chips					3	100				Silty SAND with occasional Silt zones - olive-gray, loose, non-plastic, rootlets present, strong hydrocarbon odor, brown product via sheen test (30-31.5 feet bgs)
	B29-13	15:50			2	100	31			
					5	100			SM	
							32			
					9	100	33			SAND - black, wet, medium dense, poorly graded, entire core covered with brown product (32.5-34 feet bgs)
	B29-14	16:00			7	100				
					9	100	34			
									SP	
							35			
					4	100				
	B29-15	16:08		58,822	9	100	36			SAND - as above, product saturated throughout core (35-36.5 feet bgs)
					12	100				
							37			Drilling resumes at 8:40, 9/25/95
							38			
	B29-16	9:00								SAND - black, wet, saturated with product to 39 feet bgs, less staining from 39-40 feet bgs, some brown bedding or zones of oxidation, sheen throughout (36.5-40 feet bgs)
							39			
							40			
							41			
							42			SAND - olive-gray, wet, sheen via sheen test, strong sheen via drill stem (40-44 feet bgs)

NWT 002666

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-29**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER: Roger Brown	DRILL START Time: 14:15	DRILL FINISH Time: 9:30
	SAMPLING METHOD: Split Spoon		
	DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE B-59 Mobile Drill		
	DRILLER: Brad James	Date: 9/22/95	Date: 9/25/95
PROJECT #: 2708	DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
	B29-01	14:08	-	230	-	-				Silty GRAVEL - brown, dry, fill, no sheen via sheen test (surface)
							1			
							2			
					27	100	3			Sandy Silty GRAVEL - gray/brown, damp, dense, non-plastic, well graded, no hydrocarbon odor, no sheen via sheen test
	B29-02	14:18			27	100			GM	
					32	0	4			
							5			
	B29-03				6	100				Sandy Silty GRAVEL - as above, no hydrocarbon odor, no sheen via sheen test
		14:22			9	0	6			
					5	0				
							7			
					11	100	8			
	B29-04	14:26			5	60			GW	Sandy GRAVEL with Silt - dark gray, moist to wet, medium dense, non-plastic, well graded, possible petroleum hydrocarbon odor, no sheen via sheen test
					11	0	9			
							10			
3/4" Bentonite Chips	B29-05				3	100				Silty Sandy GRAVEL - brown, wet, dense, slightly plastic, well graded, no petroleum hydrocarbon odor, no sheen via sheen test
		14:30			13	20	11			
					20	0				
							12		GM	
	B29-06	14:35			11	100	13			Silty Sandy GRAVEL - as above, slight naphthalene odor, turning to dark gray at 13.2 feet, no sheen via sheen test
					14	20				
					30	0	14			
							15			
					5	100				
	B29-07	15:05			8	100	16			SILT with some Sand and Gravel - brown, moist, stiff, slightly plastic, possible petroleum hydrocarbon odor, no sheen via sheen test
					12	100				
							17		ML	
					6	100	18			SILT with some Sand and Gravel - as above, more Gravel, brown with slight odor to 18.25 feet bgs, dark gray with distinct odor to 19 feet bgs with wood fragments and occasional tar globs, no sheen via sheen test
	B29-08	15:11			12	100				
					15	100	19			
							20			

NWT 002667

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-29**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Roger Brown	DRILL START Time: 14:15 Date: 9/22/95	DRILL FINISH Time: 9:30 Date: 9/25/95
	SAMPLING METHOD:	Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	31.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B29-01	14:08	-	230	-	-	1			Silty GRAVEL - brown, dry, fill, no sheen via sheen test (surface)
							2			
					27	100	3			Sandy Silty GRAVEL - gray/brown, damp, dense, non-plastic, well graded, no hydrocarbon odor, no sheen via sheen test
	B29-02	14:18			27	100			GM	
					32	0	4			
							5			
	B29-03				6	100				Sandy Silty GRAVEL - as above, no hydrocarbon odor, no sheen via sheen test
		14:22			9	0	6			
					5	0				
							7			
					11	100	8			
	B29-04	14:26			5	60			GW	Sandy GRAVEL with Silt - dark gray, moist to wet, medium dense, non-plastic, well graded, possible petroleum hydrocarbon odor, no sheen via sheen test
					11	0	9			
							10			
	B29-05				3	100				Silty Sandy GRAVEL - brown, wet, dense, slightly plastic, well graded, no petroleum hydrocarbon odor, no sheen via sheen test
		14:30			13	20	11			
					20	0			GM	
							12			
	B29-06	14:35			11	100	13			Silty Sandy GRAVEL - as above, slight naphthalene odor, turning to dark gray at 13.2 feet, no sheen via sheen test
					14	20				
					30	0	14			
							15			
					5	100				SILT with some Sand and Gravel - brown, moist, stiff, slightly plastic, possible petroleum hydrocarbon odor, no sheen via sheen test
	B29-07	15:05			8	100	16			
					12	100			ML	
							17			
							18			SILT with some Sand and Gravel - as above, more Gravel, brown with slight odor to 18.25 feet bgs, dark gray with distinct odor to 19 feet bgs with wood fragments and occasional tar globs, no sheen via sheen test
					6	100				
	B29-08	15:11			12	100				
					15	100	19			
							20			

NWT 002668

HAHN & ASSOCIATES, INC.	SOIL BORING NUMBER B-29			
434 NW Sixth Avenue				
Portland, Oregon				
(503) 796-0717	HAI LOGGER:	Roger Brown	DRILL START	DRILL FINISH
PROJECT:	SAMPLING METHOD:	Split Spoon		
Northwest Natural Gas Co.	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger	Time:	Time:
Gasco Facility	EQUIPMENT TYPE	B-59 Mobile Drill	14:15	9:30
Portland, Oregon	DRILLER:	Brad James	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	9/22/95	9/25/95

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	31.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
					12	100				
	B29-09	15:17			13	100	21		ML	Gravelly SILT - gray/brown with gray mottling, moist, very stiff, slightly plastic, slight petroleum hydrocarbon odor, no sheen via sheen test, tip of core is black
					15	100				
							22		ML + tar	Gravelly SILT - black, moist, strong hydrocarbon odor, sheen via sheen test, tarry globs (22.5-22.75 feet bgs)
	B29-10A				-	100	23			SILT - gray with red-brown mottling, non-plastic, slight hydrocarbon odor (22.75-23 feet bgs)
		15:23			-	100				
	B29-10				-	100	24		SP	SAND - dark gray, moist to wet, poorly graded (23-24 feet bgs)
							25			
					3	100			tar	SILT and SAND - as above , tarry (25-25.25 feet bgs)
	B29-11	15:30			9	100	26		ML	SILT - gray, as above (25.25-26.25 feet bgs)
					12	100			tar	SILT and SAND - black, tarry, hydrocarbon odor, sheen via sheen test (26.25-27 feet bgs)
							27			
					3	100	28		ML	
3/4" Bentonite Chips	B29-12	15:40			5	100		9/22/95		SILT - olive-gray with red-brown mottling, medium stiff, organic matter or root zones with brown product in them, petroleum hydrocarbon odor, sheen via sheen test, brown product present (27.5-29 feet bgs)
					6	100	29			
							30			
					3	100				Silty SAND with occasional Silt zones - olive-gray, loose, non-plastic, rootlets present, strong hydrocarbon odor, brown product via sheen test (30-31.5 feet bgs)
	B29-13	15:50			2	100	31		SM	
					5	100				
							32			
					9	100	33			SAND - black, wet, medium dense, poorly graded, entire core covered with brown product (32.5-34 feet bgs)
	B29-14	16:00			7	100				
					9	100	34		SP	
							35			
					4	100				SAND - as above, product saturated throughout core (35-36.5 feet bgs)
	B29-15	16:08		58,822	9	100	36			
					12	100				
							37			Drilling resumes at 8:40, 9/25/95
							38			SAND - black, wet, saturated with product to 39 feet bgs, less staining from 39-40 feet bgs, some brown bedding or zones of oxidation, sheen throughout (36.5-40 feet bgs)
	B29-16	9:00								
							39			
							40			
							41			
							42			SAND - olive-gray, wet, sheen via sheen test, strong sheen on drill stem (40-44 feet bgs)

NWT 002669

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-29**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Roger Brown	DRILL START Time: 14:15 Date: 9/22/95	DRILL FINISH Time: 9:30 Date: 9/25/95
	SAMPLING METHOD:	Split Spoon		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	31.1 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B29-17	9:10	69.0	16.5			43 44 45		SP	SAND with some Silt - gray, moist, no sheen via sheen test, no sheen on drill stem (44-45 feet bgs)
	B29-18	9:25	28.1	0.18			46 47 48		SP	SAND with some Silt - moist to wet, poorly graded, fine to medium grained, no sheen via sheen test, no sheen on core (45-50 feet bgs)
							49 50 51 52 53 54 55 56 57 58 59 60			Drilled to 50 feet bgs Sampled to 48 feet bgs * Sample Number Prefix is 2708-950922-

NWT 002670

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-30**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Hans Feige	DRILL START Time: 10:15	DRILL FINISH Time: 12:40
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/22/95	Date: 9/22/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	6-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	33.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TPH-G/418.1 M (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B30-04	10:20	345	-			1–5	9/22/95	GM	Silty GRAVEL with Sand - black, moist, some wet zones, plastic, hydrocarbon odor, sheen via sheen test
	B30-05	10:25	28.4	-			6–10		GM	Silty GRAVEL with Sand - as above, hydrocarbon odor, sheen via sheen test
	B30-06	10:35	52.4	6,776			11–12			Silty GRAVEL with Sand - black, wet, plastic, slight sheen
	B30-07	10:45	9.0	-			13–15			Silty GRAVEL with Sand - brown, wet, plastic, no sheen via sheen test
	B30-08	10:55	17.6	-			16–18		GM	Silty GRAVEL sith Sand - brown, wet, stiff, plastic, hydrocarbon odor
	B30-09	11:20	24.2	-			19–20			Silty GRAVEL with Sand - as above, hydrocarbon odor

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-30**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER:	Hans Feige	DRILL START Time: 10:15 Date: 9/22/95	DRILL FINISH Time: 12:40 Date: 9/22/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	6-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	33.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TPH-G/418.1 M (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B30-10	11:30	35.1	-	21	GM	Silty GRAVEL with Sand - as above, hydrocarbon odor, no sheen via sheen test
					22		
					23	SP	SAND - gray/black, wet, dense, non-plastic, sheen via sheen test
	B30-11	11:40	337	-	24		SILT - gray, wet, stiff, plactic, hydrocarbon odor
					25	ML	
					26		SILT - gray, wet, stiff, slight plastic odor
					27		
					28		
	B30-12	11:50	202	853	29	ML	Sandy SILT - as above, strong sheen via sheen test
					30		
					31		
					32		
					33	SM	Silty SAND - brown, wet, dense, slightly plastic, hydrocarbon odor, no sheen via sheen test
	B30-13	12:20	184	-	34		
					35		
					36		Boring terminated at 35 feet bgs Sample to 34 feet bgs
					37		
					38		* Sample Number Prefix is 2708-950922-
					39		
					40		

NWT 002672

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-30-A**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Hans Feige	DRILL START Time: 9:00	DRILL FINISH Time: 9:40
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/22/95	Date: 9/22/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
	B30-01	8:55	20.6	965			1		ML	Surface sample
							2			
							3			
							4			Sandy SILT - black, moist, tarry, hydrocarbon odor
	B30-02	9:20	304	-			5			
							6			
							7			Fill material, low recovery in sampler
							8			
3/4" Bentonite Chips							9			
	B30-03	9:30	155	-			10		GP	
							11			
							12			Fill material - as above, little gravels, moist to wet, tarry, hydrocarbon odor
							13			
							14			
							15			
							16			Boring terminated at 15 feet bgs due to lack of recovery in sample barrels.
							17			
							18			* Sample Number Prefix is 2708-950922-
							19			
							20			

BORING DIAMETER:	6-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	33.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-31**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT #: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 4" OD Core Barrel DRILLING METHOD: 4 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations, Inc.	DRILL START Time: 14:20 Date: 9/25/95	DRILL FINISH Time: 15:45 Date: 9/25/95

BORING DIAMETER: 8-inch
CASING DIAMETER: Not Applicable
SURFACE ELEVATION: 25.4 feet msl
TOP OF CASING ELEVATION: Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B31-01	13:50		38	GM	Silty SAND and GRAVEL - brown, dry, well graded, no hydrocarbon odor (surface sample)
	B31-02	14:30	57.5	-	ML	SILT with Gravel - brownish-yellow, moist, slightly plastic, no hydrocarbon odor, no sheen via sheen test (2-5 feet bgs)
	B31-03	14:35	41.2	-		SILT with Gravel - as above, no hydrocarbon odor, no sheen via sheen test (5-10 feet bgs)
	B31-04	14:50	117	-	GM	Sandy GRAVEL with Silt - gray, moist
	B31-05	15:10	135	-	SP	SAND with Gravel - olive-gray, moist to wet (17-18 feet bgs) Black, hard material (lampblack), coal-like, with slight petroleum hydrocarbon odor and slight sheen at 18-19.5 feet bgs

CORE INTERVAL / SAMPLE RECOVERY / DEPTH (feet) / GROUNDWATER

NWT 002674

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-31**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 14:20 Date: 9/25/95	DRILL FINISH Time: 15:45 Date: 9/25/95
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	25.4 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHS (ppm)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B31-06	15:20		12,666	21	9/25/95	SP	SAND - black, moist, tarry, poorly graded, hydrophobic, sheen via sheen test (20-21 feet bgs)
			697.0		22		ML	Sandy SILT - brown, moist, stiff, plastic, some organic matter, no hydrocarbon odor, no sheen via sheen test (21-24 feet bgs)
	B31-07	15:25		-	23			
			175		24			
	B31-08	15:30		5.5	25			SAND with some Silt - olive-gray, poorly graded, no hydrocarbon odor, no sheen via sheen test (24-25 feet bgs)
			207		26		SP	SAND - brown, wet, poorly graded, fine grained, slight hydrocarbon odor (25-28 feet bgs)
	B31-09	15:35						
			61.1		27			
	B31-10	15:40		ND	28			
	B31-11	15:45	59.2	ND	29		ML	Clayey SILT with some Sand - olive-gray, slightly plastic, no hydrocarbon odor, no sheen via sheen test (28-28.25 feet bgs)
					30		SP	SAND - olive-gray, wet, poorly graded, fine to medium grained, no hydrocarbon odor, no sheen via sheen test (28.25-30 feet bgs)
					31			Installed a 2-inch diameter 0.010-inch slotted stainless steel well screen from 26 to 29 feet bgs. Purged twenty five gallons of water using a peristaltic pump prior to groundwater sampling. GROUNDWATER SAMPLE (2708-950925-BW31-01) collected at 17:20 hrs, 9/25/95. Well point was removed prior to abandonment.
					32			
					33			
					34			
					35			Boring terminated at 30 feet bgs Sample to 29 feet bgs
					36			* Sample Number Prefix is 2708-950925-
					37			
					38			
					39			
					40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-32**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 11:50	DRILL FINISH Time: 15:40
	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/4/95	Date: 10/4/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B32-01	11:45	1067	61			1		GM	Silty SAND with Gravel - brown, moist, no hydrocarbon odor, no sheen via sheen test (surface)
							2			
					17	0	3			
					18	0				
					15	0	4			
							5			
					7	0			ML	Sandy SILT and GRAVEL - black, moist, slightly plastic, hydrocarbon odor, sheen via shen test (5-6.5 feet bgs)
					8	0	6			
					4	10				
							7			
	B32-02	12:08		-					SM	Silty SAND with Gravel - olive-gray to black, moist, hydrocarbon odor (6.5-10 feet bgs)
			296				8			
								10/4/95		
							9			
							10			
									GP	Sandy GRAVEL - brown, wet, no sheen via sheen test (10-11.5 feet bgs)
							11			
	B32-03	12:15	785	28,772			12			
	B32-04	12:18	-							SAND and GRAVEL with some Silt - black, matrix is tar material, highly viscous, strong sheen via sheen test (11.5-15 feet bgs)
							13			
							14			
							15			
										SAND and GRAVEL with some Silt - black, wet, matrix is tar material, highly viscous, strong sheen on sampling core (15-17 feet bgs)
							16			
	B32-05	12:25		-			17			Gravelly SILT - brown, wet, little tar (17-17.5 feet bgs)
			809						GP	
							18			
							19			
							20			

NWT 002676

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-32**		
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	Core Barrel	Time:	Time:
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger	11:50	15:40
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	10/4/95	10/4/95

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							21		ML + tar	
	B32-06	12:32	1072	-			22			SILT and TAR - black, moist, plastic, smooth texture, highly viscous (20-25 feet bgs)
	B32-07	12:34	-	-			23			
							24		ML + tar	
							25			
							26			Sandy SILT - black, wet, poorly graded, matrix is tar material, highly viscous, roots present (25-26 feet bgs)
							27			
							28		ML	Sandy SILT - olive-gray, moist, tar seams present - preferential in areas of roots, cracks (26-30 feet bgs)
	B32-08	12:46		-						
			1321				29			
							30			
							31			
	B32-09	13:15		-						Sandy SILT - olive-gray to green, moist, firm, slightly plastic, pockets of brown product - lighter in color and less viscous than above, brown froth via sheen test (30-35 feet bgs)
			1219				32			
							33			
	B32-10	13:20		-						
			1355				34			
							35		ML	
							36			Sandy SILT - brown with orange pockets, saturated with oily, black product (35-37.5 feet bgs)
	B32-11	13:29		-						
			499				37			
	B32-12	13:33		-			38		SP	SAND - black, wet, poorly graded, fine grained, saturated with product, sheen via sheen test (35-37.5 feet bgs)
			745.0				39		ML	Sandy SILT - brown with orange pockets, saturated with oily, black product, sheen via sheen test (38-40 feet bgs)
	B32-13	13:36	1041	-			40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-32**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 11:50	DRILL FINISH Time: 15:40
	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/4/95	Date: 10/4/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	36.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							41		SM	Silty SAND - olive-gray, wet, firm, fine grained, strong sheen via sheen test (40-42.5 feet bgs)
							42			
							43		SP	SAND - olive-gray, wet, poorly graded, fine grained, saturated with oily product (42.5-43 feet bgs)
	B32-14	13:45		-			44		ML	Sandy SILT - olive-gray, wet, wood fragments present, saturated with oily product (43-44.5 feet bgs)
			287				45			
							46		SP	
	B32-15	14:26	1230	21,961			47			
							48			SAND - olive-gray, wet, poorly graded, fine grained, saturated with oily product (44.5-50.5 feet bgs)
							49			
							50			
							51			SAND with lenses of Silt - as above, saturated with oily product (50.5-52.5 feet bgs)
	B32-16	14:47		-						
			562				52		SP	
							53			SAND - olive-gray, wet, poorly graded, fine grained, saturated with oily product (52.5-54 feet bgs)
							54			
							55		SM	Silty SAND - olive-gray, moist, sheen via sheen test (54-55 feet bgs)
							56		SP	SAND - olive-gray, wet, saturated with product (55-56 feet bgs)
	B32-17	15:04		-						
			461				57		SM	Silty SAND - olive-gray, moist, no sheen via sheen test (56-57.5 feet bgs)
							58		SP	SAND - olive-gray, wet, loose, poorly graded, fine grained, slight sheen on core (57.5-59 feet bgs)
	B32-18	15:29	954	1.2			59			
							60			

* Sample Number Prefix is 2708-951004-

NWT 002678

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-33**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:50 Date: 10/5/95	DRILL FINISH Time: 9:10 Date: 10/6/96
	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
	B33-01	13:15	-	955			1		GM	Silty SAND with Gravel - brown, moist, no hydrocarbon odor, no sheen, no hydrocarbon odor (surface)
							2			
	B33-02	14:00		38	3	100	3			Sandy SILT and GRAVEL - olive grey, moist, loose, no sheen
			97		5	50				
					18	0	4			
							5			
					15	100			SM + tar	Tarry Silty SAND with Gravel - black, wet, medium dense, viscous tar seeps from cracks
	B33-03	14:03		8,238	15	100	6			
			219		16	50				
							7			
					50/5"	5	8			Rock in end of sampler - no recovery
							9			
							10			
							11			
	B33-04	14:28		-	12	100				
			318		11	50	12			Tarry Silty SAND with Gravel - black, moist, medium dense
					9	0			SM +tar	
							13			
					2	100	14			Tarry Silty SAND with Gravel - as above, loose
	B33-05	14:30	624	-	5	50				
					7	0	15			
							16			Tarry Gravels with Sand and Silt - black, moist, viscous tar zone at 16.5 feet bgs
	B33-06	14:42		-			17			
			646				18		GM + tar	
							19			
							20			

3/4" Bentonite Chips

NWT 002679

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-33**			
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	Core Barrel	Time: 13:50	Time: 9:10
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/5/95	Date: 10/6/96
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.8 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B33-07	14:50	701	-			21–25		tar	TAR - some gravel and wood fragments at 21.5 feet bgs
	B33-08	15:00	2500+	-			26–27		SM	Silty SAND -black, moist,many rootlets and wood fragments, tar im matrix, strong sheen (25-27 feet bgs)
	B33-09	15:03	1475	-			28–30		ML	Sandy SILT - brown with green mottling, moist, stiff, rootlets and cracks contain wet, viscous tar (27-30 feet bgs)
	B33-10	15:34	1383	-			31–35			Sandy SILT - brown with orange oxidation spots, moist, tar seams present - preferential in areas of rootlets and cracks
	B33-11	15:45	2500+	-			36–40		ML	Sandy SILT - green, moist, stiff, black tarry patches throughout core, tarry sand seam at 38.5 feet bgs

NWT 002680

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-33**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:50	DRILL FINISH Time: 9:10
	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/5/95	Date: 10/6/96
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips							41		ML	Sandy SILT - as above, moist, fingers of tar throughout core (40 - 43 feet bgs)
							42			
							43			SAND - olive gray and green mottled, moist, medium dense, fine grained, strong sheen (43 - 45 feet bgs)
							44			
	B33-12	15:55		-						
			819.0				45			
							46		SP	SAND with some Silt- olive gray, moist, medium dense, fingers of tar throughout core, sheen
							47			
							48			
							49			
	B33-13	16:05		-						
			692				50			
							51		SM	Silty SAND - olive gray, moist, medium dense, fine grained, fingers of tar throughout core, sheen
							52			
							53			
							54			
	B33-14	16:25		65						
			793				55			
							56			Sandy SILT - olive gray, moist, thin fine grained sand lenses, roots at 57 feet bgs, less product than above
							57		ML	
	B33-15	8:27		-			58			
			2500+				59			
							60			

NWT 002681

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**B-33**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:50 Date: 10/5/95	DRILL FINISH Time: 9:10 Date: 10/6/96
PROJECT #: 2708	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
							61		ML	Sandy SILT - as above, black oily product within rootlet zones (60-62 feet bgs)
							62			
	B33-16	8:40		-					SP	SAND - olive gray to black, wet, saturated with black, oily product (62 - 63 feet bgs)
			2500+				63			
							64		ML	Sandy SILT - green, moist, stiff, many rootlets present, product within rootlet zones (63 - 65 feet bgs)
							65			
							66		SM	Silty SAND - olive gray and green mottled, wet, fine grained, saturated with brown/black product, sand lens at 67 feet bgs is saturated with product (65 - 67 feet bgs)
	B33-17	8:55		-						
			407				67			
							68		ML	SILT - olive gray, moist, stiff, bark and rootlets present, no product, no sheen (67 - 70 feet bgs)
							69			
	B33-18	9:00		5.7						
			133				70			
							71			
							72			
							73			
							74			
							75			
							76			
							77			
							78			
							79			
							80			

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.8 feet msl
TOP OF CASING ELEVATION:	Not Applicable

Drilled to 70 feet bgs
Sampled to 70 feet bgs

* Sample Number Prefix is 2708-951005-

NWT 002682

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-34**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time:	DRILL FINISH Time:
	SAMPLING METHOD:	4" OD Core Barrel	9:45	13:15
	DRILLING METHOD:	10 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	9/26/95	9/26/95

BORING DIAMETER:	12-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B34-01	8:45	-	94	1	SM	Silty SAND with Gravel - brown, moist, no hydrocarbon odor (surface)
	B34-02 (dup)	8:50	-		2		
					3	GM	No Recovery-Gravels and Cobbles (0 to 5 feet bgs)
					4		
					5		
	B34-03	10:00	-	-	6		Silty Sany GRAVEL with Cobbles, olive grey, moist, wood fragmernts, sheen
					7		
					8		Silty Sandy GRAVEL with Cobbles, as above, brown, sheen, cobble fragment in end of sampler
	B34-04	10:20		-	9	GP + tar	Tarry Sandy GRAVEL - black, hard, sheen, large brick or slag at 9 feet bgs
			1344		10		
					11		Tarry Sandy GRAVEL - black, less hard than above, tar oozing from sand, large brick at 12.5 feet bgs
	B34-05	10:30		13,499	12		
			2,500+		13		
					14		
					15		
					16		Tarry Sandy with GRAVEL - black, moist, tar content less than above, aluminum strips from 17 to 17.5 feet bgs.
	B34-06	10:45		-	17		
			260		18	GP + tar	
					19		
					20		

9/26/95

NWT 002683

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-34**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:45	DRILL FINISH Time: 13:15
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	10 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9/26/95	Date: 9/26/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	12-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	34.9 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
							21			SAND - black, wet, loose, medium grained, poorly graded, sheen throughout, brick at 20.5 feet bgs.
							22			
	B34-07	11:35		-					SP	
			1,107				23			
							24			
							25			
3/4" Bentonite Chips										SAND - black to olive gray, wet, loose, wood fragments, sheen throughout (25 - 27.5 feet bgs)
	B34-08	12:00		-			26			
			1,422				27			
							28			Sandy SILT - light brown, moist, organic matter and oxidized zones, thin tarry beds throughout core (27.5 - 30 feet bgs)
	B34-09	12:05		-			29		ML	
			2,500+				30			
							31			Silty SAND - olive gray, wet, fine to medium grained, wood fragments, patches of black oil throughout
	B34-10	12:30		-			32		SM	
			2,500+				33			
	B34-11	12:35		-			34			
			2,500+				35			
							36		ML	SILT - green and gray mottled with brown oily pockets, sheen, product is more oil-like and less tar-like at this depth
	B34-12	13:00		-			37			
			2,500+				38			Drilled to 37 feet bgs Sampled to 37 feet bgs
							39			* Sample Number Prefix is 2708-950926-
							40			

NWT 002684

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-35**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:20	DRILL FINISH Time: 12:05
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/5/95	Date: 10/5/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	8-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	33.8 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4" Bentonite Chips	B35-01	10:20	38	39			1		GM	Sandy GRAVEL with Silt - brown, moist, no hydrocarbon odor (surface)
							2			
	B35-02	10:35	235	-	5	90	3			Sandy GRAVEL with Silt, brown, wet, hardened tar in end of sampler, no sheen
					5	0				
					7	0	4			
							5			
					31	5				No Recovery - Rock blocking end of sampler
					34	0	6			
							7			
	B35-03	10:44		-	7	100	8		SP + tar	Tarry SAND with Gravel and Silt, moist, black, tar throughout matrix, sheen
			520		5	10				
					8	0	9			
							10			
	B35-04	10:50		-			11			Tarry SAND with Gravel and Silt, as above
			715				12			
							13			
							14			
							15			
							16			No Recovery - rock blocking end of sampler
							17			
							18		SP + tar	
							19	9/26/95		
							20			

NWT 002685

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER B-35**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:20	DRILL FINISH Time: 12:05
	SAMPLING METHOD:	4" OD Core Barrel		
	DRILLING METHOD:	4 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 10/5/95	Date: 10/5/95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	SAMPLE RECOVERY	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
					4	100				
					6	100	21		GP+ oil	Gravelly SILT with Sand, black, moist, many roots and wood fragments, saturated with black oily product
	B35-05	11:10	936	-	7	80				
							22		SP + oil	SAND - black, wet, medium grained, saturated with black oily product (21.5 - 22.5 feet bgs)
	B35-06	11:16		41,602						
			2,255				23			
										SILT - olive gray to green, upper 6-inches is tarry, no tar below (22.5-24 feet bgs)
	B35-07	11:20	499	-			24			
							25		ML	
										SILT - olive gray with orange oxidation spots, moist, medium stiff, some root zones present, no product, no sheen
3/4" Bentonite Chips	B35-08	11:32	98	-			26			
	B35-09	11:56		-			27			
			335				28			
							29			
	B35-10	12:02		9.3						
			299				30			
							31			
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

Drilled to 30 feet bgs
Sampled to 30 feet bgs

* Sample Number Prefix is 2708-951005-

NWT 002686

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER M-11**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:17	DRILL FINISH Time: 10:30
	SAMPLING METHOD:	3-inch Split Spoon/4-inch OD Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 2-Nov-95	Date: 3-Nov-95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	10-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.4 feet MSL
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
	M11-01	1315	-	106			1		GP	Surface: Sandy Silty GRAVEL - brown, slightly moist, grass covered area.
Bentonite Chips							2			
							3			
					18	100	4		SP	SAND with gravel (3.5-4.0 Feet bgs) - brown, loose, moist, coarse grained, pieces of brick SAND with lampblack (4.0-5.0 feet bgs) - black, loose, hydrophobic, hydrocarbon odor, no sheen.
	M11-02	1330		-	27	100				
			11.5		21	70	5			
					14	100			GP	Sandy GRAVEL (5.0-6.5 feet bgs) - black (Lampblack), no sheen, pieces of brick, large pieces of slag looking material .
					8	100	6			
					7	30	7			
									SP	
					8	100	8			SAND with gravel (7.5-9.0 feet bgs) - black (Lampblack), pieces of brick, slag looking material (blue coloration), black, moist, hydrocarbon odor, no sheen.
	M11-03	1335		-	5	100				
			194		6	30	9			
							10			SAND (10.0-10.5 feet bgs) - Lampblack
20 % Solids Bentonite Grout							11			SAND (10.5-11.0 feet bgs) - brown, moist to wet, medium grained, loose, poorly graded, slight sheen.
							12			
							13			SAND (11.0-15.0 feet bgs) - black/metallic, moist to wet, strong hydrocarbon odor, sheen, brown froth via sheen test saturated with product, silt layers encountered at 12.5 and 13.5 feet bgs approximately 1 inch thick.
	M11-04	1350		-						
			2500+				14			
							15			
							16			SAND (15.0-20.0 feet bgs) - saturated with black oily product, wet, medium grained, loose, 2 inches of moist silt, olive grey with orange oxidation spots at 18.5 feet bgs.
	M11-05	1400		-			17			
			2500+				18		SP	
							19			
							20			

NWT 002687

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER M-11**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:17	DRILL FINISH Time: 10:30
	SAMPLING METHOD:	3-inch Split Spoon/4-inch OD Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 2-Nov-95	Date: 3-Nov-95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
20 % Solids Bentonite Grout							21		SP	SAND (20.0-23.0 feet bgs) - wet, loose, medium grained, poorly graded, sheen on core, saturated with oily product.
							22			
	M11-06	1415		-			23			
			642				24		ML	SILT (23.0-25.0 feet bgs) - olive grey, moist, root zones, soft black viscous tarry material, some sand from 24-25 feet bgs.
							25			
							26		SP	SAND (25.0-30.0 feet bgs) - wet, medium-grained, poorly graded, loose, product saturated, froth via sheen test, saturated with product to 30.5 feet bgs.
							27			
							28			
	M11-07	1425		-			29			
			1511				30			
							31		ML	SILT (30.5-35.0 feet bgs) - green to grey, brown, moist, stiff, plastic (some clay content), oily product migrations through root zones/fractures.
							32			
	M11-08	1435		-			33			
			996				34			
							35			
							36			SILT (35.0-40.0 feet bgs) - green, moist, stiff, plastic (some clay content), no product observed within core, root zones clean, slight sheen.
							37			
							38			
							39		ML	
	M11-09	1450		7.9			40			
			29.3							

NWT 002688

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER M-11**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:17	DRILL FINISH Time: 10:30
	SAMPLING METHOD:	3-inch Split Spoon/4-inch OD Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 2-Nov-95	Date: 3-Nov-95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
							41		ML	SILT (40.0-45.0 feet bgs) - olive grey, moist, stiff, root zones present, no product observed, no sheen via sheen test.
							42			
							43			
	M11-10	1500		10.9			44			
			23.1				45			
							46			SILT (45.0-49.0 feet bgs) - olive grey, moist, stiff, root zones present, no product, no sheen, large 6-inch tree limb/trunk at 45 feet bgs.
							47			
							48			
							49			
	M11-11	1513		-			50			Sandy SILT (49.0-50.0 feet bgs) - as above.
			-				51			Sandy SILT (50.0-51.0 feet bgs) - olive grey, soft, moist to wet, sheen?.
							52			SILT (51.0-53.0 feet bgs) - olive grey, moist, stiff, root zones, wood fragments.
							53			SILT (53.0-55.0 feet bgs) - green, slightly moist, stiff, no sheen.
							54			1540 - stop for day 11/3/95 - start drilling at 0825.
	M11-12	1524		-			55			
			-				56			SILT (55.0-60.0 feet bgs) - green, slightly moist, stiff, no sheen, no product, 6-inch sandy silt zone at 58 feet bgs.
							57			
							58		ML	
	M11-13	840		-			59			
			3.8				60			
20 % Solids Bentonite Grout										

NWT 002689

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**M-11**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:17	DRILL FINISH Time: 10:30
	SAMPLING METHOD:	3-inch Split Spoon/4-inch OD Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 2-Nov-95	Date: 3-Nov-95
PROJECT #: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	10-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	35.4 feet MSL
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
20 % Solids Bentonite Grout							61		ML	Sandy SILT (60.0-65.0 feet bgs) - olive grey, moist, stiff, sheen on outside of core from water in hole, no sheen inside core.
							62			
							63			
							64			Sandy SILT (65.0-67.5 feet bgs) - olive grey, moist, stiff, sheen on outside of core from water in hole, no sheen inside core, approximately 1/4-inch of sand in end of core.
							65			
							66			Silty SAND (66.0-66.5 feet bgs) - olive grey,wet, moderately dense, no sheen.
	M11-14	1020		-					SM	
			7.8				67		ML	
							68		SM	SAND (67.5-68.5 feet bgs) - brown, wet, moderately dense, no sheen, fine grained.
							69			
	M11-15	1030		-					SP	SAND (68.5-70.0 feet bgs) - brown, wet, loose, poorly graded, no sheen, fine grained.
			2.3				70			
							71			Boring terminated at 70.0 feet bgs.
							72			*Sample prefix is 2708-951102-
							73			
							74			
							75			
							76			
							77			
							78			
							79			
							80			

APPENDIX B

Monitoring Well Logs

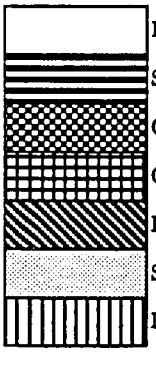
NWT 002691

KEY TO BORING LOGS

Soil classification in this report is based upon visual and manual field observations which include moisture, consistency, plasticity and grading estimates and should not be construed to imply field or laboratory testing unless presented herein. Soils are classified in accordance with the Unified Soil Classification System. Stratigraphic boundaries are approximate representations only. No warranty is provided as to the continuity of soil strata between borings.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)				
MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COURSE GRAINED SOILS	GRAVELS More Than Half the Course Fraction is Larger Than No. 4 Sieve Size	Clean Gravels With Little or No Fines	GW	Well Graded Gravels, Gravel-Sand Mixtures
			GP	Poorly Graded Gravels, Gravel-Sand Mixtures
		Gravels With Over 12% Fines	GM	Silty Gravels, Poorly Graded Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, Poorly Graded Gravel-Sand-Clay Mixtures
More Than Half is Larger Than #200 Sieve	SANDS More Than Half the Course Fraction is Smaller Than No. 4 Sieve Size	Clean Sands With Little or No Fines	SW	Well Graded Sands, Gravelly Sands
			SP	Poorly Graded Sands, Gravelly Sands
		Sands With Over 12% Fines	SM	Silty Sands, Poorly Graded Sand-Silt Mixtures
			SC	Clayey Sands, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS	SILTS AND CLAYS Liquid Limit Less Than 50%		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands, or Clayey Silts with Slight Plasticity
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Clays and Organic Silty Clays of Low Plasticity
More Than Half is Smaller Than #200 Sieve	SILTS AND CLAYS Liquid Limit Greater Than 50%		MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Clays of Medium to High Plasticity, Organic Silts
HIGHLY ORGANIC SOILS			Pt	Peat and Other Highly Organic Soils

LEGEND FOR BORING LOGS



- Blank Casing
- Slotted Screen
- Cement Grout
- Concrete
- Bentonite
- Sand Pack
- Fill Material

ABBREVIATIONS

NA	Not Applicable
ND	Not Detected Above Detection Limit
NS	Not Sampled
PAH	Polynuclear Aromatic Hydrocarbons
ppm	Parts Per Million
SPT	Standard Penetration Test
▽	Measured Static Water Level in Well
▼	Estimated Water Level During Drilling

Updated: 7/17/96 RBE
File: Boring Log Key

HAHN AND ASSOCIATES, INC.

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-1-22 OWRD #			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 11:30 Date: 24-Oct-95	DRILL FINISH Time: 13:10 Date: 24-Oct-95
	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	32 Feet MSL
TOP OF CASING ELEVATION:	34.75 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3, -2, -1			Ground surface
Concrete	M1-01	1135	0.9	5.8			1			Surface: Sandy, Silty, GRAVEL - brown, moist, pieces of brick.
3/8-inch Bentonite							2			
2-inch ID PVC Casing							3			
						3"				Sandy GRAVEL (3.0-3.5 feet bgs) - brown, moist.
	M1-02	1150		12.8			4			Sandy GRAVEL with silt (3.5-5.0 feet bgs) - brown, moist, no hydrocarbon odor, no sheen, lampblack at 4.0-4.5 feet bgs.
			1.1				5		GP	
							6			Sandy GRAVEL with small cobbles and bricks (5.0-10.0 feet bgs) - olive grey, moist to wet, no hydrocarbon odor, no sheen, lampblack from 5.0-5.4 feet bgs.
	M1-03	1158		-			7			
			4.1				8			
							9			
							10			
							11			Gravelly SAND with silt and pieces of brick (10.0-12.5 feet bgs) - moist, hydrocarbon odor, no sheen, wood fragments.
	M1-04	1205	-	-			12			
							13			Gravelly SAND with silt and pieces of brick (10.0-12.5 feet bgs) - olive grey with blue staining, moist to wet, hydrocarbon odor, no sheen.
Colorado 10-20Sand Pack							14	10/24/95		
2-inch ID 0.010-inch PVC Slotted Screen							15	▽	SP	
							16			Silty SAND with gravel (15.0-16.0 feet bgs) - brown with turquoise blue staining, wet, strong hydrocarbon odor.
							17			SAND (16.0-20.0 feet bgs) - olive grey, wet, fine grained, strong metallic sheen on core, black staining.
	M1-05	1220		-			18			
			1.4				19			
							20			

NWT 002693

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-1-22 OWRD #			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time:	DRILL FINISH Time:
	SAMPLING METHOD:	Core Barrel	11:30	13:10
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations	24-Oct-95	24-Oct-95

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	32 Feet MSL
TOP OF CASING ELEVATION:	34.75 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
10-20 Sand / Cap					21				
					9		21		SP
					20				
							22		
3/8-inch Bentonite							23		
	M1-06	1252		0.46			24		ML
			0.7				25		
							26		
							27		
							28		
							29		
							30		
							31		
							32		
							33		
							34		
							35		
							36		
							37		
							38		
							39		
							40		

SOIL DESCRIPTION

SAND (20.0-21.4 feet bgs) - black, wet, loose, poorly graded, fine grained, oily product coated, wood fragments.
SILT (21.4-21.5 feet bgs) - moist, slight sheen?, wood fragments.

SAND (22.5-25.0 feet bgs) - olive grey, moist, slightly plastic, no sheen, mild hydrocarbon odor

Boring terminated at 20.0 feet bgs
Boring sampled to 20.5 feet
Monitoring well installed to 20.0 feet bgs

Materials:
10 feet 2-inch diameter, 0.010-inch PVC slotted screen
15 feet 2-inch diameter PVC blank casing
14 50# bags 10/20 sand
6 50# bags bentonite chips
1 end cap
1 locking cap
above-grade steel monument
3 guard posts

Well depth is 25.0 feet below top of casing

* Sample Prefix Number is 2708-951024

NWT 002694

HAHN & ASSOCIATES, INC.	MONITORING WELL NUMBER	MW-2-32		
434 NW Sixth Avenue	OWRD # 84235			
Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
(503) 796-0717	SAMPLING METHOD:	3-inch Split Spoon/4-inch Core Barrel		
PROJECT:	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	Time:	Time:
Northwest Natural Gas Co.	EQUIPMENT TYPE	B-59 Mobile Drill	11:20	13:00
Gasco Facility	DRILLER:	Brad James	Date:	Date:
Portland, Oregon	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	6-Nov-95	6-Nov-95
PROJECT: 2708				

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch
SURFACE ELEVATION:	35.80 feet MSL
TOP OF CASING ELEVATION:	34.46 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Flush Monument										Ground surface
Concrete	M2-01	1115	9.3	10.3			1		GM	Surface: Sandy, Silty, GRAVEL - moist, brown, well graded, stone for parking lot.
							2			SAND (1.5-4.0 feet bgs) - brown, slightly moist, loose, poorly graded, fine/medium grained, no hydrocarbon odor, slight sheen?.
							3			
	M2-02	1125		-			4			
			40.4				5		SP	SAND with gravel (5.0-6.5 feet bgs) - brown, slightly moist, loose, poorly graded, fine/medium grained, no hydrocarbon odor, slight sheen, lampblack in end of sampler.
					9	60	6			
					7	0				
					7	0	7			Sandy, Silty, GRAVEL (6.5-7.5 feet bgs) - lampblack, pieces of brick, concrete.
	M2-03	1135		-			8			Driller notes large concrete pieces at 8.5 feet bgs.
			43.7				9			
							10		GM	Sandy, Silty, GRAVEL (10.0-11.5 feet bgs) - as above, some lampblack, hydrocarbon odor, slight sheen.
					7	50				
					9	0	11			
					9	0	12			
							13			Sandy GRAVEL (12.5-14.0 feet bgs) - olive grey, moist, loose, hydrocarbon odor, sheen, brick in end of sampler.
					5	50				
					9	0	14			
					6	0	15		GP	Sandy GRAVEL (15.0-16.5 feet bgs) - large pieces of brick material, loose, hydrocarbon odor, sheen.
					6		16			
					9					
					50/5"		17			
	M2-04	1200	25.9	-	7	70	18			Gravelly Sand (17.5-19.0 feet bgs) - yellow/brown, moist, poorly graded, fine grained, no hycdrocarbon odor, no sheen, minor olive grey silt lenses.
					11	0				
					15	0	19		SP	
							20			

Bentonite Chips
2-inch ID Blank PVC Casing

NWT 002695

HAHN & ASSOCIATES, INC.	MONITORING WELL NUMBER	MW-2-32		
434 NW Sixth Avenue	OWRD # 84235			
Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
(503) 796-0717	SAMPLING METHOD:	3-inch Split Spoon/4-inch Core Barrel		
PROJECT:	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	Time:	Time:
Northwest Natural Gas Co.	EQUIPMENT TYPE	B-59 Mobile Drill	11:20	13:00
Gasco Facility	DRILLER:	Brad James	Date:	Date:
Portland, Oregon	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.	6-Nov-95	6-Nov-95
PROJECT: 2708				

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch
SURFACE ELEVATION:	35.80 feet MSL
TOP OF CASING ELEVATION:	34.46 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS Total PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
					10	100				
PVC	M2-05	1210	24.7	-	8	100	21	11/6/95		SAND (20.0-21.5 feet bgs) - orange/brown, moist, loose, poorly graded, medium grained, no hycdrocarbon odor, no sheen.
					9	0				
							22		SP	
										SAND (22.5-23.0 feet bgs) - as above, wet, no hydrocarbon odor, no sheen.
					7	100	23			
					8	100				SAND (23.0-24.0 feet bgs) - olive grey, wet, loose, fine grained, no hydrocarbon odor, no sheen.
					6	90	24			
	M2-06	1223	25.4	0.43						Silty SAND (24.0-25.0 feet bgs) - wet, slightly dense, hydrocarbon odor?, no sheen, olive grey silt lenses.
							25			
										Silty SAND (25.0-27.5 feet bgs) - wet, slightly dense, fine grained, slight hydrocarbon odor?, no sheen.
							26		SM	
	M2-07	1240		-			27			
			17.8							Silty SAND (27.5-28.5 feet bgs) - olive grey, wet, loose, fine grained, no hydrocarbon odor, no sheen.
							28		SP	
	M2-08	1250		-			29			Sandy SILT (31.5-32.5 feet bgs) - olive grey, orange oxidation spots, no hydrocarbon odor, no sheen, thin lenses of fine grained sand.
			23.1							
							30		SM	
							31			
Cap	M2-09	1255		-			32		ML	Boring terminated at 32.5 feet bgs Boring sampled to 32.5 feet Monitoring well installed to 31.5feet bgs Well depth is 31.5 feet below top of casing
			25.7							
							33			
							34			
							35			Materials: 10 feet 2-inch diameter, 0.020-inch PVC slotted screen 21.5 feet 2-inch diameter PVC blank casing 12 50# bags 10/20 sand 13 50# bags bentonite chips 1 end cap 1 locking cap Flush steel monument
							36			
							37			
							38			
							39			
							40			* Sample Prefix Number is 2708-951106-

Colorado 10/20 Sand Pack

2-inch ID 0.020-inch PVC Slotted Screen

NWT 002696

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-3-26 OWRD # 84232			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 15:10 Date: 1-Nov-95	DRILL FINISH Time: 9:00 Date: 2-Nov-95
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.20 feet MSL
TOP OF CASING ELEVATION:	34.11 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3 -2 -1			Ground surface
Concrete 2-inch ID Blank PVC Casing							1 2 3 4 5			See boring log for well MW-3-56 for soil description.
Bentonite Chips 2-inch ID Stainless Steel Casing							6 7 8 9 10 11 12 13 14 15			
Colorado 10-20 Sand Pack Stainless Steel Continuous Slot Screen							16 17 18 19 20	11/2/95		

NWT 002697

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-3-26 **OWRD # 84232**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 15:10	DRILL FINISH Time: 9:00
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 1-Nov-95	Date: 2-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.20 feet MSL
TOP OF CASING ELEVATION:	34.11 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Colorado 10-20 Sand Pack 2-inch 20 Slot Stainless Screen Cap							21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40			Boring terminated at 26.0 feet bgs Monitoring well installed to 26.0 feet bgs **Materials:** 15 feet 2-inch diameter, 0.010-inch stainless steel slotted screen 10 feet 2-inch diameter stainless steel blank casing 5 feet 2-inch diameter PVC blank casing 12 50# bags 10/20 sand 7 50# bags bentonite chips 1 end cap 1 locking cap above-grade steel monument 3 guard posts

NWT 002698

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-3-56 **OWRD # 84231**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: Core Barrel DRILLING METHOD: 6 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations	DRILL START Time: 8:00 Date: 1-Nov-95	DRILL FINISH Time: 11:00 Date: 1-Nov-95	

BORING DIAMETER: 10-inch
CASING DIAMETER: 2-inch ID
SURFACE ELEVATION: 31.20 feet MSL
TOP OF CASING ELEVATION: 34.07 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3			
							-2			
							-1			Ground surface
Concrete	M3-01	758	1.7				1			Surface - Sandy Silty Gravel - brown, moist, no hydrocarbon odor, no sheen, grassy area.
							2		GM	
Bentonite Chips										
2-inch ID Blank PVC Casing					11	0	3			No Recovery (2.5-4.0 feet bgs).
					12	0				
					15	0	4			
							5			
	M3-02	810	251		16	100				Sandy Silty GRAVEL (5.0-6.5 feet bgs) - brown with black tarry staining, moist, hydrocarbon odor, sheen, pockets of moist tar.
	M3-03	812	282		17	70	6			
					14	0				
							7			
	M3-04	817			9	100	8			Sandy Silty GRAVEL (7.5-9.0 feet bgs) - black and tarry, moist, hydrocarbon odor, sheen.
			247		11	100				
					17	50	9			
							10			
							11			
					50/3"	0				Large Gravels.
							12			
					50/3"	0	13			
							14			
Bentonite Grout							15			
2-inch ID Blank Stainless Steel Casing	M3-05	840			16	100				Sandy GRAVEL with silt (15.0-16.5 feet bgs) - black, slightly moist, loose, hydrocarbon odor, sheen, brick and wood fragments.
			59.7		38	100	16	11/1/95		
					50/3"	0			GM	
							17			
	M3-06	850			12	100	18			Sandy GRAVEL (17.5-19.0 feet bgs) - olive grey, wet, loose, slight hydrocarbon odor, slight sheen, brick and wood fragments.
			15.9		7	30				
					4	0	19		GP	Sandy Gravel (19.0-20.5 feet bgs) - as above, hydrocarbon odor, sheen.
					17	100				
	M3-07	9:00			18	100	20			

NWT 002699

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-3-56** **OWRD # 84231**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:00	DRILL FINISH Time: 11:00
	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 1-Nov-95	Date: 1-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.20 feet MSL
TOP OF CASING ELEVATION:	34.07 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Grout 2-inch ID Blank Stainless Steel Casing			7.9		20	100				
					8	20	21			SILT with some gravel (20.5-21.0 feet bgs) - brown, moist, stiff, slight hydrocarbon odor, sheen.
									ML	
							22			SILT with gravel (21.0-25.0 feet bgs) - black tarry substance, moist to wet, hydrocarbon odor, sheen, 22.5-23.0 feet bgs is wet and tarry.
	M3-08	910								
			45.7				23		GP	
							24			
							25			
										Sandy SILT (25.0-29.9 feet bgs) - olive grey with orange oxidized zones, moist, no hydrocarbon odor, no sheen, sand lens at 25.5 feet bgs.
							26		ML	
							27			
	M3-09	915					28			
			5.8				29			
							30			SAND (29.9-34.0 feet bgs) - olive grey, wet, loose, medium grained, slight hydrocarbon odor, slight sheen, sand lens at 25.5 feet bgs.
							31			
	M3-10	925								
			9.8				32			
							33			
							34		SP	
	M3-11	930								SAND (34.0-35.0 feet bgs) - brown, wet, loose, fine grained, no hydrocarbon odor, no sheen, thin silt lenses present.
			2.8				35			SAND (35.0-37.5 feet bgs) - olive grey, wet, loose, poorly graded, fine grained, no hydrocarbon odor, no sheen.
							36			
	M3-12	955								
			9.8				37			
							38			SAND (37.5-39.0 feet bgs) - brown, wet, medium dense, fine grained, no hydrocarbon odor, no sheen, silt layers
	M3-13	1000								
Bent. Chips			5.9				39			
							40		SM	Silty SAND (39.0-40.0 feet bgs) - brown, moist to wet, dense, fine grained, no hydrocarbon odor, no sheen.

NWT 002700

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-3-56 **OWRD # 84231**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:00 Date: 1-Nov-95	DRILL FINISH Time: 11:00 Date: 1-Nov-95
	SAMPLING METHOD:	Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.20 feet MSL
TOP OF CASING ELEVATION:	34.07 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bent. Chips							41			SAND (40.0-41.5 feet bgs) - olive grey, wet, loose, medium grained, no hydrocarbon odor, no sheen.
2-inch Blank Stainless Steel Casing	M3-14	1010	19.0				42			SAND (41.5-45.0 feet bgs) - olive grey, wet, fine grained, silt layers.
							43			
	M3-15	1015	3.1				44			
							45		SP	
							46			SAND (45.0-49.0 feet bgs) - olive grey, wet, loose, poorly graded, medium grained, no hydrocarbon odor, no sheen.
							47			
							48			
	M3-16	1025	6.7				49			SAND (49.0-50.0 feet bgs) - as above, silt layers, no hydrocarbon odor, no sheen.
							50			SAND (50.0-55.0 feet bgs) - olive grey, wet, loose, poorly graded, medium grained, no hydrocarbon odor, no sheen, olive grey silt layers. Heaving sands reported by driller.
Colorado 10-20Sand Pack							51			
2-inch ID 0.020-inch Stainless Steel Slotted Screen							52			
							53			Boring terminated at 56.5 feet bgs Boring sampled to 56.5 feet Monitoring well installed to 55 feet bgs
	M3-17	1048	-				54			Materials: 10 feet 2-inch diameter, 0.010-inch PVC slotted screen 6.5 feet 2-inch diameter PVC blank casing 39.5 feet 2-inch diameter stainless steel blank casing 12 50# bags 10/20 sand 3 50# bags bentonite chips 4 bags bentonite grout 1 end cap 1 locking cap above-grade steel monument 3 guard posts
	M3-18	1050	-				55		SP	
Cap					3	100				
					5	100	56			
					16	100				
							57			
							58			
							59			
							60			

* Sample Prefix Number is 2708-951101-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-4-35 **OWRD # 84230**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:30	DRILL FINISH Time: 13:17
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 31-Oct-95	Date: 31-Oct-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.70 feet MSL
TOP OF CASING ELEVATION:	34.54 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3 -2 -1			Ground surface
Concrete 2-inch ID PVC Casing Bentonite Chips 2-inch ID Stainless Steel Casing							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			See boring log for well MW-4-57 for soil description.

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-4-35 **OWRD # 84230**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: Not Sampled DRILLING METHOD: 6 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations	DRILL START Time: 10:30 Date: 31-Oct-95	DRILL FINISH Time: 13:17 Date: 31-Oct-95

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
Bentonite; Blank Stainless Steel Casing; Colorado 10-20 Sand Pack; 2-inch ID 0.020-inch Stainless Steel Continuous Slot Screen; Cap							21–40	10/31/95	

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.70 feet MSL
TOP OF CASING ELEVATION:	34.54 feet MSL

SOIL DESCRIPTION

Boring terminated at 35.0 feet bgs
Monitoring well installed to 35.0 feet bgs

Materials:
10 feet 2-inch diameter, 0.010-inch stainless steel slotted screen
14 feet 2-inch diameter stainless steel blank casing
8 feet 2-inch diameter PVC blank casing
11 50# bags 10/20 sand
14 50# bags bentonite chips
1 end cap
1 locking cap
above-grade steel monument
3 guard posts

* Sample Prefix Number is 2708-951031-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-4-57 **OWRD # 84229**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 3-inch Split Spoon/Core Barrel DRILLING METHOD: 6 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations	DRILL START Time: 10:15 Date: 30-Oct-95	DRILL FINISH Time: 13:15 Date: 30-Oct-95

BORING DIAMETER: 10-inch
CASING DIAMETER: 2-inch ID
SURFACE ELEVATION: 31.7 feet MSL
TOP OF CASING ELEVATION: 34.53 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3			
							-2			
							-1			Ground surface
Concrete	M4-01	1005	1.9	195			1		SM	Surface: Silty SAND with gravel - brown, moist, pieces of brick, grass covered area, no hydrocarbon odor, no sheen.
							2			
Bentonite					50/5.5"	60	3		GM	Silty Sandy GRAVEL (2.5 feet bgs) - brown, moist, well graded, no hydrocarbon odor, no sheen.
2-inch ID Blank PVC Casing							4			
							5			
					23	70				Sandy GRAVEL (5.0-6.5 feet bgs) - dry, loose, poorly graded, no hydrocarbon odor, no sheen.
					27	0	6		GP	
					27	0	7			
	M4-02	1035		-	4	100	8		GM	Silty GRAVEL with sand (7.5-8.5 feet bgs) - brown, moist, well graded, no hydrocarbon odor, no sheen.
			2.8		50/5.5"	50	9			Concrete (8.5-9.5 feet bgs)
					38	0	10			
Bentonite Slurry							11		GM	
2-inch ID Blank Stainless Steel Casing							12			
										No recovery (12.5-14.5 feet bgs)
					7	0	13			
					6	0				
					6	0	14			
					5	0				
							15			
	M4-03	1104	-	-	2	100				Silty GRAVEL with sand (15.0-16.5 feet bgs) - olive grey with some black staining, wet, well graded, slight hydrocarbon odor, slight sheen.
					4	0	16			
					5	0				
							17			Silty GRAVEL with sand (16.5-20 feet bgs) - as above, moist, hydrocarbon odor, slight sheen, pieces of brick, switch to core barrel sampler.
							18			
	M4-04	1110		-						
			10.2				19		GM	
							20			

NWT 002704

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-4-57 **OWRD # 84229**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 10:15 Date: 30-Oct-95	DRILL FINISH Time: 13:15 Date: 30-Oct-95
	SAMPLING METHOD:	3-inch Split Spoon/Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.7 feet MSL
TOP OF CASING ELEVATION:	34.53 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Slurry; 2-inch ID Black Stainless Steel Casing	M4-05	1115	7.0	-	21–25		ML	SILT with sand and gravel (20.0-25.0 feet bgs) - brown, moist, slightly plastic, no hydrocarbon odor, no sheen.
	M4-06	1135	10.2	3,261	26–27		SM	Silty SAND (25.0-27.0 feet bgs) - olive grey, moist to wet, wood fragments, hydrocarbon odor, sheen.
					28		ML	Sandy SILT (27.0-28.0 feet bgs) - olive grey with brown and orange oxidation spots, root zones, no hydrocarbon odor, no sheen.
	M4-07	1140	2.1	-	29–30	10/30/95	SM	Silty SAND (28.0-30.0 feet bgs) - olive grey with brown mottling, moist to wet, fine grained, root zones, no hydrocarbon odor, no sheen.
	M4-08	1150	2.4	-	31–32		SP	SAND (30.0-32.5 feet bgs) - olive grey, wet, loose, poorly graded, fine grained, root zones, hydrocarbon odor, sheen.
					33		ML	SILT (32.5-33.0 feet bgs) - brown with orange oxidized zones, moist, slightly plastic, no hydrocarbon odor, no sheen.
	M4-09	1155	2.6	-	34		SM	Silty SAND (33.0-33.5 feet bgs) - brown with bright orange oxidized zones, moist to wet, dense, fine grained.
					35–39		ML	SILT (33.5-35.0 feet bgs) - olive grey, moist, stiff, no hydrocarbon odor, no sheen. SILT with fine sand (35.0-39.0 feet bgs) - olive grey, moist, stiff, root zones, no hydrocarbon odor, no sheen.
	M4-10	1210	-	-	40		SP	SAND (39.0-40.0 feet bgs) - olive grey, wet, loose, medium grained, no hydrocarbon odor, no sheen.

NWT 002705

HAHN & ASSOCIATES, INC.	MONITORING WELL NUMBER	MW-4-57		
434 NW Sixth Avenue	OWRD # 84229			
Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
(503) 796-0717	SAMPLING METHOD:	3-inch Split Spoon/Core Barrel	Time:	Time:
PROJECT:	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	10:15	13:15
Northwest Natural Gas Co.	EQUIPMENT TYPE	B-59 Mobile Drill		
Gasco Facility	DRILLER:	Brad James	Date:	Date:
Portland, Oregon	DRILLING CONTRACTOR:	Geo-Tech Explorations	30-Oct-95	30-Oct-95
PROJECT: 2708				

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.7 feet MSL
TOP OF CASING ELEVATION:	34.53 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Chip Seal; 20/40; 2-inch ID Blank Stainless Steel Casing; Colorado 10-20 Sand Pack; 2-inch ID 0.020-inch Stainless Steel Slotted Screen; Cap							41			SAND (40.0-44.0feet bgs) - as above, no hydrocarbon odor, no sheen.
							42		SP	
							43			
	M4-11	1220		-						
			8.7				44			
	M4-12	1225	-	-			45		ML	Sandy SILT (44.0-45.0 feet bgs) - olive grey, moist, stiff, slightly plastic, no hydrocarbon odor, no sheen.
							46			SAND (45.0-49.0 feet bgs) - olive grey, wet, loose, medium grained, no hydrocarbon odor, no sheen, thin silt layers from 49.0-50.0 feet bgs.
							47		SP	
	M4-13	1238		-			48			
			31.9				49			
							50			
							51			SAND (50.0-55.0 feet bgs) - as above, no hydrocarbon odor, no sheen.
							52			
							53			
							54			
	M4-14	1245		-			55			
			178				56			SAND (55.0-58.0 feet bgs) - as above, no hydrocarbon odor, no sheen.
							57		SP	
	M4-15	1312		0.26			58			
			17.5				59			
							60			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-4-57** **OWRD # 84229**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:15	DRILL FINISH Time: 13:15
	SAMPLING METHOD:	3-inch Split Spoon/Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 30-Oct-95	Date: 30-Oct-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	31.7 feet MSL
TOP OF CASING ELEVATION:	34.53 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
							61		
							62		
							63		
							64		
							65		
							66		
							67		
							68		
							69		
							70		
							71		
							72		
							73		
							74		
							75		
							76		
							77		
							78		
							79		
							80		

SOIL DESCRIPTION

Boring terminated at 58.0 feet bgs
Boring sampled to 58.0 feet
Monitoring well installed to 58.0 feet bgs

Materials:
10 feet 2-inch diameter, 0.010-inch stainless steel slotted screen
40.5 feet 2-inch diameter stainless steel blank casing
5.5 feet 2-inch diameter PVC blank casing
13 50# bags 10/20 sand
5 50# bags bentonite chips
1 end cap
1 locking cap
above-grade steel monument
3 guard posts

* Sample Prefix Number is 2708-951030-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-5-32** **OWRD # 84228**		DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede		
	SAMPLING METHOD:	Split Spoon/Core Barrel	Time:	Time:
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	13:03	15:00
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations	27-Oct-95	27-Oct-95

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.8 feet bgs
TOP OF CASING ELEVATION:	35.51 feet bgs

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3			
							-2			
							-1			Ground surface
Concrete	M5-01	1306		1.4						Surface: Silty GRAVEL - brown, moist, well graded, no hydrocarbon odor, no sheen.
			1107				1			
							2			
									GP	
					50/5"	50	3			GRAVEL (2.5-3.0 feet bgs) - grey, damp, loose, poorly graded, no hydrocarbon odor, no sheen.
							4			
							5			
	M5-02	1320		-	10	100				
			874		6	0	6			Silty GRAVEL (5.0-6.0 feet bgs) - brown, moist, well graded, no hydrocarbon odor, no sheen.
					26	0		10/27/95	GM	
							7			
							8			
										GRAVEL (7.5-9.0 feet bgs) - brown, wet, loose, well graded, no hydrocarbon odor, no sheen.
					10	30				
					15	0	9			
					19	0				
3/8-inch Bentonite Chips							10			
2-inch ID Blank PVC Casing	M5-03	1330		-	8	100			GP	
			279		5	0	11			GRAVEL with coarse sand and silt (10.0-13.0 feet bgs) - brown, wet, no hydrocarbon odor, no sheen.
					5	0				Switch to core barrel sampler.
							12			
	M5-04	1340		-			13			
			383							SAND with lampblack (13.0-15.0 feet bgs) - black, dry, hard, fine grained, hydrophobic, hydrocarbon odor.
							14			
							15			
	M5-05	1350		1,942			16		SP	SAND (15.0-20.0 feet bgs) - dark grey, moist, medium dense, poorly graded, fine grained, pieces of bark, hydrocarbon odor?, olive grey sandy silt on core bottom.
			81.1							
							17			
							18			
							19			
							20			

NWT 002708

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-5-32 **OWRD # 84228**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 13:03	DRILL FINISH Time: 15:00
	SAMPLING METHOD:	Split Spoon/Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 27-Oct-95	Date: 27-Oct-95
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.8 feet bgs
TOP OF CASING ELEVATION:	35.51 feet bgs

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Colorado 10-20 Sand Pack; 2-inch ID 0.020-inch PVC Slotted Screen; Cap	M5-06	1357		-						
			117				21		ML	Sandy SILT (20.0-22.0 feet bgs) - brown with orange mottling, moist, non-plastic, no hydrocarbon odor, no sheen, some root zones.
	M5-07	1400	18.1	0.91			22			SAND (22.5-22.5 feet bgs) - brown, wet, fine grained, no hydrocarbon odor, no sheen.
							23			SAND (22.5-23.5 feet bgs) - as above, no hydrocarbon odor, no sheen.
							24			Silty SAND (23.5-25.0 feet bgs) - brown with orange oxidation spots, wet, loose, no hydrocarbon odor, no sheen.
	M5-08	1406		-						
			62.1				25		SP	SAND (25.0-26.5 feet bgs) - brown with orange oxidation spots, wet, loose, fine grained, some thin silt layers no hydrocarbon odor, no sheen.
							26			
							27			SAND (26.5-27.5 feet bgs) - olive grey, wet, loose, poorly graded, some thin silt layers, no hydrocarbon odor, no sheen.
							28			SAND with thin silt layers (27.5-30.0 feet bgs) - olive grey, wet, loose, no hydrocarbon odor, no sheen.
	M5-09	1425		-			29			
			177				30			
					1	100				
					3	100	31			SAND with thin silt (30.0-32.0 feet bgs) - olive grey, wet, loose, poorly graded, fine grained, no hydrocarbon odor, no sheen.
					4	100				
	M5-10	1448		ND	4	70	32			
			29.4							Boring terminated at 32.0 feet bgs Boring sampled to 32.0 feet Monitoring well installed to 32.0 feet bgs
							33			
							34			Materials: 10 feet 2-inch diameter, 0.020-inch PVC slotted screen 21 feet 2-inch diameter PVC blank casing 12.5 50# bags 10/20 sand 10 50# bags 3/8-inch bentonite chips 1 end cap 1 locking cap above-grade steel monument 3 guard posts
							35			
							36			
							37			
							38			* Sample Prefix Number is 2708-951027-
							39			
							40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-6-32 **OWRD # 84239**		DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	Time: 11:40	Time: 14:00
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9-Nov-95	Date: 9-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Flush Monument										Ground surface
Concrete							1			See boring log for well MW-6-61 for soil description.
							2			
							3			
							4			
							5			
							6			
							7			
							8			
							9			
2-inch ID Blank PVC Casing							10			
							11			
							12			
							13			
							14			
							15			
3/8-inch Bentonite Chips							16			
							17			
Stainless Steel Casing							18			
							19			
10-20							20			

Updated: 7/18/96 RAH
File: 2708 MW-6-32

NWT 002710

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-6-32 **OWRD # 84239**			
	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	Time: 11:40	Time: 14:00
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 9-Nov-95	Date: 9-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.8 feet MSL
TOP OF CASING ELEVATION:	35.51 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Colorado 10-20 Sand Pack 2-inch ID 0.020 Stainless Steel Continuous Slotted Screen Cap							21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40			Boring terminated at 32.0 feet bgs Monitoring well installed to 32.0 feet bgs Materials: 15 feet 2-inch diameter, 0.020-inch stainless steel slotted screen 5 feet 2-inch diameter stainless steel blank casing 16 feet 2-inch diameter PVC blank casing 9.5 50# bags 10/20 sand 12 50# bags bentonite chips 1 end cap 1 locking cap flush steel monument 3 guard posts

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER**	**MW-6-61**	
	OWRD # 84236		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 8:50 Date: 7-Nov-95
	SAMPLING METHOD:	4-inch Core Barrel	DRILL FINISH Time: 11:45 Date: 7-Nov-95
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	
	EQUIPMENT TYPE	B-59 Mobil Drill	
	DRILLER:	Brad James	
	DRILLING CONTRACTOR:	Geo-Tech Explorations	

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.8 feet MSL
TOP OF CASING ELEVATION:	34.50 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Flush Monument										Ground surface
Concrete							1			Surface: concrete.
Bentonite Chips							2			SAND (1.0-5.0 feet bgs) - brown, slightly moist, loose, poorly graded, medium grained, no hydrocarbon odor, slight sheen?.
	M6-01	905		ND			3		SP	
			16.9				4			
							5			
							6			SAND (5.0-10.0 feet bgs) - as above, no hydrocarbon odor, slight sheen?.
2-inch ID Blank PVC Casing	M6-02	910		-			7			
			17.0				8			
							9			
							10			
							11			SAND (10.0-16.5 feet bgs) - as above, no hydrocarbon odor, slight sheen?.
	M6-03	920		-			12			
			17.5				13			
							14			
							15			
Bentonite Slurry							16			
Blank Stainless Steel Casing	M6-04	930		-			17			
			15.1				18		SP	
							19	11/7/95		SAND (17.5-20.0 feet bgs) - as above, moist to wet, no hydrocarbon odor, no sheen, dark grey sand at 19.5 feet bgs.
	M6-05	940	11.0	-			20	▽		

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-6-61 **OWRD # 84236**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:50	DRILL FINISH Time: 11:45
	SAMPLING METHOD:	4-inch Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 7-Nov-95	Date: 7-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.8 feet MSL
TOP OF CASING ELEVATION:	34.50 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
2-inch ID Blank Stainless Steel Casing Bentonite Slurry							21			SAND (20.0-24.0 feet bgs) - as above, wet, hydrocarbon odor, no sheen.
							22			
	M6-06	945		-			23			
			9.1				24		SP	
							25			
							26			SAND (25.0-30.5 feet bgs) - as above, wet, hydrocarbon odor, brown product saturated from 28-30.5 feet bgs, also thin silt layers.
							27			
							28			
	M6-07	1000		-						
			115				29			
							30			
	M6-08	1015		20,614						
			634				31			SILT (30.5-34.0 feet bgs) - green, stiff, root zones, no product, wood fragments, slight sheen?.
							32			
	M6-09	1020		-			33			
			23.9				34			
							35		ML	
							36			SILT (35.0-38.0 feet bgs) - green with brown motting (35.0-36.0 feet bgs), olive grey (36.0-38.0 feet bgs), moist, stiff, root zones, no sheen, no product.
							37			
							38			
										Sandy SILT (38.0-39.0 feet bgs) - olive grey, stiff, no sheen.
	M6-10	1040		1.5			39			Sandy SILT (39.0-40.0 feet bgs) - olive grey, wet, stiff.
			14.8				40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-6-61 **OWRD # 84236**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:50	DRILL FINISH Time: 11:45
	SAMPLING METHOD:	4-inch Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 7-Nov-95	Date: 7-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.8 feet MSL
TOP OF CASING ELEVATION:	34.50 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Slurry; Bentonite Chip Seal; 2-inch ID Blank Stainless Steel Casing; 20/40 Sand; Colorado 10-20 Sand Pack; 2-inch ID 0.020-inch Stainless Steel Slotted Screen					41	ML	SILT (40.0-49.0 feet bgs) - olive grey, moist, medium stiff, fine grained sand lenses, no sheen.
					42		
					43		
	M6-11	1050		0.06			
			14.8		44		
					45		
					46		
					47		
					48		
	M6-12	1100		-	49		
			12.8		50	SP	SAND (49.0-52.0 feet bgs) - olive grey, wet, loose, poorly graded, fine grained, no sheen.
					51		
					52		
					53		SAND (52.0-55.0 feet bgs) - as above, thin, brown silt layers, no sheen.
	M6-13	1120		-			
			8.4		54		
					55		
					56		SAND (55.0-60.0 feet bgs) - as above, thin olive grey silt layers, no sheen
					57		
	M6-14	1140		-	58		
			7.8		59		
					60		

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-6-61 **OWRD # 84236**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:50	DRILL FINISH Time: 11:45
	SAMPLING METHOD:	4-inch Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 7-Nov-95	Date: 7-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.8 feet MSL
TOP OF CASING ELEVATION:	34.50 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
Sand / Cap							61		
							62		
							63		
							64		
							65		
							66		
							67		
							68		
							69		
							70		
							71		
							72		
							73		
							74		
							75		
							76		
							77		
							78		
							79		
							80		

SOIL DESCRIPTION

Boring terminated at 61.0 feet bgs
Boring sampled to 60.0 feet
Monitoring well installed to 61.0 feet bgs
Well depth is 61.0 feet below top of casing

Materials:
10 feet 2-inch diameter, 0.010-inch stainless steel slotted screen
35 feet 2-inch diameter stainless steel blank casing
15 feet 2-inch diameter PVC casing
1 50# bags 20/40 sand
11 50# bags 10/20 sand
5 50# bags bentonite chips
5 bags bentonite grout
1 end cap
1 locking cap
Flush steel monument

* Sample Prefix Number is 2708-951107-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-8-29 **OWRD # 84226**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:30	DRILL FINISH Time: 11:15
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 26-Oct-95	Date: 26-Oct-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.09 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3 -2 -1			Ground surface
Concrete 2-inch ID Blank PVC Casing 3/8-inch Bentonite Chips 2-inch ID Blank Stainless Steel Casing Colorado 10-20 Sand Pack							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			See boring log for well MW-8-56 for soi description.

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-8-29 **OWRD # 84226**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 8:30	DRILL FINISH Time: 11:15
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobile Drill		
	DRILLER:	Brad James	Date: 26-Oct-95	Date: 26-Oct-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.09 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Colorado 10-20 Sand Pack 2-inch ID 0.020-inch Stainless Steel Slotted Screen Cap							21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40			Boring terminated at 29.0 feet bgs Monitoring well installed to 29.0 feet bgs Materials: 10 feet 2-inch diameter, 0.010-inch stainless steel slotted screen 13 feet stainless steel blank casing 3 feet 2-inch diameter PVC blank casing 12 50# bags 10/20 sand 13 50# bags 3/8-inch bentonite chips 1 end cap 1 locking cap above-grade steel monument 3 guard posts

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-8-56 **OWRD # 84226**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 905	DRILL FINISH Time: 1410
	SAMPLING METHOD:	3-inch Split Spoon/Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 25-Oct-95	Date: 25-Oct-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.13 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3			
							-2			
							-1			Ground surface
Concrete	M8-01	900	5.9	281			1		SM	Surface: Silty SAND with gravel - brown, moist, no hydrocarbon odor, no sheen.
2-inch ID Blank PVC Casing							2			
					6	100	3			Tarry GRAVEL - black, moist, strong hydrocarbon odor, liquied-viscous tar from 5-6.5 feet bgs, sand and silt mix from 8.5-10.5 feet bgs.
					15	0				
					29	0	4			
							5			
	M8-02	915		-	6	100				
			84.8		7	20	6			
					12	0			GP	
							7			
							8			
	M8-03	945	-	-	5	100	9			
					9	10				
					10	0	10			
2-inch ID Blank Stainless Steel Casing					8	100				
					15	100	11			
					13	0				Silty GRAVEL (10.5-11.5 feet bgs) - brown and tan mottled, some black staining, moist, hydrocarbon odor.
							12			
3/4-inch Bentonite Chips										Silty GRAVEL (12.5-13.0 feet bgs) - olive grey, moist, slight hydrocarbon odor, no sheen.
							13			
	M8-04	1002	-	-	10	100				Silty GRAVEL (13.0-14.0 feet bgs) - loose, pieces of brick, moist, slight hydrocarbon odor, no sheen.
					11	100	14			
					13	50				
							15		GM	
						0				No Recovery (15.0-16.0 feet bgs).
						0	16	10/25/95		
					11					Silty GRAVEL (16.0-17.0 feet bgs) - black, hydrophobic, lampblack?, poor recovery.
					50/1"		17			
							18			Silty GRAVEL (17.5-20.0 feet bgs) - brown, wet, no hydrocarbon odor, no sheen, brick and wood fragments.
	M8-05	1025	-	-			19			
							20			

NWT 002718

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-8-56 **OWRD # 84226**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 905 Date: 25-Oct-95	DRILL FINISH Time: 1410 Date: 25-Oct-95
	SAMPLING METHOD:	3-inch Split Spoon/Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.13 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4-inch Bentonite Chips; 2-inch ID Blank Stainless Steel Casing							21		GM	Silty GRAVEL (20.0-22.0 feet bgs) - brown, wet, brick and wood fragments, no hydrocarbon odor, no sheen.
	M8-06	1034		-			22			
			5.0							SAND (22.0-25.0 feet bgs) - black, wet, loose, coarse grained, lampblack throughout, hydrocarbon odor, sheen, becoming solid and brittle with a slight sheen from 23.0-23.3 feet bgs.
	M8-07	1044		-	9	100	23		SP	
			13.3		50/3"	100			lampblack	
							24			
							25			
							26		ML	Tarry SILT (25.0-27.5 feet bgs) - black, wet, stiff, mostly tar, strong sheen, vegetation throughout sample.
	M8-08	1115		-			27			
			225							SILT (27.5-30.0 feet bgs) - olive grey, moist, stiff, vegetation, tar within root zones, sheen.
							28			
							29			
							30			
							31			SILT (30.0-35.0 feet bgs) - olive grey, moist, stiff, semi-viscous tar within root zones.
							32			
							33			
							34			
	M8-09	1134		-			35			
			81.5							Sandy SILT (35.0-40.0 feet bgs) - brown, orange-mottled, moist, stiff, tar within root zones.
							36			
							37			
							38		ML	
2-inch ID Blank Stainless Steel Casing; 3/4-inch Bentonite Chips	M8-10	1152	-	-			39			
							40			

NWT 002719

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-8-56** **OWRD # 84226**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 905 Date: 25-Oct-95	DRILL FINISH Time: 1410 Date: 25-Oct-95
	SAMPLING METHOD:	3-inch Split Spoon/Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.13 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
3/4-inch Bentonite Chips					41		ML	Sandy SILT (40.0-42.0 feet bgs) - as above.
2-inch ID Blank Stainless Steel Casing					42		SP	SAND (42-42.3 feet bgs) - olive grey, medium grained, black product saturated, less viscous than tar.
					43		ML	SILT (42.3-42.8 feet bgs) - olive grey, medium grained, black product saturated.
					44			
	M8-11	1202	112	8.1	45		SP	SAND (42.8-45 feet bgs) - olive grey, wet, loose, poorly graded, medium grained, no product, slight sheen.
					46			SAND (45.0-47.5 feet bgs) - olive grey, wet, loose, poorly graded, medium grained, no sheen.
	M8-12	1245		-	47			
			43.7		48			SAND (47.5-50.0 feet bgs) - olive grey, wet, loose, poorly graded, medium grained, some thin silt layers, no sheen.
					49			
	M8-13	1314	-	-	50			
					51			SAND (50.0-54.0 feet bgs) - as above, no hydrocarbon odor, no sheen.
	M8-14	1320	-	-	52			
					53			
					54			
					55		SP	SAND (54.0-56.0 feet bgs) - as above, no hydrocarbon odor, no sheen.
Cap	M8-15	1400	-	0.64	56			
					57			
					58			
					59			
					60			

Colorado 10-20 Sand Pack

2-inch ID 0.020-inch Stainless Steel Slotted Screen

NWT 002720

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-8-56 **OWRD # 84226**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time:	DRILL FINISH Time:
	SAMPLING METHOD:	3-inch Split Spoon/Core Barrel	905	1410
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date:	Date:
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations	25-Oct-95	25-Oct-95

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.6 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
							61		
							62		
							63		
							64		
							65		
							66		
							67		
							68		
							69		
							70		
							71		
							72		
							73		
							74		
							75		
							76		
							77		
							78		
							79		
							80		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.13 feet MSL

SOIL DESCRIPTION

Boring terminated at 56.0 feet bgs
Boring sampled to 56.0 feet
Monitoring well installed to 56.0 feet bgs

Materials:
10 feet 2-inch diameter, 0.020-inch stainless steel slotted screen
40.5 feet 2-inch diameter stainless steel blank casing
4.5 feet 2-inch diameter PVC blank casing
11 50# bags 10/20 sand
26 50# bags bentonite chips
1 end cap
1 locking cap
above-grade steel monument
3 guard posts

* Sample Prefix Number is 2708-951025-

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER**	**MW-9-29**
	OWRD # 84223	

PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregons PROJECT: 2708	HAI LOGGER: Rob Ede SAMPLING METHOD: 3-inch Split Spoon DRILLING METHOD: 6 1/4-inch ID Hollow Stem Auger EQUIPMENT TYPE B-59 Mobile Drill DRILLER: Brad James DRILLING CONTRACTOR: Geo-Tech Explorations	DRILL START Time: 9:30 Date: 23-Oct-95	DRILL FINISH Time: 12:30 Date: 23-Oct-95

BORING DIAMETER:	10-inch OD
CASING DIAMETER:	2-inch
SURFACE ELEVATION:	37.9 feet MSL
TOP OF CASING ELEVATION:	37.65 MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Flush Monument										Ground surface
Concrete	M9-01	855	0.4	21.5			1		GW	Surface: Sandy GRAVEL - grey gravel, olive grey sand, moist, non-plastic, well graded, no hydrocarbon odor, no sheen.
							2			
					9	100			GM	Sandy, Silty GRAVEL (2.0-3.0 feet bgs) - brown, moist, loose, non-plastic, well graded, slight hydrocarbon odor, slight sheen.
	M9-02	935	5.5	-	15	100	3			
					14	50			SP	SAND (3.0-3.5 feet bgs) - brown, moist, loose, poorly graded, fine grained.
					2	100	4		ML	Gravelly SILT (3.5-4.5 feet bgs) - brown, moist, stiff, poorly graded, wire present, no hydrocarbon odor, no sheen.
	M9-03	940	0.7	-	5	100				SAND (4.5-5.0 feet bgs) - brown, moist, loose, poorly graded, fine grained, no hydrocarbon odor, no sheen.
					7	70	5		SP	
	M9-04	950	1.3	163	2	100				Sandy SILT (5.0-6.5 feet bgs) - orange/brown with black and blue/grey staining, moist, slight hydrocarbon odor?, sheen is blue/green in color.
					5	0	6		ML	
					50/2"	0				
							7			CONCRETE
							8			
							9			
							10			
							11			Sandy SILT (11.5-13.0 feet bgs) - brown, moist to wet, slightly plastic, very fine sand, no hydrocarbon odor, no sheen.
	M9-05	1045		0.52	13	100	12			
			6.7		8	30				SILT (13.0-15.0 feet bgs) - brown, moist to wet, stiff, slightly plastic, no hydrocarbon odor, no sheen.
					5	0	13			
					3	100			ML	SILT (15.0-15.5 feet bgs) - as above, no hydrocarbon odor, no sheen.
	M9-06	1055		-	3	100	14			
			8.8		4	100				Sandy SILT (15.5-16.0 feet bgs) - brown, moist to wet, slightly stiff, no hydrocarbon odor, no sheen.
					8	50	15	10/23/95		
					2	0				
					2	100	16			
	M9-07	1120		-	3	100				SAND with muscovite (16.0-17.0 feet bgs) - brown, wet, no hydrocarbon odor, no sheen.
			20.9		6	100	17			
					2	100			SP	SAND (17.0-18.5 feet bgs) - as above, no hydrocarbon odor, no sheen.
					3	100	18			
					5	100				
					2	100	19			SILT (18.5-20.0 feet bgs) - brown, moist to wet, stiff, no hydrocarbon odor, no sheen.
					4	100			ML	
					8	100	20			

Bentonite Chips
2-inch ID Blank PVC Casing
20-40
Colorado 10-20 Sand Pack

NWT 002722

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-9-29** **OWRD # 84223**		DRILL START	DRILL FINISH
PROJECT:	HAI LOGGER:	Rob Ede		
Northwest Natural Gas Co.	SAMPLING METHOD:	3-inch Split Spoon		
Gasco Facility	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	Time: 9:30	Time: 12:30
Portland, Oregons	EQUIPMENT TYPE	B-59 Mobile Drill		
PROJECT: 2708	DRILLER:	Brad James	Date: 23-Oct-95	Date: 23-Oct-95
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch OD
CASING DIAMETER:	2-inch
SURFACE ELEVATION:	37.9 feet MSL
TOP OF CASING ELEVATION:	37.65 MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Colorado 10-20 Sand Pack 2-inch ID 0.010-inch PVC Slotted Screen Cap					2	100				
					3	100	21			SAND (20.0-24.0 feet bgs) - brown, wet, stiff, fine grained, muscovite present 20.0-21.5 feet bgs, no hydrocarbon odor, no sheen.
	M9-08	1140		-	3	100				
			9.5		2	100	22		SP	
					2	100				
					9	90	23			
					3	100				
					6	100	24			
	M9-09	1200	-	-	16	100			ML	Sandy SILT (24.0-25.0 feet bgs) - brown, moist to wet, stiff, no hydrocarbon odor, no sheen.
					25	90	25			
					5	100			SP	SAND (25.0-26.0 feet bgs) - olive grey, wet, loose, fine grained, no hydrocarbon odor, no sheen.
					8	100	26			
					12	70			ML	Sandy SILT (26.0-26.5 feet bgs) - brown, wet, stiff, slighlty plastic, no hydrocarbon odor, no sheen.
					3	100	27		SP	SAND (26.7-27.5 feet bgs) - brown, wet, loose, poorly graded, medium grained, no hydrocarbon odor, no sheen.
	M9-10	1210		-	5	100				
			2.0		12	80	28		ML	SILT (27.5-28.0 feet bgs) - brown, moist to wet, stiff, no hydrocarbon odor, no sheen.
							29			
							30			
							31			Boring terminated at 29.0 feet bgs Boring sampled to 28.0 feet Monitoring well installed to 29.0 feet bgs
							32			
							33			Materials: 10 feet 2-inch diameter, 0.010-inch PVC slotted screen 18 feet 2-inch diameter PVC blank casing 1 50# bags 20/40 sand 12 50# bags 10/20 sand 10 50# bags bentonite chips 1 end cap 1 locking cap Flush steel monument
							34			
							35			
							36			* Sample Prefix Number is 2708-961023-
							37			
							38			
							39			
							40			

NWT 002723

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-10-25** **OWRD # 84238**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 9:00 Date: 9-Nov-95	DRILL FINISH Time: 10:00 Date: 9-Nov-95
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)
Steel Monument							-3		
							-2		
							-1		
Concrete							1		
2-inch ID Blank PVC Casing							2		
							3		
							4		
							5		
Bentonite Chips							6		
2-inch ID Blank Stainless Steel Casing							7		
							8		
							9		
							10		
							11		
							12		
							13		
							14		
							15		
Colorado 10-20 Sand Pack							16		
							17		
							18		
20-Slot Stainless Steel Continuous Screen							19		
							20		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.22 feet MSL

SOIL DESCRIPTION

Ground surface

See boring log for well MW-10-61 for soi description.

NWT 002724

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-10-25 **OWRD # 84238**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:00	DRILL FINISH Time: 10:00
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 9-Nov-95	Date: 9-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.22 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Colorado 10-20 Sand Pack 20-Slot Stainless Steel Screen Cap							21 22 23 24 25			Boring terminated at 25.0 feet bgs Monitoring well installed to 25.0 feet bgs Materials: 10 feet 2-inch diameter, 0.020-inch stainless steel slotted screen 5 feet 2-inch diameter PVC blank casing 9 feet stainless steel blank casing 11 bags 10/20 sand 6 50# bags bentonite chips 1 end cap 1 locking cap above-grade steel monument 3 guard posts * Sample Prefix Number is 2708-951109-
							26 27 28 29 30			
							31 32 33 34 35			
							36 37 38 39 40			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-10-61** **OWRD # 84237**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:00	DRILL FINISH Time: 12:30
	SAMPLING METHOD:	4-inch Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 8-Nov-95	Date: 8-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.33 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument					-3 to -1		Ground surface
Concrete 2-inch ID Blank PVC Casing	M10-01	850	26.2	78.7	1	GM	Silty Sandy GRAVEL - grey/brown, wet.
	M10-02	855	57.1	107	2		
					3		SAND (2.5-3.0 feet bgs) - brown, moist, poorly graded, loose, medium grained.
	M10-03	905		-	4	SP	SAND (3.0-4.0 feet bgs) - black, poorly graded, loose, medium grained, hydrocarbon odor, sheen.
			102		5		
Bentonite Grout Slurry 2-inch ID Blank Stainless Steel Casing					6		SAND with gravel (5.0-10.0 feet bgs) - black, moist, moderately dense, hydrocarbon odor, strong sheen, tar from 7-8 foot depth, lampblack present?, brick at 8 feet bgs.
	M10-04	920		-	7		
			566		8		
					9		
					10		
					11		Tarry SAND with gravel (10.0-15.0 feet bgs) - wet oozing tar saturated sand and gravel from 10-12 feet bgs,very hard tar matrix from 12-15 feet bgs.
	M10-05	930		-	12		
			241		13	SP	
					14		
					15		
					16	ML	Tarry SILT with gravel (15.0-16.5 feet bgs) - black, moist, oozing tar, silts are saturated with oily tar, silts repel water.
					17		SAND (17.0-20.0 feet bgs) - olive grey, moist to wet, fine grained, product saturated (brown), froth via sheen, large piece of wood in end of sampling core.
					18		
					19	SP	
	M10-06	950		-	20	11/8/95	
			2500+				

NWT 002726

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-10-61 **OWRD # 84237**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:00	DRILL FINISH Time: 12:30
	SAMPLING METHOD:	4-inch Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 8-Nov-95	Date: 8-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.33 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Grout Slurry 2-inch ID Blank Stainless Steel Casing					21		SP	SAND (20.0-23.5 feet bgs) - brown, wet, loose, poorly graded, medium grained, product saturated (oozes out of pore spaces)
	M10-07	1005		-	22			
			2500+		23			
					24			SILT (23.5-25.0 feet bgs) - brown, moist, stiff, root zones, no product, no sheen.
	M10-08	1010		-				
			1204		25		ML	
					26			SILT (25.0-30.0 feet bgs) - brown, moist, stiff, root zones, some black and brown spots (organic looking), no obvious product.
					27			
					28			
	M10-09	1018		0.76				
			943		29			
					30			
					31			SILT (30.0-35.0 feet bgs) - olive grey with orange spots, , root zones, no product, no sheen, poor sample recovery.
	M10-10	1025	-	-	32			
					33			
					34			
					35			
Bentonite Grout Slurry 2-inch ID Blank Stainless Steel Casing					36			SILT (35.0-40.0 feet bgs) - olive grey to green, root zones, small piece of bark, no sheen.
	M10-11	1035	65.3	-				
	M10-12	1040	68.3	-	37			
					38		ML	
					39			
					40			

NWT 002727

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW-10-61 **OWRD # 84237**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:00	DRILL FINISH Time: 12:30
	SAMPLING METHOD:	4-inch Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 8-Nov-95	Date: 8-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.33 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Grout Slurry; Bentonite Chip Seal; 2-inch ID Blank Stainless Steel Casing; 20-40 Colorado 10-20 Sand Pack; 2-inch ID 0.020-inch Stainless Steel Continous Slotted Screen							41		ML	SILT (40.0-45.0 feet bgs) - olive grey to green (transition to green with depth), moist, stiff, non-plastic, slightly brittle from 44-45 feet bgs, root zones, bark, sandy silt from 43.5-44 feet bgs.
							42			
							43			
	M10-13	1050		-			44			
			220				45			
							46			SILT (45.0-47.5 feet bgs) - olive green to 46.5 feet bgs, tan to 47.5 feet bgs, moist, hard/slightly brittle, no sheen.
							47			
	M10-14	1115		-			48		SP	SAND (47.5-53.0 feet bgs) - tan, wet, loose, poorly graded, fine grained, no sheen, some muscovite from 50-53 feet bgs.
			61.3				49			
							50			
							51			
	M10-15	1145		-			52			
			62.3				53			
							54		ML	Sandy SILT (53.0-57.5 feet bgs) - tan, moist, medium stiff, interbedded with fine grained sands from 55.0-57.5 feet bgs.
							55			
							56			
	M10-16	1200		-			57			Tree trunk at 57.5 feet bgs surrounded by olive grey sands.
			47.6				58		SM	Silty SAND (57.5-60.0 feet bgs).
	M10-17	1210		-			59			
							60			

NWT 002728

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW-10-61** **OWRD # 84237**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:00	DRILL FINISH Time: 12:30
	SAMPLING METHOD:	4-inch Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 8-Nov-95	Date: 8-Nov-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	36.5 feet MSL
TOP OF CASING ELEVATION:	39.33 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Cap							61			Boring terminated at 61.0 feet bgs Boring sampled to 60.0 feet Monitoring well installed to 61.0 feet bgs Materials: 10 feet 2-inch diameter, 0.010-inch stainless steel slotted screen 5 feet 2-inch diameter PVC blank casing 45 feet stainless steel blank casing 1 50# bags 20/40 sand 11 bags 10/20 sand 2 50# bags bentonite chips 5 bags bentonite grout 1 end cap 1 locking cap above-grade steel monument 3 guard posts * Sample Prefix Number is 2708-951108-
							62			
							63			
							64			
							65			
							66			
							67			
							68			
							69			
							70			
							71			
							72			
							73			
							74			
							75			
							76			
							77			
							78			
							79			
							80			

NWT 002729

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER MW-11-32** **OWRD # 84232**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 1350 Date: 3-Nov-95	DRILL FINISH Time: 1430 Date: 3-Nov-95
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
	Steel Monument						-3 -2 -1			Ground surface
Concrete Bentonite Chips 2-inch ID Blank PVC Casing							1 2 3 4 5 6			See boring log for boring M-11 for soil description.
Stainless Steel Casing Bentonite Chips							7 8 9 10 11 12 13 14 15 16 17 18 19 20			

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.4 feet MSL
TOP OF CASING ELEVATION:	38.39 feet MSL

NWT 002730

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER MW-11-32** **OWRD # 84232**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 1350 Date: 3-Nov-95	DRILL FINISH Time: 1430 Date: 3-Nov-95
	SAMPLING METHOD:	Not Sampled		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.4 feet MSL
TOP OF CASING ELEVATION:	38.39 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Colorado 10-20 Sand Pack 2-inch ID 0.020-inch Stainless Steel Continuous Slotted Screen Cap							21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40			Boring terminated at 32.0 feet bgs Monitoring well installed to 32.0 feet bgs Materials: 10 feet 2-inch diameter, 0.020-inch stainless steel slotted screen 15 feet stainless steel casing 6 feet 2-inch diameter PVC blank casing 13 50# bags 10/20 sand 12 50# bags bentonite chips 1 end cap 1 locking cap above-grade steel monument 3 guard posts

NWT 002731

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER MW-12-36** **OWRD # 84224**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 1410 Date: 23-Oct-95	DRILL FINISH Time: 1550 Date: 23-Oct-95
	SAMPLING METHOD:	4-inch OD Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James		
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.9 feet MSL
TOP OF CASING ELEVATION:	38.69 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3 to -1			Ground surface
Concrete Bentonite Chips 2-inch ID Blank PVC Casing	M12-01	1415	0.1	116			1		GP	Surface: Sandy GRAVEL, (placed for ground cover) - moist, no hydrocarbon odor, no sheen.
							2			
	M12-02	1420		-					SP	SAND (2.0-4.5 feet bgs) - brown, moist, fine grained, loose, some thin silty zones present, no hydrocarbon odor, slight sheen.
			0.5				3			
							4			
	M12-03	1428	3.9	-			5		ML	SILT (4.5-9.5 feet bgs) - moist to wet, olive grey, very soft, strong hydrocarbon odor, strong sheen.
							6			
							7			
							8			
							9			
							10			
	M12-04	1440		-			11			SILT (9.5-14.5 feet bgs) - olive grey/green mottled with orange spots (oxidized zones), moist, stiff, strong hydrocarbon odor, sheen, brown oil-like substance in upper 2 feet of core.
			46.3				12			
							13			
							14	10/23/95		
							15			
Bentonite Chips 2-inch ID Blank PVC Casing	M12-05	1450		-			16		SP	SILT (14.5-15 feet bgs) - olive grey, brown mottled, stiff, strong hydrocarbon odor, sheen via sheen test. SAND (15-16.5 feet bgs) - brown, wet, fine grained, poorly graded, strong hydrocarbon odor, sheen.
			69.6				17			
							18		ML	SILT (16.5-19.5 feet bgs) - olive grey and brown mottled, stiff, strong hydrocarbon odor, sheen via sheen test, stained soil from 16.5-17.5 feet bgs.
							19			
							20		SP	

NWT 002732

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER MW-12-36** **OWRD # 84224**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon PROJECT: 2708	HAI LOGGER:	Rob Ede	DRILL START Time: 1410	DRILL FINISH Time: 1550
	SAMPLING METHOD:	4-inch OD Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 23-Oct-95	Date: 23-Oct-95
	DRILLING CONTRACTOR:	Geo-Tech Explorations		

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	35.9 feet MSL
TOP OF CASING ELEVATION:	38.69 feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite; 2-inch ID Blank PVC Casing					21		SP	SAND (19.5-24.5 feet bgs) - olive grey, wet, fine grained, sheen on core, hydrocarbon odor, loose, 1-inch silt layer encountered at 21.0 feet bgs, some product staining on silts.
					22			
	M12-06	1458		8.6				
			72.4		23			
					24			
					25			SAND (24.5-29.5 feet bgs) - olive grey changing to brown with depth, wet, fine grained, loose, muscovite present, no hydrocarbon odor, no sheen.
					26			
	M12-07	1510		ND	27			
			1.0		28			
Colorado 10-20 Sand Pack; 2-inch ID 0.010-inch PVC Slotted Screen					29			
					30			SAND (30.0-34.5 feet bgs) - brown, wet, fine to medium grained, loose, no hydrocarbon odor, no sheen, muscovite present.
					31			
					32			
	M12-08	1530		-				
			0.7		33		SP	
					34			
					35			SAND (34.5-36.0 feet bgs) - brown, wet, medium grained, loose, no hydrocarbon odor, no sheen, muscovite present.
Cap	M12-09	1550	0.9	-	36			Bedrock encountered at 36 feet bgs (augers grinding on hard surface).
					37			
					38			
					39			
					40			

NWT 002733

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER MW-12-36** **OWRD # 84224**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 1410	DRILL FINISH Time: 1550
	SAMPLING METHOD:	4-inch OD Core Barrel		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger		
	EQUIPMENT TYPE	B-59 Mobil Drill		
	DRILLER:	Brad James	Date: 23-Oct-95	Date: 23-Oct-95
PROJECT: 2708	DRILLING CONTRACTOR:	Geo-Tech Explorations		

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS TOTAL PAHs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
							41			Boring terminated at 36.0 feet bgs Boring sampled to 36.0 feet Monitoring well installed to 36.0 feet bgs Materials: 10 feet 2-inch diameter, 0.010-inch PVC slotted screen 10 feet 2-inch diameter PVC blank casing 16 50# bags 10/20 sand 14 50# bags bentonite chips 1 end cap 1 locking cap above-grade steel monument 3 guard posts * Sample Prefix Number is 2708-951023-
							42			
							43			
							44			
							45			
							46			
							47			
							48			
							49			
							50			
							51			
							52			
							53			
							54			
							55			
							56			
							57			
							58			
							59			
							60			

APPENDIX C

Sediment Core Logs

NWT 002735

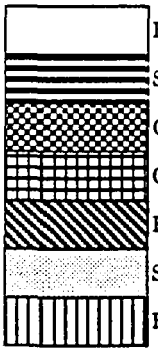
KEY TO BORING LOGS

Soil classification in this report is based upon visual and manual field observations which include moisture, consistency, plasticity and grading estimates and should not be construed to imply field or laboratory testing unless presented herein. Soils are classified in accordance with the Unified Soil Classification System. Stratigraphic boundaries are approximate representations only. No warranty is provided as to the continuity of soil strata between borings.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COURSE GRAINED SOILS More Than Half is Larger Than #200 Sieve	GRAVELS More Than Half the Course Fraction is Larger Than No. 4 Sieve Size	Clean Gravels With Little or No Fines	GW	Well Graded Gravels, Gravel-Sand Mixtures
			GP	Poorly Graded Gravels, Gravel-Sand Mixtures
		Gravels With Over 12% Fines	GM	Silty Gravels, Poorly Graded Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, Poorly Graded Gravel-Sand-Clay Mixtures
	SANDS More Than Half the Course Fraction is Smaller Than No. 4 Sieve Size	Clean Sands With Little or No Fines	SW	Well Graded Sands, Gravelly Sands
			SP	Poorly Graded Sands, Gravelly Sands
		Sands With Over 12% Fines	SM	Silty Sands, Poorly Graded Sand-Silt Mixtures
			SC	Clayey Sands, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More Than Half is Smaller Than #200 Sieve	SILTS AND CLAYS Liquid Limit Less Than 50%		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands, or Clayey Silts with Slight Plasticity
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Clays and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit Greater Than 50%		MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Clays of Medium to High Plasticity, Organic Silts
HIGHLY ORGANIC SOILS			Pt	Peat and Other Highly Organic Soils

LEGEND FOR BORING LOGS



- Blank Casing
- Slotted Screen
- Cement Grout
- Concrete
- Bentonite
- Sand Pack
- Fill Material

ABBREVIATIONS

NA	Not Applicable
ND	Not Detected Above Detection Limit
NS	Not Sampled
PAH	Polynuclear Aromatic Hydrocarbons
ppm	Parts Per Million
SPT	Standard Penetration Test
▽	Measured Static Water Level in Well
▼	Estimated Water Level During Drilling

Updated: 7/17/96 RBE
File: Boring Log Key

HAHN AND ASSOCIATES, INC.

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER SD-4**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:33 Date: 1/23/96	DRILL FINISH Time: 9:50 Date: 1/23/96
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski		
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems		

SAMPLE NUMBER*	TIME (1/25/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	Core Interval	RECOVERY INTERVAL	DEPTH (feet)	STRATA (USCS)
SD-4-01	12:25	2.3	165/ND				ML
SD-4-02	12:30	4.0	-			1	
SD-4-03	12:36	9.5	-			2	
SD-4-04	12:47	13.6	-			3	
SD-4-05	12:54	24.3	-			4	
SD-4-06	13:00	23.4	-			5	
SD-4-07	13:30	16.7	-			6	
SD-4-08	13:32	15.6	-			7	SM
SD-4-09	13:36	13.9	-			8	
SD-4-10	13:38	12.3	-			9	
SD-4-11	13:40	11.6	0.15/ND			10	
						11	
						12	
						13	
						14	
						15	
						16	
						17	
						18	
						19	
						20	

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

SILT-brown, wet, very soft, roots, sheen, hydrocarbon odor (0"-6")

Sandy SILT-grey, wet, soft, roots, sheen, hydrocarbon odor (6"-3')

Sandy SILT with gravel and wood chips-brown, wet, sheen, hydrocarbon odor (3'-4')

Sandy SILT with fine grained sand seams-grey, moist, rootlets throughout, much vegetative material from 4' to 5', sheen within sand seams only, hydrocarbon odor (4'-6')

Silty SAND-grey, moist, fine grained, root fragments, no sheen, hydrocarbon odor (6'-7')

Silty SAND-as above, many root fragments, no sheen, hydrocarbon odor (7'-9.5')

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened and sampled 1/25/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002737

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER SD-5**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 10:23	DRILL FINISH Time: 10:40
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date: 1/23/96	Date: 1/23/96
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems		

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SAMPLE NUMBER*	TIME (1/25/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	DEPTH (feet)
SD-5-01	14:30	4.7	118/ND	
SD-5-02	14:33	4.4	-	1
SD-5-03	14:35	3.5	-	2
SD-5-04	14:40	3.7	-	3
SD-5-05	14:45	3.4	-	4
SD-5-06	14:50	9.6	-	5
SD-5-07	15:00	9.4	-	6
SD-5-08	15:05	19.0	-	7
SD-5-09	15:10	17.4	1,154/ND	8
				9
				10
				11
				12
				13
				14
				15
				16
				17
				18
				19
				20

STRATA (USCS): SM; ML; ML

SOIL DESCRIPTION

Silty SAND-brown, wet, loose,very fine grained, sheen (0"-6")

SILT with silty sand lenses-brown, wet, medium stiff, roots, strong sheen (6"-2')

SILT-olive grey, wet, very soft, wood chips at 2', slight sheen (2'-3')

Sandy SILT-dark brown, moist, medium stiff, rootlets, many wood fragments and dark grey to black discoloration from 6' to 8', sheen (3'-8')

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened and sampled 1/25/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002738

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**SD-6**	
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 11:02 Date: 1/23/96
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel	DRILL FINISH Time: 11:20 Date: 1/23/96
	DRILLING METHOD:	Vibration/Push	
	EQUIPMENT TYPE	VibraCore attached to barge	
	DRILLER:	Bill Jaworski	
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems	

SAMPLE NUMBER*	TIME (1/25/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	Core Interval	RECOVERY INTERVAL	DEPTH (feet)	STRATA (USCS)
SD-6-01	15:46	6.5	101/ND				
SD-6-02	15:48	14.6	-			1	
SD-6-03	15:50	12.0	-			2	SP
SD-6-04	15:52	6.8	-			3	
SD-6-05	15:55	2.6	-			4	
SD-6-06	16:05	4.0	-			5	SM
SD-6-07	16:10	9.1	-			6	
SD-6-08	16:13	5.3	-			7	
SD-6-09	16:15	3.1	2.2/ND			8	SP
						9	
						10	
						11	
						12	
						13	
						14	
						15	
						16	
						17	
						18	
						19	
						20	

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

SAND-brown, wet, loose, medium grained, wood fragments, slight sheen (0"-1')

SAND-as above, moist to wet, many wood fragments from 2' to 2.5' with an associated strong sheen (1'-4')

Silty SAND-brown, moist to wet, loose, much root material, increasing silt content with depth, sheen (4'-5')

SAND with interbedded Silts-grey, moist to wet, loose, silts are dark grey, moist, soft, root material and sheen in sands only(5'-8')

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened and sampled 1/25/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002739

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**SD-7**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 9:33	DRILL FINISH Time: 9:50
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date: 1/23/96	Date: 1/23/96
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems		

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SAMPLE NUMBER*	TIME (1/26/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
SD-7-01	8:32	55.8	26,408/54		ML	SILT-brown, wet, very soft, no sheen (0"-2")
SD-7-02	8:35	318	-	1	GP	Tarry, Sandy GRAVEL, black, tar is hard to slightly plastic, much vegetation, rootlets, decreasing tar content with depth, sheen (2"-1')
SD-7-03	8:37	5.5	-	2	SP	SAND, dark grey, medium grained, loose, some tar in matrix, sheen (1'-2')
SD-7-04	8:40	4.6	-	3	ML	Sandy SILT with fine grained sand seams-grey, moist, slightly stiff, rootlets and wood fragments, no sheen (2'-4')
SD-7-05	9:00	4.1	-	4		
SD-7-06	9:04	1.8	-	5	SM	Silty SAND-grey, moist, fine grained, bedded brown vetetative material, no sheen (4'-6.5')
SD-7-07	9:08	2.1	-	6		
SD-7-08	9:18	1.5	-	7		
SD-7-09	9:23	1.2	-	8	ML	Sandy SILT-grey, moist, medium stiff, shell material, root fragments, no sheen (6.5'-9')
SD-7-10	9:25	1.2'	10.9/ND	9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened and sampled 1/26/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002740

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER SD-8**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time:	DRILL FINISH Time:
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel	9:33	9:50
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems	1/23/96	1/23/96

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SAMPLE NUMBER*	TIME (1/26/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
SD-8-01	9:50	14.3	875/ND	1	ML	Sandy SILT-brown, wet, very soft, some medium grained sand lenses, root material, no sheen (0-2')
SD-8-02	9:52	12.9	-			
SD-8-03	9:56	12.1	-	2		Sandy SILT-as above, some gravel, slight sheen (2'-4')
SD-8-04	10:00	11.9	-	3		
SD-8-05	10:03	12.3	-	4		Sandy SILT with fine grained sand seams-olive grey, moist, medium stiff, rootlets throughout, much vegetative material, slight sheen (4'-5')
SD-8-06	10:15	13.0	-	5		
SD-8-07	10:18	13.3	-	6	SP	SAND-grey, moist, medium grained, loose, wood fragments, strong sheen (5'-7')
SD-8-08	10:23	30.4	-	7		
SD-8-09	10:30	172.0	-	8	ML	Tarry Sandy SILT-olive grey, moist, stiff, seams of black viscous tar and hardened tar (7'-8')
SD-8-10	10:32	59.7	3,254/2.6	9		Sandy SILT-as above, no tar, strong sheen (8'-9')
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened and sampled 1/26/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**SD-9**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Rob Ede	DRILL START Time: 13:25 Date: 1/24/96	DRILL FINISH Time: 14:00 Date: 1/24/96
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski		
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems		

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SAMPLE NUMBER*	TIME (1/26/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
SD-9-01	10:50	15.8	125/ND	1	ML	Sandy SILT-brown, wet, very soft, some medium grained sand lenses, root material , no sheen (0-2')
SD-9-2 (dup)	10:55	13.8	94/ND			
SD-9-03	10:58	13.0	-	2		
SD-9-04	11:00	13.4	-	3	GP	Gravel-wet, loose, angular, no sheen (2'-3'.5)
SD-9-05	11:02	17.3	-	4	SM	Silty SAND-wet, loose, medium grained, root fragments, strong metallic sheen (3.5'-4')
SD-9-06	11:06	110	5,471/14	5	SP	Tarry SAND-wet, medium grained, root fragments, bits of solidified tar, sheen (4'-5')
				6		
				7		
				8		
				9		
				10		
				11		
				12		* Sample Number Prefix is 2708-960124-
				13		Core collected and sealed 1/24/96 Core opened and sampled 1/26/96
				14		
				15		
				16		BTEX = benzene, toluene, ethyl benzene, xylene PAHs = polynuclear aromatic hydrocarbons ppm = parts per million ND = non-detect
				17		
				18		
				19		
				20		

NWT 002742

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER SD-10**			
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Steve Johnson (FES)	DRILL START Time: 15:04	DRILL FINISH Time: 15:30
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date: 1/23/96	Date: 1/23/96
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems		

	SAMPLE NUMBER*	TIME (1/26/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	Core Interval	RECOVERY INTERVAL	DEPTH (feet)	STRATA (USCS)		
	SD-10-01	12:50	2.5	ND/283				ML	BORING DIAMETER:	3.75-inch
	SD-10-02	12:55	2.4	-			1		CASING DIAMETER:	3.75-inch
	SD-10-03	13:00	4.4	-			2		SURFACE ELEVATION:	Not Surveyed
	SD-10-04	13:05	7.1	-			3		TOP OF CASING ELEVATION:	Not Applicable
	SD-10-05	13:08	3.6	-			4		SOIL DESCRIPTION	
	SD-10-06	13:25	3	-			5	SP		
	SD-10-07	13:28	2.3	-			6			
	SD-10-08	13:22	0.6	-			7			
	SD-10-09	13:30	3.2	ND/9.6			8			
							9			
							10			
							11			
							12			
							13			
							14			
							15			
							16			
							17			
							18			
							19			
							20			

SILT-dark brown, wet, soft, some medium grained sand lenses, some plant material and wood chips, slight hydrocarbon odor and sheen from 0 to 0.5 feet (0-2')

SAND-wet, loose, medium grained, wood chips, no hydrocarbon odor or sheen (2'-3')

SAND-as above, some gravel, no hydrocarbon odor or sheen (3'-5')

SAND- dark brown, loose, medium grained, some silt, wood chips, slight hydrocarbon odor, no sheen (5'-7.5')

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened and sampled 1/26/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002743

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**SD-11**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Steve Johnson (FES)	DRILL START Time: 16:00	DRILL FINISH Time: 16:25
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date: 1/23/96	Date: 1/23/96
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems		

SAMPLE NUMBER*	TIME (1/26/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	DEPTH (feet)	STRATA (USCS)
SD-11-01	13:53	366	5.6/ND		SP
SD-11-02	13:55	34.2	-	1	
SD-11-03	14:00	13.3	569/ND	2	ML
SD-11-04	14:03	7.8	-	3	
SD-11-05	14:11	6.3	-	4	SP
SD-11-06	14:14	12.6	-	5	
SD-11-07	14:16	6.3	-	6	
				7	
				8	
				9	
				10	
				11	
				12	
				13	
				14	
				15	
				16	
				17	
				18	
				19	
				20	

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

SAND-brown, wet, loose, medium grained, wood chips on surface, hydrocarbon odor, sheen (0'-1')

SILT-dark brown, stiff, medium grained sand lenses, strong hydrocarbon odor and sheen (1'-2')

SAND-dark brown, loose, medium grained, some silt, wood chips, hydrocarbon odor and sheen (2'-3')

SAND- as above, no wood chips, brick fragments from 5' to 5.5', slight hydrocarbon odor, no sheen, (3'-6')

* Sample Number Prefix is 2708-960123-

Core collected and sealed 1/23/96
Core opened ans sampled 1/26/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002744

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**SD-12**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Steve Johnson (FES)	DRILL START Time:	DRILL FINISH Time:
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel	9:01	9:30
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems	1/24/96	1/24/96

SAMPLE NUMBER*	TIME (1/26/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	Core Interval	RECOVERY INTERVAL	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
SD-12-01	10:40	0.0	0.72/ND			1	SM	Silty SAND-gray, wet, loose, fine grained, no hydrocarbon odor, no sheen (0'-1')
SD-12-02	10:45	0.0	-			2		Silty SAND-as above, wet, wood chips from 2' to 3', slight hydrocarbon odor, no sheen (1'-4')
SD-12-03	10:50	0.3	-			3		
SD-12-04	11:00	0.1	8.4/ND			4		
SD-12-05	11:05	0.0	-			5	CL	Clay, greenish gray, moist, some silt, plastic, no hydrocarbon odor, no sheen (4'-5.5')
SD-12-06	11:08	0.0	-			6	ML	Sandy SILT- light brown, moist, no hydrocarbon odor, no sheen (5.5'-8')
SD-12-07	11:25	0.0	-			7		
SD-12-08	11:28	0.3	-			8		
SD-12-09	11:41	0.6	-			9	SP	SAND, light brown, moist, fine grained,no hydrocarbon odor, no sheen, (8.'-10')
SD-12-10	11:45	0.9	-					
SD-12-11	11:50	3.0	-			10		
						11		
						12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		
						20		

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

* Sample Number Prefix is 2708-960124-

Core collected and sealed 1/24/96
Core opened and sampled 1/26/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**SD-13**		
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	HAI LOGGER:	Steve Johnson (FES)	DRILL START Time: 9:43	DRILL FINISH Time: 10:15
	SAMPLING METHOD:	3.75"OD Disposable Core Barrel		
	DRILLING METHOD:	Vibration/Push		
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date: 1/24/96	Date: 1/24/96
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems		

SAMPLE NUMBER*	TIME (1/26/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	Core Interval	RECOVERY INTERVAL	DEPTH (feet)	STRATA (USCS)
SD-13-01	10:10	0.7	1.4/ND			1	SM
SD-13-02	10:15	2.4	-			2	ML
SD-13-03	10:20	4.5	-			3	ML
SD-13-04	10:25	5.8	-			4	SP
						5	
						6	
						7	
						8	
						9	
						10	
						11	
						12	
						13	
						14	
						15	
						16	
						17	
						18	
						19	
						20	

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SOIL DESCRIPTION

Silty SAND-dark brown to gray, wet, loose, fine grained, no hydrocarbon odor, no sheen (0'-1')

sandy SILT-dark brown to gray, roots from 1' to 2, large wood chips from 1' to 3', slight hydrocarbon odor from 2' to 3', no sheen (1'-3')

SAND-dark gray, medium grained, hydrocarbon odor, no sheen (3'-3.5')

* Sample Number Prefix is 2708-960124-

Core collected and sealed 1/24/96
Core opened and sampled 1/26/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002746

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**SD-14**		
	HAI LOGGER:	Steve Johnson (FES)	DRILL START	DRILL FINISH
PROJECT: Northwest Natural Gas Co. Gasco Facility Portland, Oregon	SAMPLING METHOD:	3.75"OD Disposable Core Barrel	Time:	Time:
	DRILLING METHOD:	Vibration/Push	12:16	12:25
	EQUIPMENT TYPE	VibraCore attached to barge		
	DRILLER:	Bill Jaworski	Date:	Date:
PROJECT #: 2708	DRILLING CONTRACTOR:	Marine Sampling Systems	1/24/96	1/24/96

BORING DIAMETER:	3.75-inch
CASING DIAMETER:	3.75-inch
SURFACE ELEVATION:	Not Surveyed
TOP OF CASING ELEVATION:	Not Applicable

SAMPLE NUMBER*	TIME (1/25/96)	HEADSPACE (ppm)	LAB RESULTS total PAHs/total BTEX(ppm)	DEPTH (feet)	STRATA (USCS)	SOIL DESCRIPTION
SD-14-01	9:00	0.1	0.15/ND	1	ML	SILT-dark brown, wet, root material, no hydrocarbon odor, no sheen (0'-1')
SD-14-02	9:10	1.5	-	2		SILT-as above, some fine grained sand lenses,no hydrocarbon odor, no sheen (1'-2')
SD-14-03	9:20	1.8	-	3	SM	Silty SAND-medium grained, large wood chips, no hydrocarbon odor, no sheen (2'-3.5')
SD-14-04	9:25	2.4		4		Silty SAND-fine grained, small wood chips, no hydrocarbon odor, no sheen (3.5'-4')
SD-14-05	9:35	-	-	5	ML	SILT- light brown, moist, painted wood fragment at 4.5', small wood fragments from 5' to 6', shell fragments from 6' to 7', decaying wood odor, no hydrocarbon odor, no sheen (4'-7.5')
SD-14-06	9:40	0.5	-	6		
SD-14-07	9:50	0.2	-	7		
SD-14-08	9:55	0.4	-	8		
SD-14-09	10:00	5.8	181/ND	9	SP	SAND, light brown, moist, medium grained, no hydrocarbon odor, no sheen, (7.5'-8.5')
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

Core Interval

RECOVERY INTERVAL

* Sample Number Prefix is 2708-960124-

Core collected and sealed 1/24/96
Core opened and sampled 1/25/96

BTEX = benzene, toluene, ethyl benzene, xylene
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
ND = non-detect

NWT 002747

APPENDIX D

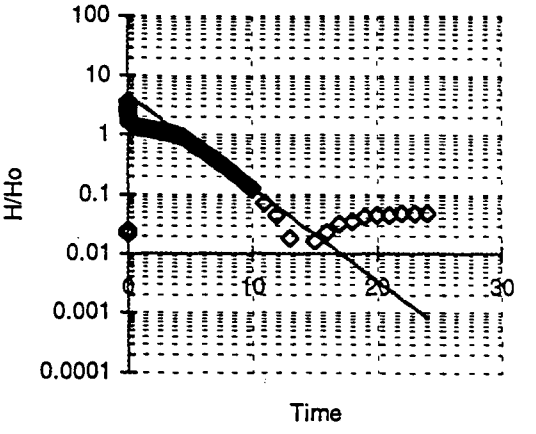
Slug Test Reports

NWT 002748

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name:	RI/FS	Project No.:	2708
Client Name:	Northwest Natural Gas Company	Identification:	MW-1-22
Analysis By:	RBE		
Run Date:	3/28/96		

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	5.73	feet
Water Table Depth:	13.52	feet
Aquifer Thickness:	5.73	feet
Line Fit Starting No.:	101	Min 1 to
Line Fit Ending No.:	126	Max 140
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	3.52E-01	ft./day
Error of Fit:	0.009	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	13.54	0.02		-3.817	1.558
2)	0.01	13.54	0.02		-3.817	1.555
3)	0.02	13.54	0.02		-3.817	1.552
4)	0.03	13.54	0.02		-3.817	1.549
5)	0.03	13.55	0.03		-3.689	1.546
6)	0.04	17.09	3.57		1.272	1.543
7)	0.05	17.19	3.67		1.301	1.540
8)	0.06	15.97	2.45		0.894	1.537
9)	0.07	16.31	2.79		1.025	1.534
10)	0.08	16.70	3.18		1.157	1.531
11)	0.08	16.48	2.96		1.085	1.528
12)	0.09	16.24	2.72		1.002	1.525
13)	0.10	15.96	2.44		0.893	1.522
14)	0.11	15.79	2.27		0.818	1.519
15)	0.12	15.61	2.09		0.738	1.516
16)	0.13	15.49	1.97		0.677	1.513
17)	0.13	15.38	1.86		0.620	1.510
18)	0.14	15.30	1.78		0.578	1.507
19)	0.15	15.22	1.70		0.531	1.504
20)	0.16	15.18	1.66		0.508	1.501
21)	0.17	15.14	1.62		0.481	1.498
22)	0.18	15.12	1.60		0.468	1.495
23)	0.18	15.09	1.57		0.451	1.492
24)	0.19	15.08	1.56		0.443	1.489
25)	0.20	15.07	1.55		0.435	1.486
26)	0.21	15.05	1.53		0.427	1.483
27)	0.22	15.04	1.52		0.421	1.480

28)	0.23	15.03	1.51		0.414	1.476
29)	0.23	15.02	1.50		0.408	1.473
30)	0.24	15.01	1.49		0.401	1.470
31)	0.25	15.01	1.49		0.399	1.467
32)	0.26	15.01	1.49		0.395	1.464
33)	0.27	15.00	1.48		0.391	1.461
34)	0.28	15.00	1.48		0.389	1.458
35)	0.28	14.99	1.47		0.387	1.455
36)	0.29	14.99	1.47		0.385	1.452
37)	0.30	14.98	1.46		0.380	1.449
38)	0.31	14.98	1.46		0.378	1.446
39)	0.32	14.98	1.46		0.376	1.443
40)	0.33	14.98	1.46		0.376	1.440
41)	0.33	14.97	1.45		0.372	1.437
42)	0.35	14.96	1.44		0.367	1.431
43)	0.37	14.96	1.44		0.365	1.425
44)	0.38	14.95	1.43		0.360	1.419
45)	0.40	14.95	1.43		0.358	1.413
46)	0.42	14.95	1.43		0.356	1.407
47)	0.43	14.94	1.42		0.352	1.401
48)	0.45	14.94	1.42		0.350	1.395
49)	0.47	14.94	1.42		0.347	1.389
50)	0.48	14.93	1.41		0.343	1.383
51)	0.50	14.93	1.41		0.341	1.377
52)	0.52	14.92	1.40		0.339	1.371
53)	0.53	14.92	1.40		0.336	1.365
54)	0.55	14.92	1.40		0.334	1.359
55)	0.57	14.91	1.39		0.331	1.353
56)	0.58	14.91	1.39		0.329	1.347
57)	0.60	14.90	1.38		0.325	1.341
58)	0.62	14.90	1.38		0.325	1.335
59)	0.63	14.90	1.38		0.323	1.329
60)	0.65	14.90	1.38		0.321	1.323
61)	0.67	14.89	1.37		0.318	1.317
62)	0.68	14.89	1.37		0.316	1.311
63)	0.70	14.89	1.37		0.313	1.305
64)	0.72	14.89	1.37		0.311	1.299
65)	0.73	14.88	1.36		0.309	1.293
66)	0.75	14.88	1.36		0.307	1.286
67)	0.77	14.88	1.36		0.307	1.280
68)	0.78	14.88	1.36		0.304	1.274
69)	0.80	14.87	1.35		0.302	1.268
70)	0.82	14.87	1.35		0.299	1.262
71)	0.83	14.87	1.35		0.297	1.256
72)	0.85	14.86	1.34		0.295	1.250
73)	0.87	14.86	1.34		0.295	1.244
74)	0.88	14.86	1.34		0.293	1.238

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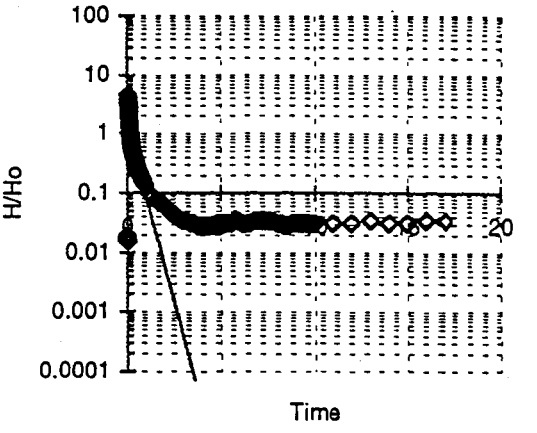
75)	0.90	14.86	1.34		0.290	1.232
76)	0.92	14.85	1.33		0.287	1.226
77)	0.93	14.85	1.33		0.285	1.220
78)	0.95	14.85	1.33		0.285	1.214
79)	0.97	14.85	1.33		0.285	1.208
80)	0.98	14.85	1.33		0.283	1.202
81)	1.00	14.84	1.32		0.281	1.196
82)	1.20	14.82	1.30		0.259	1.124
83)	1.40	14.79	1.27		0.241	1.051
84)	1.60	14.77	1.25		0.222	0.979
85)	1.80	14.75	1.23		0.204	0.906
86)	2.00	14.72	1.20		0.183	0.834
87)	2.20	14.70	1.18		0.167	0.762
88)	2.40	14.68	1.16		0.148	0.689
89)	2.60	14.66	1.14		0.132	0.617
90)	2.80	14.64	1.12		0.112	0.545
91)	3.00	14.62	1.10		0.094	0.472
92)	3.20	14.60	1.08		0.074	0.400
93)	3.40	14.57	1.05		0.051	0.327
94)	3.60	14.55	1.03		0.030	0.255
95)	3.80	14.53	1.01		0.005	0.183
96)	4.00	14.49	0.97		-0.027	0.110
97)	4.20	14.46	0.94		-0.061	0.038
98)	4.40	14.43	0.91		-0.091	-0.035
99)	4.60	14.39	0.87		-0.140	-0.107
100)	4.80	14.33	0.81		-0.212	-0.179
101)	5.00	14.28	0.76		-0.281	-0.252
102)	5.20	14.22	0.70		-0.351	-0.324
103)	5.40	14.18	0.66		-0.416	-0.396
104)	5.60	14.14	0.62		-0.485	-0.469
105)	5.80	14.10	0.58		-0.548	-0.541
106)	6.00	14.06	0.54		-0.616	-0.614
107)	6.20	14.03	0.51		-0.683	-0.686
108)	6.40	13.99	0.47		-0.753	-0.758
109)	6.60	13.96	0.44		-0.816	-0.831
110)	6.80	13.93	0.41		-0.892	-0.903
111)	7.00	13.91	0.39		-0.955	-0.976
112)	7.20	13.88	0.36		-1.030	-1.048
113)	7.40	13.85	0.33		-1.106	-1.120
114)	7.60	13.83	0.31		-1.174	-1.193
115)	7.80	13.81	0.29		-1.238	-1.265
116)	8.00	13.79	0.27		-1.317	-1.337
117)	8.20	13.77	0.25		-1.390	-1.410
118)	8.40	13.75	0.23		-1.470	-1.482
119)	8.60	13.73	0.21		-1.542	-1.555
120)	8.80	13.72	0.20		-1.614	-1.627
121)	9.00	13.70	0.18		-1.698	-1.699

122)	9.20	13.69	0.17		-1.772	-1.772
123)	9.40	13.67	0.15		-1.871	-1.844
124)	9.60	13.67	0.15		-1.931	-1.917
125)	9.80	13.65	0.13		-2.025	-1.989
126)	10.00	13.64	0.12		-2.096	-2.061
127)	11.00	13.59	0.07		-2.631	-2.423
128)	12.00	13.56	0.04		-3.124	-2.785
129)	13.00	13.54	0.02		-4.017	-3.147
130)	14.00	13.52	0.00		-	-3.509
131)	15.00	13.50	0.02		-4.135	-3.871
132)	16.00	13.50	0.02		-3.772	-4.233
133)	17.00	13.49	0.03		-3.442	-4.595
134)	18.00	13.49	0.04		-3.352	-4.957
135)	19.00	13.48	0.04		-3.170	-5.319
136)	20.00	13.48	0.04		-3.101	-5.680
137)	21.00	13.48	0.04		-3.101	-6.042
138)	22.00	13.47	0.05		-3.037	-6.404
139)	23.00	13.47	0.05		-3.037	-6.766
140)	24.00	13.47	0.05		-3.037	-7.128

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-2-32
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	13.75	feet
Water Table Depth:	19.59	feet
Aquifer Thickness:	13.75	feet
Line Fit Starting No.:	15	Min 1 to
Line Fit Ending No.:	81	Max 133
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	3.41E+00	ft./day
Error of Fit:	4.684	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	19.57	0.02		-3.963	0.420
2)	0.01	19.57	0.02		-4.135	0.397
3)	0.02	19.57	0.02		-4.135	0.374
4)	0.03	19.57	0.02		-4.135	0.351
5)	0.03	19.57	0.02		-3.963	0.328
6)	0.04	19.57	0.02		-4.135	0.306
7)	0.05	19.57	0.02		-4.135	0.283
8)	0.06	24.08	4.49		1.502	0.260
9)	0.07	23.45	3.86		1.351	0.237
10)	0.08	22.84	3.25		1.177	0.214
11)	0.08	23.46	3.87		1.354	0.191
12)	0.09	23.22	3.63		1.290	0.168
13)	0.10	22.90	3.31		1.197	0.145
14)	0.11	22.57	2.98		1.092	0.123
15)	0.12	22.28	2.69		0.988	0.100
16)	0.13	21.99	2.40		0.876	0.077
17)	0.13	21.64	2.05		0.717	0.054
18)	0.14	21.41	1.82		0.599	0.031
19)	0.15	21.15	1.56		0.443	0.008
20)	0.16	21.00	1.41		0.344	-0.014
21)	0.17	21.02	1.43		0.357	-0.037
22)	0.18	20.87	1.28		0.245	-0.060
23)	0.18	20.65	1.06		0.057	-0.083
24)	0.19	20.56	0.97		-0.034	-0.106
25)	0.20	20.49	0.90		-0.101	-0.129
26)	0.21	20.42	0.83		-0.182	-0.152
27)	0.22	20.38	0.79		-0.236	-0.174

28)	0.23	20.33	0.74		-0.297	-0.197
29)	0.23	20.29	0.70		-0.355	-0.220
30)	0.24	20.26	0.67		-0.405	-0.243
31)	0.25	20.23	0.64		-0.449	-0.266
32)	0.26	20.20	0.61		-0.489	-0.289
33)	0.27	20.18	0.59		-0.531	-0.312
34)	0.28	20.17	0.57		-0.553	-0.335
35)	0.28	20.14	0.55		-0.598	-0.357
36)	0.29	20.12	0.53		-0.627	-0.380
37)	0.30	20.11	0.52		-0.652	-0.403
38)	0.31	20.10	0.51		-0.675	-0.426
39)	0.32	20.08	0.49		-0.707	-0.449
40)	0.33	20.07	0.48		-0.734	-0.472
41)	0.33	20.06	0.47		-0.747	-0.494
42)	0.35	20.04	0.45		-0.794	-0.540
43)	0.37	20.02	0.43		-0.844	-0.586
44)	0.38	20.00	0.41		-0.889	-0.632
45)	0.40	19.99	0.40		-0.921	-0.677
46)	0.42	19.97	0.38		-0.962	-0.723
47)	0.43	19.96	0.37		-0.997	-0.769
48)	0.45	19.97	0.38		-0.970	-0.815
49)	0.47	19.93	0.34		-1.067	-0.860
50)	0.48	19.93	0.34		-1.094	-0.906
51)	0.50	19.92	0.33		-1.115	-0.952
52)	0.52	19.90	0.31		-1.184	-0.997
53)	0.53	19.88	0.29		-1.224	-1.043
54)	0.55	19.87	0.28		-1.280	-1.089
55)	0.57	19.87	0.27		-1.291	-1.134
56)	0.58	19.86	0.27		-1.328	-1.180
57)	0.60	19.85	0.26		-1.351	-1.226
58)	0.62	19.83	0.24		-1.427	-1.271
59)	0.63	19.82	0.23		-1.452	-1.317
60)	0.65	19.82	0.23		-1.483	-1.363
61)	0.67	19.81	0.22		-1.510	-1.409
62)	0.68	19.81	0.22		-1.537	-1.454
63)	0.70	19.80	0.21		-1.570	-1.500
64)	0.72	19.79	0.20		-1.599	-1.546
65)	0.73	19.79	0.20		-1.614	-1.591
66)	0.75	19.78	0.19		-1.650	-1.637
67)	0.77	19.78	0.19		-1.682	-1.683
68)	0.78	19.77	0.18		-1.698	-1.729
69)	0.80	19.77	0.18		-1.715	-1.774
70)	0.82	19.77	0.18		-1.732	-1.820
71)	0.83	19.76	0.17		-1.772	-1.866
72)	0.85	19.76	0.17		-1.790	-1.912
73)	0.87	19.75	0.16		-1.826	-1.957
74)	0.88	19.75	0.16		-1.826	-2.003

75)	0.90	19.74	0.15		-1.871	-2.049
76)	0.92	19.74	0.15		-1.911	-2.094
77)	0.93	19.74	0.15		-1.911	-2.140
78)	0.95	19.73	0.14		-1.952	-2.186
79)	0.97	19.73	0.14		-1.973	-2.231
80)	0.98	19.73	0.14		-2.002	-2.277
81)	1.00	19.72	0.13		-2.025	-2.323
82)	1.20	19.69	0.10		-2.293	-2.871
83)	1.40	19.68	0.09		-2.465	-3.420
84)	1.60	19.67	0.07		-2.590	-3.968
85)	1.80	19.66	0.07		-2.674	-4.517
86)	2.00	19.65	0.06		-2.765	-5.066
87)	2.20	19.64	0.05		-2.937	-5.614
88)	2.40	19.64	0.05		-3.058	-6.163
89)	2.60	19.63	0.04		-3.194	-6.711
90)	2.80	19.63	0.04		-3.297	-7.260
91)	3.00	19.62	0.03		-3.381	-7.808
92)	3.20	19.62	0.03		-3.381	-8.357
93)	3.40	19.62	0.03		-3.474	-8.905
94)	3.60	19.62	0.03		-3.474	-9.454
95)	3.80	19.62	0.03		-3.576	-10.002
96)	4.00	19.62	0.03		-3.576	-10.551
97)	4.20	19.62	0.03		-3.576	-11.099
98)	4.40	19.62	0.03		-3.576	-11.648
99)	4.60	19.62	0.03		-3.576	-12.196
100)	4.80	19.62	0.03		-3.474	-12.745
101)	5.00	19.62	0.03		-3.474	-13.293
102)	5.20	19.62	0.03		-3.474	-13.842
103)	5.40	19.62	0.03		-3.474	-14.390
104)	5.60	19.62	0.03		-3.474	-14.939
105)	5.80	19.63	0.04		-3.297	-15.487
106)	6.00	19.62	0.03		-3.381	-16.036
107)	6.20	19.62	0.03		-3.474	-16.584
108)	6.40	19.62	0.03		-3.474	-17.133
109)	6.60	19.62	0.03		-3.474	-17.681
110)	6.80	19.62	0.03		-3.381	-18.230
111)	7.00	19.62	0.03		-3.381	-18.779
112)	7.20	19.62	0.03		-3.381	-19.327
113)	7.40	19.62	0.03		-3.381	-19.876
114)	7.60	19.62	0.03		-3.381	-20.424
115)	7.80	19.62	0.03		-3.381	-20.973
116)	8.00	19.62	0.03		-3.474	-21.521
117)	8.20	19.62	0.03		-3.474	-22.070
118)	8.40	19.62	0.03		-3.576	-22.618
119)	8.60	19.62	0.03		-3.576	-23.167
120)	8.80	19.62	0.03		-3.474	-23.715
121)	9.00	19.62	0.03		-3.474	-24.264

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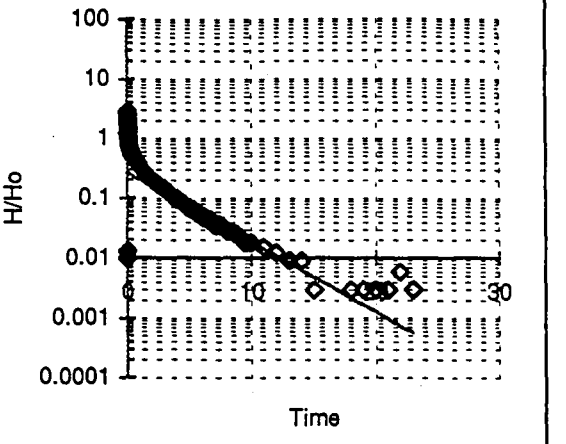
122)	9.20	19.62	0.03		-3.474	-24.812
123)	9.40	19.62	0.03		-3.474	-25.361
124)	9.60	19.62	0.03		-3.474	-25.909
125)	9.80	19.62	0.03		-3.474	-26.458
126)	10.00	19.62	0.03		-3.474	-27.006
127)	11.00	19.62	0.03		-3.474	-29.749
128)	12.00	19.62	0.03		-3.474	-32.492
129)	13.00	19.62	0.03		-3.381	-35.234
130)	14.00	19.62	0.03		-3.474	-37.977
131)	15.00	19.62	0.03		-3.474	-40.719
132)	16.00	19.62	0.03		-3.381	-43.462
133)	17.00	19.62	0.03		-3.381	-46.205

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-3-26
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	10.13	feet
Water Table Depth:	18.78	feet
Aquifer Thickness:	10.13	feet
Line Fit Starting No.:	91	Min 1 to
Line Fit Ending No.:	130	Max 139
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	3.08E-01	ft./day
Error of Fit:	0.372	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	18.77	0.01		-4.343	-1.321
2)	0.01	18.77	0.01		-4.605	-1.323
3)	0.02	18.77	0.01		-4.605	-1.325
4)	0.03	18.77	0.01		-4.605	-1.328
5)	0.03	18.77	0.01		-4.343	-1.330
6)	0.04	19.99	1.21		0.187	-1.332
7)	0.05	21.43	2.65		0.975	-1.334
8)	0.06	21.64	2.86		1.052	-1.337
9)	0.07	21.55	2.77		1.017	-1.339
10)	0.08	21.26	2.48		0.906	-1.341
11)	0.08	21.07	2.29		0.829	-1.343
12)	0.09	20.92	2.14		0.761	-1.346
13)	0.10	20.74	1.96		0.675	-1.348
14)	0.11	20.60	1.82		0.596	-1.350
15)	0.12	20.46	1.68		0.516	-1.352
16)	0.13	20.34	1.56		0.447	-1.355
17)	0.13	20.22	1.44		0.362	-1.357
18)	0.14	20.12	1.34		0.289	-1.359
19)	0.15	20.00	1.22		0.200	-1.361
20)	0.16	19.92	1.14		0.128	-1.363
21)	0.17	19.84	1.06		0.059	-1.366
22)	0.18	19.77	0.99		-0.009	-1.368
23)	0.18	19.71	0.93		-0.071	-1.370
24)	0.19	19.66	0.88		-0.123	-1.372
25)	0.20	19.62	0.84		-0.174	-1.375
26)	0.21	19.59	0.81		-0.213	-1.377
27)	0.22	19.56	0.78		-0.254	-1.379

28)	0.23	19.53	0.75		-0.286	-1.381
29)	0.23	19.51	0.73		-0.312	-1.384
30)	0.24	19.49	0.71		-0.338	-1.386
31)	0.25	19.48	0.70		-0.355	-1.388
32)	0.26	19.47	0.69		-0.370	-1.390
33)	0.27	19.46	0.67		-0.393	-1.392
34)	0.28	19.44	0.66		-0.411	-1.395
35)	0.28	19.44	0.66		-0.416	-1.397
36)	0.29	19.43	0.65		-0.435	-1.399
37)	0.30	19.42	0.64		-0.451	-1.401
38)	0.31	19.41	0.63		-0.465	-1.404
39)	0.32	19.40	0.61		-0.486	-1.406
40)	0.33	19.39	0.61		-0.496	-1.408
41)	0.33	19.38	0.60		-0.506	-1.410
42)	0.35	19.36	0.58		-0.543	-1.415
43)	0.37	19.35	0.56		-0.571	-1.419
44)	0.38	19.34	0.56		-0.589	-1.424
45)	0.40	19.32	0.54		-0.611	-1.428
46)	0.42	19.31	0.53		-0.629	-1.433
47)	0.43	19.30	0.52		-0.646	-1.437
48)	0.45	19.29	0.51		-0.666	-1.442
49)	0.47	19.29	0.51		-0.677	-1.446
50)	0.48	19.28	0.50		-0.689	-1.450
51)	0.50	19.27	0.49		-0.709	-1.455
52)	0.52	19.27	0.49		-0.722	-1.459
53)	0.53	19.26	0.48		-0.734	-1.464
54)	0.55	19.25	0.47		-0.749	-1.468
55)	0.57	19.25	0.47		-0.761	-1.473
56)	0.58	19.24	0.46		-0.774	-1.477
57)	0.60	19.24	0.46		-0.783	-1.482
58)	0.62	19.23	0.45		-0.796	-1.486
59)	0.63	19.23	0.45		-0.810	-1.491
60)	0.65	19.22	0.44		-0.816	-1.495
61)	0.67	19.22	0.43		-0.832	-1.500
62)	0.68	19.21	0.43		-0.839	-1.504
63)	0.70	19.20	0.42		-0.860	-1.509
64)	0.72	19.20	0.42		-0.860	-1.513
65)	0.73	19.20	0.42		-0.877	-1.517
66)	0.75	19.19	0.41		-0.884	-1.522
67)	0.77	19.19	0.41		-0.899	-1.526
68)	0.78	19.18	0.40		-0.914	-1.531
69)	0.80	19.18	0.40		-0.924	-1.535
70)	0.82	19.17	0.39		-0.939	-1.540
71)	0.83	19.17	0.39		-0.947	-1.544
72)	0.85	19.17	0.38		-0.955	-1.549
73)	0.87	19.16	0.38		-0.970	-1.553
74)	0.88	19.16	0.38		-0.981	-1.558

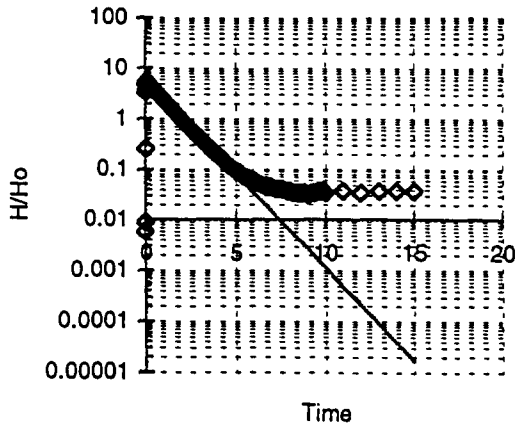
75)	0.90	19.15	0.37		-0.997	-1.562
76)	0.92	19.15	0.37		-0.997	-1.567
77)	0.93	19.14	0.36		-1.013	-1.571
78)	0.95	19.14	0.36		-1.022	-1.575
79)	0.97	19.14	0.36		-1.033	-1.580
80)	0.98	19.13	0.35		-1.041	-1.584
81)	1.00	19.13	0.35		-1.050	-1.589
82)	1.20	19.09	0.31		-1.184	-1.642
83)	1.40	19.06	0.28		-1.284	-1.696
84)	1.60	19.03	0.25		-1.390	-1.750
85)	1.80	19.01	0.23		-1.483	-1.803
86)	2.00	18.99	0.21		-1.570	-1.857
87)	2.20	18.97	0.19		-1.666	-1.910
88)	2.40	18.96	0.18		-1.737	-1.964
89)	2.60	18.94	0.16		-1.826	-2.017
90)	2.80	18.93	0.15		-1.890	-2.071
91)	3.00	18.92	0.14		-1.952	-2.125
92)	3.20	18.91	0.13		-2.048	-2.178
93)	3.40	18.90	0.12		-2.096	-2.232
94)	3.60	18.89	0.11		-2.180	-2.285
95)	3.80	18.88	0.10		-2.293	-2.339
96)	4.00	18.88	0.10		-2.333	-2.392
97)	4.20	18.87	0.09		-2.397	-2.446
98)	4.40	18.87	0.08		-2.465	-2.499
99)	4.60	18.86	0.08		-2.551	-2.553
100)	4.80	18.85	0.07		-2.631	-2.607
101)	5.00	18.85	0.07		-2.674	-2.660
102)	5.20	18.85	0.07		-2.718	-2.714
103)	5.40	18.84	0.06		-2.765	-2.767
104)	5.60	18.84	0.06		-2.882	-2.821
105)	5.80	18.84	0.06		-2.882	-2.874
106)	6.00	18.83	0.05		-2.996	-2.928
107)	6.20	18.83	0.05		-3.058	-2.982
108)	6.40	18.83	0.05		-3.058	-3.035
109)	6.60	18.82	0.04		-3.124	-3.089
110)	6.80	18.82	0.04		-3.124	-3.142
111)	7.00	18.82	0.04		-3.297	-3.196
112)	7.20	18.81	0.03		-3.381	-3.249
113)	7.40	18.82	0.04		-3.297	-3.303
114)	7.60	18.81	0.03		-3.381	-3.357
115)	7.80	18.81	0.03		-3.474	-3.410
116)	8.00	18.81	0.03		-3.576	-3.464
117)	8.20	18.81	0.03		-3.576	-3.517
118)	8.40	18.81	0.03		-3.576	-3.571
119)	8.60	18.81	0.02		-3.689	-3.624
120)	8.80	18.81	0.02		-3.689	-3.678
121)	9.00	18.80	0.02		-3.817	-3.732

122)	9.20	18.80	0.02		-3.817	-3.785
123)	9.40	18.80	0.02		-4.017	-3.839
124)	9.60	18.80	0.02		-4.017	-3.892
125)	9.80	18.80	0.02		-4.017	-3.946
126)	10.00	18.80	0.02		-4.017	-3.999
127)	11.00	18.80	0.02		-4.200	-4.267
128)	12.00	18.79	0.01		-4.423	-4.535
129)	13.00	18.79	0.01		-4.711	-4.803
130)	14.00	18.79	0.01		-4.711	-5.071
131)	15.00	18.78	0.00		-5.809	-5.339
132)	16.00	18.78	0.00		-5.809	-5.606
133)	17.00	18.78	0.00		-5.809	-5.874
134)	18.00	18.78	0.00		-5.809	-6.142
135)	19.00	18.78	0.00		-5.809	-6.410
136)	20.00	18.78	0.00		-5.809	-6.678
137)	21.00	18.78	0.00		-5.809	-6.946
138)	22.00	18.79	0.01		-5.116	-7.213
139)	23.00	18.78	0.00		-5.809	-7.481

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name:	RI/FS	Project No.:	2708
Client Name:	Northwest Natural Gas Company	Identification:	MW-3-56
Analysis By:	RBE		
Run Date:	3/28/96		

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	35.57	feet
Water Table Depth:	23.3	feet
Aquifer Thickness:	12	feet
Line Fit Starting No.:	10	Min 1 to
Line Fit Ending No.:	101	Max 131
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	1.28E+00	ft./day
Error of Fit:	0.099	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	23.31	0.01		-4.711	1.731
2)	0.01	23.31	0.01		-4.711	1.724
3)	0.02	23.31	0.01		-5.116	1.717
4)	0.03	23.31	0.01		-4.711	1.710
5)	0.03	23.55	0.25		-1.374	1.703
6)	0.04	28.08	4.78		1.564	1.696
7)	0.05	26.54	3.24		1.176	1.689
8)	0.06	27.17	3.87		1.354	1.682
9)	0.07	28.58	5.28		1.664	1.674
10)	0.08	28.86	5.56		1.716	1.667
11)	0.08	28.80	5.50		1.705	1.660
12)	0.09	28.72	5.42		1.691	1.653
13)	0.10	28.66	5.36		1.679	1.646
14)	0.11	28.64	5.34		1.675	1.639
15)	0.12	28.55	5.25		1.659	1.632
16)	0.13	28.54	5.24		1.656	1.625
17)	0.13	28.47	5.17		1.642	1.618
18)	0.14	28.44	5.14		1.636	1.611
19)	0.15	28.38	5.08		1.626	1.604
20)	0.16	28.34	5.04		1.618	1.597
21)	0.17	28.30	5.00		1.610	1.589
22)	0.18	28.26	4.96		1.601	1.582
23)	0.18	28.23	4.93		1.595	1.575
24)	0.19	28.16	4.86		1.582	1.568
25)	0.20	28.14	4.84		1.577	1.561
26)	0.21	28.10	4.80		1.569	1.554
27)	0.22	28.07	4.77		1.562	1.547

28)	0.23	28.03	4.73		1.555	1.540
29)	0.23	28.00	4.70		1.548	1.533
30)	0.24	27.97	4.67		1.541	1.526
31)	0.25	27.92	4.62		1.531	1.519
32)	0.26	27.90	4.60		1.525	1.512
33)	0.27	27.86	4.56		1.517	1.504
34)	0.28	27.83	4.53		1.510	1.497
35)	0.28	27.79	4.49		1.503	1.490
36)	0.29	27.76	4.46		1.495	1.483
37)	0.30	27.73	4.43		1.487	1.476
38)	0.31	27.69	4.39		1.479	1.469
39)	0.32	27.66	4.36		1.473	1.462
40)	0.33	27.63	4.33		1.465	1.455
41)	0.33	27.59	4.29		1.457	1.448
42)	0.35	27.53	4.23		1.442	1.434
43)	0.37	27.47	4.17		1.428	1.419
44)	0.38	27.41	4.11		1.412	1.405
45)	0.40	27.35	4.05		1.398	1.391
46)	0.42	27.29	3.99		1.383	1.377
47)	0.43	27.23	3.93		1.368	1.363
48)	0.45	27.17	3.87		1.354	1.349
49)	0.47	27.12	3.82		1.340	1.335
50)	0.48	27.07	3.77		1.326	1.320
51)	0.50	27.01	3.71		1.310	1.306
52)	0.52	26.95	3.65		1.294	1.292
53)	0.53	26.89	3.59		1.278	1.278
54)	0.55	26.83	3.53		1.261	1.264
55)	0.57	26.77	3.47		1.244	1.250
56)	0.58	26.71	3.41		1.226	1.235
57)	0.60	26.66	3.36		1.211	1.221
58)	0.62	26.61	3.31		1.196	1.207
59)	0.63	26.56	3.26		1.181	1.193
60)	0.65	26.51	3.21		1.167	1.179
61)	0.67	26.46	3.16		1.151	1.165
62)	0.68	26.42	3.12		1.137	1.150
63)	0.70	26.37	3.07		1.123	1.136
64)	0.72	26.33	3.03		1.107	1.122
65)	0.73	26.28	2.98		1.092	1.108
66)	0.75	26.24	2.94		1.077	1.094
67)	0.77	26.20	2.90		1.063	1.080
68)	0.78	26.15	2.85		1.048	1.065
69)	0.80	26.11	2.81		1.033	1.051
70)	0.82	26.07	2.77		1.018	1.037
71)	0.83	26.03	2.73		1.004	1.023
72)	0.85	25.99	2.69		0.990	1.009
73)	0.87	25.95	2.65		0.974	0.995
74)	0.88	25.91	2.61		0.960	0.980

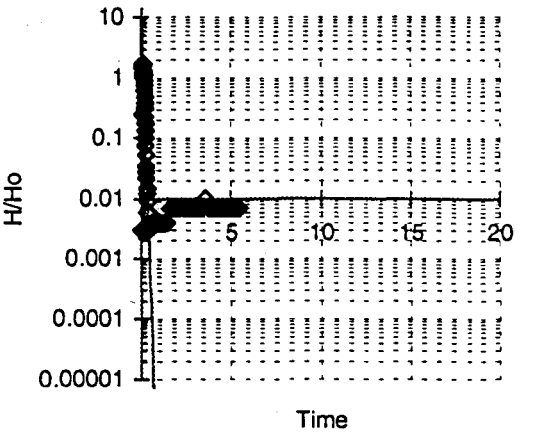
75)	0.90	25.87	2.57		0.945	0.966
76)	0.92	25.84	2.54		0.930	0.952
77)	0.93	25.80	2.50		0.917	0.938
78)	0.95	25.76	2.46		0.901	0.924
79)	0.97	25.73	2.43		0.887	0.910
80)	0.98	25.69	2.39		0.871	0.895
81)	1.00	25.66	2.36		0.858	0.881
82)	1.20	25.28	1.98		0.683	0.711
83)	1.40	24.97	1.67		0.510	0.541
84)	1.60	24.70	1.40		0.337	0.371
85)	1.80	24.47	1.17		0.154	0.201
86)	2.00	24.28	0.98		-0.020	0.031
87)	2.20	24.13	0.82		-0.192	-0.139
88)	2.40	24.00	0.70		-0.364	-0.309
89)	2.60	23.89	0.59		-0.536	-0.479
90)	2.80	23.79	0.49		-0.713	-0.648
91)	3.00	23.72	0.42		-0.875	-0.818
92)	3.20	23.65	0.35		-1.047	-0.988
93)	3.40	23.60	0.30		-1.204	-1.158
94)	3.60	23.56	0.26		-1.363	-1.328
95)	3.80	23.52	0.22		-1.523	-1.498
96)	4.00	23.49	0.19		-1.666	-1.668
97)	4.20	23.46	0.16		-1.808	-1.838
98)	4.40	23.44	0.14		-1.973	-2.008
99)	4.60	23.42	0.12		-2.120	-2.178
100)	4.80	23.41	0.11		-2.235	-2.348
101)	5.00	23.39	0.09		-2.364	-2.518
102)	5.20	23.39	0.09		-2.430	-2.688
103)	5.40	23.38	0.07		-2.590	-2.858
104)	5.60	23.37	0.07		-2.674	-3.028
105)	5.80	23.36	0.06		-2.765	-3.198
106)	6.00	23.36	0.06		-2.813	-3.368
107)	6.20	23.35	0.05		-2.937	-3.538
108)	6.40	23.35	0.05		-2.996	-3.708
109)	6.60	23.35	0.05		-3.058	-3.878
110)	6.80	23.34	0.04		-3.124	-4.048
111)	7.00	23.34	0.04		-3.124	-4.218
112)	7.20	23.34	0.04		-3.194	-4.388
113)	7.40	23.34	0.04		-3.194	-4.558
114)	7.60	23.34	0.04		-3.194	-4.728
115)	7.80	23.34	0.04		-3.297	-4.898
116)	8.00	23.34	0.04		-3.297	-5.068
117)	8.20	23.33	0.03		-3.381	-5.238
118)	8.40	23.33	0.03		-3.381	-5.408
119)	8.60	23.33	0.03		-3.381	-5.578
120)	8.80	23.33	0.03		-3.381	-5.748
121)	9.00	23.33	0.03		-3.474	-5.917

122)	9.20	23.33	0.03		-3.381	-6.087
123)	9.40	23.33	0.03		-3.381	-6.257
124)	9.60	23.34	0.04		-3.297	-6.427
125)	9.80	23.34	0.04		-3.297	-6.597
126)	10.00	23.33	0.03		-3.381	-6.767
127)	11.00	23.34	0.04		-3.297	-7.617
128)	12.00	23.33	0.03		-3.381	-8.467
129)	13.00	23.34	0.04		-3.297	-9.317
130)	14.00	23.34	0.04		-3.297	-10.167
131)	15.00	23.34	0.04		-3.297	-11.016

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-4-35
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	10.13	feet
Water Table Depth:	19.44	feet
Aquifer Thickness:	10.13	feet
Line Fit Starting No.:	14	Min 1 to
Line Fit Ending No.:	30	Max 103
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	2.59E+01	ft./day
Error of Fit:	0.809	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	19.44	0.00		-5.809	3.443
2)	0.01	19.44	0.00		-5.809	3.256
3)	0.02	19.44	0.00		-5.809	3.070
4)	0.03	19.44	0.00		-5.809	2.881
5)	0.03	19.44	0.00		-5.809	2.694
6)	0.04	19.44	0.00		-5.809	2.508
7)	0.05	19.44	0.00		-5.809	2.319
8)	0.06	19.44	0.00		-5.809	2.132
9)	0.07	19.69	0.25		-1.402	1.946
10)	0.08	20.61	1.17		0.159	1.757
11)	0.08	20.93	1.49		0.401	1.571
12)	0.09	21.09	1.65		0.498	1.384
13)	0.10	20.64	1.20		0.180	1.195
14)	0.11	21.13	1.69		0.525	1.009
15)	0.12	21.12	1.68		0.518	0.822
16)	0.13	21.12	1.68		0.518	0.633
17)	0.13	21.11	1.67		0.510	0.447
18)	0.14	21.07	1.63		0.490	0.260
19)	0.15	20.78	1.34		0.295	0.071
20)	0.16	20.56	1.12		0.115	-0.115
21)	0.17	20.35	0.91		-0.091	-0.302
22)	0.18	20.20	0.75		-0.281	-0.491
23)	0.18	20.04	0.60		-0.506	-0.677
24)	0.19	19.92	0.48		-0.728	-0.864
25)	0.20	19.82	0.38		-0.970	-1.052
26)	0.21	19.75	0.31		-1.174	-1.239
27)	0.22	19.66	0.22		-1.496	-1.426

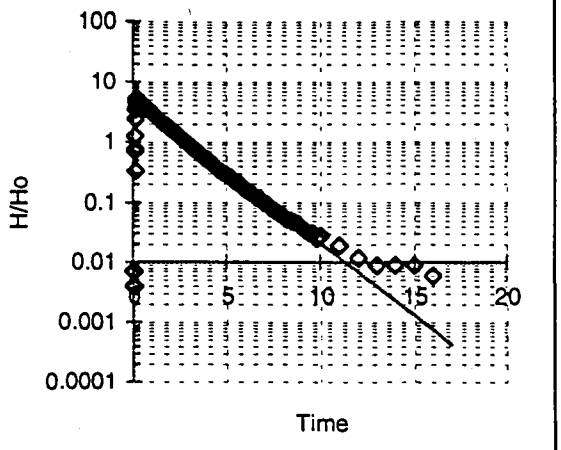
28)	0.23	19.62	0.18		-1.732	-1.614
29)	0.23	19.57	0.13		-2.025	-1.801
30)	0.24	19.54	0.10		-2.293	-1.987
31)	0.25	19.52	0.07		-2.590	-2.176
32)	0.26	19.49	0.05		-2.937	-2.363
33)	0.27	19.47	0.03		-3.381	-2.549
34)	0.28	19.47	0.03		-3.576	-2.738
35)	0.28	19.46	0.02		-3.817	-2.925
36)	0.29	19.46	0.01		-4.200	-3.111
37)	0.30	19.45	0.01		-4.423	-3.300
38)	0.31	19.45	0.01		-4.423	-3.487
39)	0.32	19.45	0.01		-5.116	-3.673
40)	0.33	19.45	0.01		-4.711	-3.862
41)	0.33	19.45	0.01		-5.116	-4.048
42)	0.35	19.44	0.00		-5.809	-4.424
43)	0.37	19.44	0.00		-5.809	-4.797
44)	0.38	19.45	0.01		-5.116	-5.172
45)	0.40	19.45	0.01		-5.116	-5.548
46)	0.42	19.44	0.00		-	-5.921
47)	0.43	19.44	0.00		-	-6.296
48)	0.45	19.44	0.00		-	-6.671
49)	0.47	19.44	0.00		-	-7.044
50)	0.48	19.44	0.00		-	-7.420
51)	0.50	19.44	0.00		-	-7.795
52)	0.52	19.44	0.00		-	-8.168
53)	0.53	19.44	0.00		-	-8.544
54)	0.55	19.44	0.00		-	-8.919
55)	0.57	19.44	0.00		-5.521	-9.292
56)	0.58	19.44	0.00		-	-9.667
57)	0.60	19.44	0.00		-5.521	-10.043
58)	0.62	19.44	0.00		-5.521	-10.416
59)	0.63	19.44	0.00		-5.521	-10.791
60)	0.65	19.44	0.00		-5.521	-11.167
61)	0.67	19.44	0.00		-5.521	-11.540
62)	0.68	19.44	0.00		-5.521	-11.915
63)	0.70	19.44	0.00		-5.521	-12.290
64)	0.72	19.44	0.00		-5.521	-12.663
65)	0.73	19.44	0.00		-5.521	-13.039
66)	0.75	19.44	0.00		-5.521	-13.414
67)	0.77	19.44	0.00		-5.521	-13.787
68)	0.78	19.44	0.00		-5.521	-14.163
69)	0.80	19.44	0.00		-5.521	-14.538
70)	0.82	19.44	0.00		-5.521	-14.911
71)	0.83	19.44	0.00		-5.521	-15.286
72)	0.85	19.44	0.00		-5.521	-15.662
73)	0.87	19.44	0.00		-5.521	-16.035
74)	0.88	19.44	0.00		-5.521	-16.410

75)	0.90	19.44	0.00		-5.521	-16.785
76)	0.92	19.44	0.00		-5.521	-17.159
77)	0.93	19.44	0.00		-5.521	-17.534
78)	0.95	19.44	0.00		-5.521	-17.909
79)	0.97	19.44	0.00		-5.521	-18.282
80)	0.98	19.44	0.00		-5.521	-18.658
81)	1.00	19.44	0.00		-5.521	-19.033
82)	1.20	19.44	0.00		-5.521	-23.528
83)	1.40	19.44	0.00		-5.521	-28.023
84)	1.60	19.43	0.01		-4.962	-32.519
85)	1.80	19.43	0.01		-4.962	-37.014
86)	2.00	19.43	0.01		-4.962	-41.509
87)	2.20	19.43	0.01		-4.962	-46.004
88)	2.40	19.43	0.01		-4.962	-50.499
89)	2.60	19.43	0.01		-4.962	-54.994
90)	2.80	19.43	0.01		-4.962	-59.489
91)	3.00	19.43	0.01		-4.962	-63.985
92)	3.20	19.43	0.01		-4.962	-68.480
93)	3.40	19.43	0.01		-4.962	-72.975
94)	3.60	19.43	0.01		-4.605	-77.470
95)	3.80	19.43	0.01		-4.962	-81.965
96)	4.00	19.43	0.01		-4.962	-86.460
97)	4.20	19.43	0.01		-4.962	-90.956
98)	4.40	19.43	0.01		-4.962	-95.451
99)	4.60	19.43	0.01		-4.962	-99.946
100)	4.80	19.43	0.01		-4.962	-104.441
101)	5.00	19.43	0.01		-4.962	-108.936
102)	5.20	19.43	0.01		-4.962	-113.431
103)	5.40	19.43	0.01		-4.962	-117.926

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-4-57
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	40.81	feet
Water Table Depth:	19.02	feet
Aquifer Thickness:	30	feet
Line Fit Starting No.:	23	Min 1 to
Line Fit Ending No.:	128	Max 133
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	8.56E-01	ft./day
Error of Fit:	1.355	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	19.02	0.00		-5.521	1.682
2)	0.01	19.01	0.01		-4.962	1.677
3)	0.02	19.02	0.00		-4.962	1.673
4)	0.03	19.02	0.00		-4.962	1.668
5)	0.03	19.02	0.00		-5.521	1.664
6)	0.04	19.02	0.00		-5.521	1.659
7)	0.05	19.01	0.01		-4.962	1.654
8)	0.06	19.01	0.01		-4.962	1.650
9)	0.07	19.02	0.00		-5.521	1.645
10)	0.08	19.02	0.00		-5.521	1.640
11)	0.08	19.73	0.71		-0.344	1.636
12)	0.09	20.29	1.27		0.241	1.631
13)	0.10	19.73	0.71		-0.340	1.626
14)	0.11	18.26	0.76		-0.269	1.622
15)	0.12	19.36	0.34		-1.094	1.617
16)	0.13	21.39	2.37		0.863	1.613
17)	0.13	21.45	2.43		0.886	1.608
18)	0.14	22.40	3.38		1.217	1.603
19)	0.15	22.98	3.96		1.376	1.599
20)	0.16	23.62	4.60		1.526	1.594
21)	0.17	23.80	4.78		1.564	1.590
22)	0.18	24.24	5.22		1.653	1.585
23)	0.18	24.37	5.35		1.677	1.580
24)	0.19	24.32	5.30		1.668	1.576
25)	0.20	24.30	5.28		1.665	1.571
26)	0.21	24.24	5.22		1.653	1.566
27)	0.22	24.21	5.19		1.647	1.562

28)	0.23	24.18	5.16		1.641	1.557
29)	0.23	24.16	5.14		1.636	1.552
30)	0.24	24.13	5.11		1.632	1.548
31)	0.25	24.10	5.08		1.625	1.543
32)	0.26	24.08	5.06		1.621	1.539
33)	0.27	24.04	5.02		1.612	1.534
34)	0.28	23.98	4.96		1.601	1.529
35)	0.28	23.96	4.94		1.597	1.525
36)	0.29	23.92	4.90		1.589	1.520
37)	0.30	23.90	4.88		1.584	1.515
38)	0.31	23.87	4.85		1.578	1.511
39)	0.32	23.83	4.81		1.570	1.506
40)	0.33	23.83	4.81		1.570	1.502
41)	0.33	23.77	4.75		1.559	1.497
42)	0.35	23.73	4.71		1.549	1.488
43)	0.37	23.67	4.65		1.537	1.478
44)	0.38	23.61	4.59		1.524	1.469
45)	0.40	23.56	4.54		1.514	1.460
46)	0.42	23.51	4.49		1.502	1.451
47)	0.43	23.46	4.44		1.490	1.441
48)	0.45	23.42	4.40		1.480	1.432
49)	0.47	23.36	4.34		1.468	1.423
50)	0.48	23.31	4.29		1.457	1.414
51)	0.50	23.26	4.24		1.446	1.404
52)	0.52	23.21	4.19		1.433	1.395
53)	0.53	23.18	4.16		1.424	1.386
54)	0.55	23.12	4.10		1.410	1.377
55)	0.57	23.07	4.05		1.400	1.367
56)	0.58	23.03	4.01		1.389	1.358
57)	0.60	22.99	3.97		1.378	1.349
58)	0.62	22.94	3.92		1.366	1.340
59)	0.63	22.90	3.88		1.355	1.330
60)	0.65	22.86	3.84		1.344	1.321
61)	0.67	22.81	3.79		1.333	1.312
62)	0.68	22.77	3.75		1.322	1.303
63)	0.70	22.73	3.71		1.311	1.293
64)	0.72	22.69	3.67		1.300	1.284
65)	0.73	22.65	3.63		1.289	1.275
66)	0.75	22.61	3.59		1.278	1.266
67)	0.77	22.57	3.55		1.266	1.256
68)	0.78	22.53	3.51		1.256	1.247
69)	0.80	22.49	3.47		1.245	1.238
70)	0.82	22.46	3.44		1.235	1.229
71)	0.83	22.42	3.40		1.223	1.219
72)	0.85	22.38	3.36		1.212	1.210
73)	0.87	22.35	3.33		1.202	1.201
74)	0.88	22.31	3.29		1.190	1.192

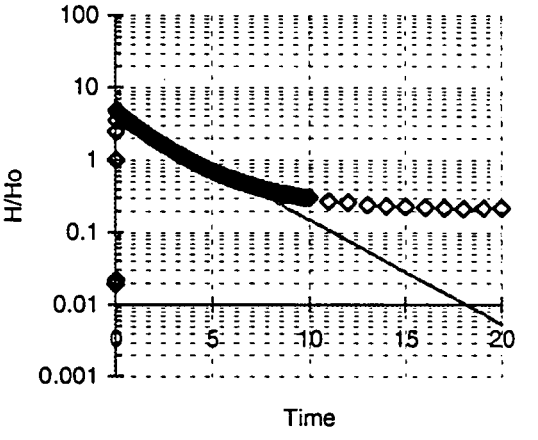
75)	0.90	22.27	3.25		1.180	1.182
76)	0.92	22.24	3.22		1.169	1.173
77)	0.93	22.20	3.18		1.158	1.164
78)	0.95	22.17	3.15		1.147	1.155
79)	0.97	22.14	3.12		1.137	1.145
80)	0.98	22.10	3.08		1.126	1.136
81)	1.00	22.07	3.05		1.115	1.127
82)	1.20	21.69	2.67		0.982	1.016
83)	1.40	21.38	2.36		0.859	0.905
84)	1.60	21.11	2.09		0.737	0.794
85)	1.80	20.87	1.85		0.616	0.683
86)	2.00	20.66	1.64		0.497	0.572
87)	2.20	20.48	1.46		0.376	0.461
88)	2.40	20.31	1.29		0.253	0.350
89)	2.60	20.16	1.14		0.130	0.239
90)	2.80	20.03	1.01		0.013	0.128
91)	3.00	19.93	0.91		-0.100	0.017
92)	3.20	19.82	0.80		-0.222	-0.094
93)	3.40	19.73	0.71		-0.340	-0.205
94)	3.60	19.66	0.64		-0.453	-0.316
95)	3.80	19.58	0.56		-0.574	-0.427
96)	4.00	19.53	0.51		-0.681	-0.538
97)	4.20	19.47	0.45		-0.801	-0.649
98)	4.40	19.42	0.40		-0.911	-0.760
99)	4.60	19.37	0.35		-1.056	-0.871
100)	4.80	19.34	0.32		-1.143	-0.982
101)	5.00	19.31	0.29		-1.245	-1.093
102)	5.20	19.28	0.26		-1.351	-1.204
103)	5.40	19.25	0.23		-1.478	-1.315
104)	5.60	19.23	0.21		-1.565	-1.426
105)	5.80	19.20	0.18		-1.732	-1.537
106)	6.00	19.18	0.16		-1.808	-1.648
107)	6.20	19.17	0.15		-1.911	-1.759
108)	6.40	19.16	0.14		-1.995	-1.870
109)	6.60	19.14	0.12		-2.120	-1.982
110)	6.80	19.14	0.12		-2.146	-2.093
111)	7.00	19.12	0.10		-2.323	-2.204
112)	7.20	19.11	0.09		-2.397	-2.315
113)	7.40	19.10	0.08		-2.538	-2.426
114)	7.60	19.09	0.07		-2.631	-2.537
115)	7.80	19.09	0.07		-2.718	-2.648
116)	8.00	19.08	0.06		-2.813	-2.759
117)	8.20	19.07	0.05		-2.937	-2.870
118)	8.40	19.07	0.05		-2.996	-2.981
119)	8.60	19.07	0.05		-3.058	-3.092
120)	8.80	19.06	0.04		-3.124	-3.203
121)	9.00	19.06	0.04		-3.270	-3.314

122)	9.20	19.05	0.03		-3.381	-3.425
123)	9.40	19.05	0.03		-3.474	-3.536
124)	9.60	19.05	0.03		-3.474	-3.647
125)	9.80	19.05	0.03		-3.689	-3.758
126)	10.00	19.05	0.03		-3.576	-3.869
127)	11.00	19.04	0.02		-3.963	-4.424
128)	12.00	19.03	0.01		-4.423	-4.979
129)	13.00	19.03	0.01		-4.711	-5.534
130)	14.00	19.03	0.01		-4.711	-6.089
131)	15.00	19.03	0.01		-4.711	-6.644
132)	16.00	19.03	0.01		-5.809	-7.199
133)	17.00	19.02	0.00		-5.809	-7.754

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-5-32
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	22.35	feet
Water Table Depth:	12.38	feet
Aquifer Thickness:	22.35	feet
Line Fit Starting No.:	37	Min 1 to
Line Fit Ending No.:	116	Max 136
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	4.61E-01	ft./day
Error of Fit:	0.629	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	12.40	0.02		-3.963	1.435
2)	0.01	12.40	0.02		-3.963	1.432
3)	0.02	12.40	0.02		-3.817	1.429
4)	0.03	13.38	1.00		0.002	1.426
5)	0.03	14.85	2.47		0.904	1.424
6)	0.04	14.88	2.50		0.917	1.421
7)	0.05	15.92	3.54		1.263	1.418
8)	0.06	17.25	4.87		1.584	1.415
9)	0.07	17.15	4.77		1.563	1.413
10)	0.08	17.15	4.77		1.562	1.410
11)	0.08	17.09	4.71		1.550	1.407
12)	0.09	17.03	4.65		1.537	1.404
13)	0.10	17.01	4.63		1.533	1.401
14)	0.11	16.97	4.59		1.524	1.399
15)	0.12	16.94	4.56		1.517	1.396
16)	0.13	16.90	4.52		1.508	1.393
17)	0.13	16.89	4.51		1.507	1.390
18)	0.14	16.86	4.48		1.501	1.388
19)	0.15	16.84	4.46		1.495	1.385
20)	0.16	16.82	4.44		1.490	1.382
21)	0.17	16.79	4.41		1.483	1.379
22)	0.18	16.77	4.39		1.478	1.376
23)	0.18	16.74	4.36		1.473	1.374
24)	0.19	16.73	4.35		1.470	1.371
25)	0.20	16.71	4.33		1.465	1.368
26)	0.21	16.69	4.31		1.460	1.365
27)	0.22	16.67	4.29		1.457	1.362

28)	0.23	16.65	4.27		1.452	1.360
29)	0.23	16.63	4.25		1.448	1.357
30)	0.24	16.61	4.23		1.443	1.354
31)	0.25	16.60	4.22		1.439	1.351
32)	0.26	16.58	4.20		1.436	1.349
33)	0.27	16.56	4.18		1.431	1.346
34)	0.28	16.55	4.17		1.427	1.343
35)	0.28	16.53	4.15		1.422	1.340
36)	0.29	16.50	4.12		1.417	1.337
37)	0.30	16.49	4.11		1.414	1.335
38)	0.31	16.48	4.10		1.410	1.332
39)	0.32	16.46	4.08		1.407	1.329
40)	0.33	16.45	4.07		1.403	1.326
41)	0.33	16.43	4.05		1.399	1.324
42)	0.35	16.40	4.02		1.392	1.318
43)	0.37	16.37	3.99		1.383	1.312
44)	0.38	16.35	3.97		1.378	1.307
45)	0.40	16.31	3.93		1.369	1.301
46)	0.42	16.28	3.90		1.361	1.296
47)	0.43	16.25	3.87		1.353	1.290
48)	0.45	16.22	3.84		1.346	1.285
49)	0.47	16.19	3.81		1.338	1.279
50)	0.48	16.16	3.78		1.328	1.273
51)	0.50	16.12	3.74		1.320	1.268
52)	0.52	16.09	3.71		1.311	1.262
53)	0.53	16.07	3.69		1.305	1.257
54)	0.55	16.04	3.66		1.297	1.251
55)	0.57	16.01	3.63		1.288	1.246
56)	0.58	15.98	3.60		1.281	1.240
57)	0.60	15.96	3.58		1.274	1.234
58)	0.62	15.92	3.54		1.265	1.229
59)	0.63	15.90	3.52		1.257	1.223
60)	0.65	15.87	3.49		1.250	1.218
61)	0.67	15.84	3.46		1.241	1.212
62)	0.68	15.82	3.44		1.235	1.207
63)	0.70	15.79	3.41		1.227	1.201
64)	0.72	15.77	3.39		1.219	1.196
65)	0.73	15.74	3.36		1.212	1.190
66)	0.75	15.71	3.33		1.204	1.184
67)	0.77	15.68	3.30		1.194	1.179
68)	0.78	15.65	3.27		1.184	1.173
69)	0.80	15.62	3.24		1.176	1.168
70)	0.82	15.60	3.22		1.168	1.162
71)	0.83	15.58	3.20		1.162	1.157
72)	0.85	15.55	3.17		1.154	1.151
73)	0.87	15.52	3.14		1.145	1.145
74)	0.88	15.50	3.12		1.137	1.140

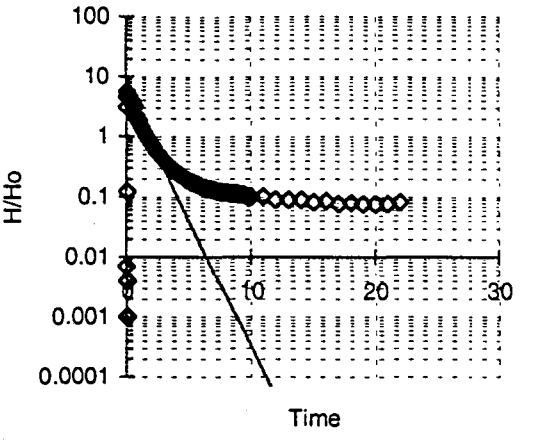
75)	0.90	15.47	3.09		1.129	1.134
76)	0.92	15.45	3.07		1.122	1.129
77)	0.93	15.43	3.05		1.114	1.123
78)	0.95	15.41	3.03		1.108	1.118
79)	0.97	15.38	3.00		1.099	1.112
80)	0.98	15.36	2.98		1.093	1.106
81)	1.00	15.34	2.96		1.085	1.101
82)	1.20	15.09	2.71		0.997	1.034
83)	1.40	14.87	2.49		0.913	0.967
84)	1.60	14.67	2.29		0.829	0.901
85)	1.80	14.49	2.11		0.747	0.834
86)	2.00	14.33	1.95		0.666	0.767
87)	2.20	14.18	1.80		0.586	0.700
88)	2.40	14.04	1.66		0.507	0.633
89)	2.60	13.92	1.54		0.434	0.567
90)	2.80	13.82	1.44		0.362	0.500
91)	3.00	13.71	1.33		0.286	0.433
92)	3.20	13.61	1.23		0.205	0.366
93)	3.40	13.54	1.16		0.148	0.300
94)	3.60	13.46	1.08		0.078	0.233
95)	3.80	13.40	1.02		0.017	0.166
96)	4.00	13.33	0.95		-0.050	0.099
97)	4.20	13.27	0.89		-0.112	0.032
98)	4.40	13.22	0.84		-0.171	-0.034
99)	4.60	13.17	0.79		-0.233	-0.101
100)	4.80	13.13	0.75		-0.286	-0.168
101)	5.00	13.09	0.71		-0.347	-0.235
102)	5.20	13.06	0.67		-0.393	-0.301
103)	5.40	13.02	0.64		-0.446	-0.368
104)	5.60	12.99	0.61		-0.491	-0.435
105)	5.80	12.96	0.58		-0.545	-0.502
106)	6.00	12.94	0.56		-0.583	-0.569
107)	6.20	12.92	0.53		-0.625	-0.635
108)	6.40	12.89	0.51		-0.679	-0.702
109)	6.60	12.87	0.49		-0.705	-0.769
110)	6.80	12.84	0.46		-0.770	-0.836
111)	7.00	12.83	0.45		-0.799	-0.902
112)	7.20	12.81	0.43		-0.849	-0.969
113)	7.40	12.79	0.41		-0.887	-1.036
114)	7.60	12.78	0.40		-0.911	-1.103
115)	7.80	12.76	0.38		-0.968	-1.170
116)	8.00	12.76	0.38		-0.976	-1.236
117)	8.20	12.74	0.36		-1.027	-1.303
118)	8.40	12.74	0.36		-1.027	-1.370
119)	8.60	12.72	0.34		-1.073	-1.437
120)	8.80	12.72	0.34		-1.091	-1.503
121)	9.00	12.71	0.33		-1.100	-1.570

122)	9.20	12.70	0.32		-1.130	-1.637
123)	9.40	12.69	0.31		-1.162	-1.704
124)	9.60	12.69	0.31		-1.181	-1.771
125)	9.80	12.68	0.30		-1.201	-1.837
126)	10.00	12.68	0.30		-1.191	-1.904
127)	11.00	12.65	0.27		-1.302	-2.238
128)	12.00	12.64	0.26		-1.347	-2.572
129)	13.00	12.62	0.24		-1.411	-2.906
130)	14.00	12.61	0.23		-1.452	-3.240
131)	15.00	12.61	0.23		-1.478	-3.574
132)	16.00	12.61	0.23		-5.809	-3.908
133)	17.00	12.60	0.22		-5.809	-4.241
134)	18.00	12.60	0.22		-1.537	-4.575
135)	19.00	12.60	0.22		-1.523	-4.909
136)	20.00	12.60	0.22		-1.523	-5.243

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-6-61
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	38.5	feet
Water Table Depth:	22.45	feet
Aquifer Thickness:	30	feet
Line Fit Starting No.:	12	Min 1 to
Line Fit Ending No.:	91	Max 138
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	1.49E+00	ft./day
Error of Fit:	1.096	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	22.45	0.00		-6.908	1.689
2)	0.01	22.45	0.00		-5.521	1.681
3)	0.02	22.46	0.01		-4.962	1.673
4)	0.03	22.45	0.00		-5.521	1.665
5)	0.03	22.45	0.00		-6.908	1.657
6)	0.04	22.57	0.12		-2.087	1.649
7)	0.05	25.54	3.09		1.128	1.641
8)	0.06	28.07	5.62		1.726	1.633
9)	0.07	26.93	4.48		1.499	1.625
10)	0.08	27.07	4.62		1.531	1.616
11)	0.08	27.30	4.85		1.579	1.608
12)	0.09	27.33	4.88		1.585	1.600
13)	0.10	27.26	4.81		1.570	1.592
14)	0.11	27.26	4.81		1.570	1.584
15)	0.12	27.26	4.81		1.570	1.576
16)	0.13	27.25	4.80		1.569	1.568
17)	0.13	27.25	4.80		1.569	1.560
18)	0.14	27.25	4.80		1.569	1.552
19)	0.15	27.25	4.80		1.568	1.543
20)	0.16	27.25	4.80		1.568	1.535
21)	0.17	27.24	4.79		1.567	1.527
22)	0.18	27.24	4.79		1.567	1.519
23)	0.18	27.24	4.79		1.567	1.511
24)	0.19	27.24	4.79		1.567	1.503
25)	0.20	27.24	4.79		1.566	1.495
26)	0.21	27.24	4.79		1.566	1.487
27)	0.22	27.24	4.79		1.565	1.479

28)	0.23	27.23	4.78		1.564	1.471
29)	0.23	26.68	4.23		1.443	1.462
30)	0.24	26.71	4.26		1.449	1.454
31)	0.25	26.71	4.26		1.450	1.446
32)	0.26	26.71	4.26		1.449	1.438
33)	0.27	26.71	4.26		1.450	1.430
34)	0.28	26.71	4.26		1.449	1.422
35)	0.28	26.71	4.26		1.449	1.414
36)	0.29	26.71	4.26		1.449	1.406
37)	0.30	26.71	4.26		1.449	1.398
38)	0.31	26.70	4.25		1.448	1.389
39)	0.32	26.70	4.25		1.447	1.381
40)	0.33	26.70	4.25		1.447	1.373
41)	0.33	26.70	4.25		1.446	1.365
42)	0.35	26.70	4.25		1.446	1.349
43)	0.37	26.65	4.20		1.435	1.333
44)	0.38	26.55	4.10		1.411	1.316
45)	0.40	26.55	4.10		1.410	1.300
46)	0.42	26.43	3.98		1.382	1.284
47)	0.43	26.43	3.98		1.382	1.268
48)	0.45	26.28	3.83		1.342	1.252
49)	0.47	26.24	3.79		1.333	1.235
50)	0.48	26.25	3.80		1.334	1.219
51)	0.50	26.12	3.67		1.299	1.203
52)	0.52	26.12	3.67		1.300	1.187
53)	0.53	25.98	3.53		1.261	1.171
54)	0.55	25.99	3.54		1.264	1.154
55)	0.57	25.99	3.54		1.264	1.138
56)	0.58	25.60	3.15		1.147	1.122
57)	0.60	25.60	3.15		1.148	1.106
58)	0.62	25.60	3.15		1.148	1.089
59)	0.63	25.60	3.15		1.146	1.073
60)	0.65	25.60	3.15		1.146	1.057
61)	0.67	25.59	3.14		1.145	1.041
62)	0.68	25.59	3.14		1.144	1.025
63)	0.70	24.78	2.33		0.845	1.008
64)	0.72	24.74	2.29		0.829	0.992
65)	0.73	24.70	2.25		0.812	0.976
66)	0.75	24.65	2.20		0.788	0.960
67)	0.77	24.61	2.16		0.771	0.943
68)	0.78	24.58	2.13		0.755	0.927
69)	0.80	24.54	2.09		0.737	0.911
70)	0.82	24.50	2.05		0.720	0.895
71)	0.83	24.47	2.02		0.704	0.879
72)	0.85	24.44	1.99		0.687	0.862
73)	0.87	24.41	1.96		0.671	0.846
74)	0.88	24.37	1.92		0.653	0.830

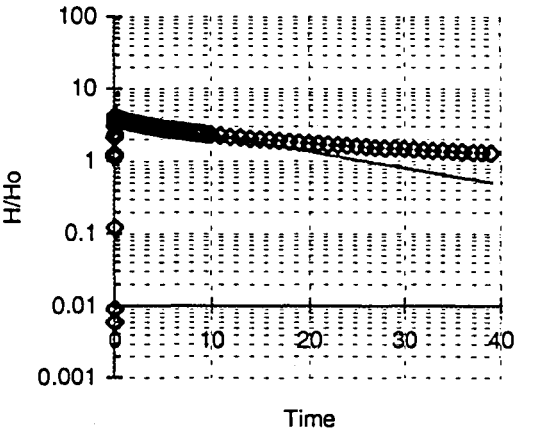
75)	0.90	24.34	1.89		0.638	0.814
76)	0.92	24.31	1.86		0.621	0.798
77)	0.93	24.28	1.83		0.606	0.781
78)	0.95	24.25	1.80		0.590	0.765
79)	0.97	24.23	1.78		0.574	0.749
80)	0.98	24.20	1.75		0.558	0.733
81)	1.00	24.17	1.72		0.542	0.716
82)	1.20	23.88	1.43		0.356	0.522
83)	1.40	23.65	1.20		0.182	0.327
84)	1.60	23.47	1.02		0.020	0.132
85)	1.80	23.32	0.87		-0.138	-0.062
86)	2.00	23.20	0.75		-0.282	-0.257
87)	2.20	23.10	0.65		-0.431	-0.451
88)	2.40	23.02	0.57		-0.555	-0.646
89)	2.60	22.95	0.50		-0.685	-0.841
90)	2.80	22.90	0.45		-0.792	-1.035
91)	3.00	22.85	0.40		-0.909	-1.230
92)	3.20	22.82	0.37		-1.008	-1.424
93)	3.40	22.78	0.33		-1.109	-1.619
94)	3.60	22.76	0.31		-1.187	-1.814
95)	3.80	22.73	0.28		-1.287	-2.008
96)	4.00	22.71	0.26		-1.347	-2.203
97)	4.20	22.69	0.24		-1.423	-2.398
98)	4.40	22.68	0.23		-1.474	-2.592
99)	4.60	22.66	0.21		-1.546	-2.787
100)	4.80	22.65	0.20		-1.625	-2.981
101)	5.00	22.64	0.19		-1.671	-3.176
102)	5.20	22.63	0.18		-1.726	-3.371
103)	5.40	22.62	0.17		-1.760	-3.565
104)	5.60	22.62	0.17		-1.796	-3.760
105)	5.80	22.61	0.16		-1.820	-3.955
106)	6.00	22.60	0.15		-1.877	-4.149
107)	6.20	22.59	0.14		-1.945	-4.344
108)	6.40	22.59	0.14		-1.945	-4.538
109)	6.60	22.59	0.14		-1.988	-4.733
110)	6.80	22.59	0.14		-1.988	-4.928
111)	7.00	22.58	0.13		-2.010	-5.122
112)	7.20	22.58	0.13		-2.033	-5.317
113)	7.40	22.57	0.12		-2.087	-5.512
114)	7.60	22.57	0.12		-2.087	-5.706
115)	7.80	22.57	0.12		-2.137	-5.901
116)	8.00	22.57	0.12		-2.137	-6.095
117)	8.20	22.57	0.12		-2.137	-6.290
118)	8.40	22.57	0.12		-2.163	-6.485
119)	8.60	22.57	0.12		-2.163	-6.679
120)	8.80	22.57	0.12		-2.163	-6.874
121)	9.00	22.56	0.11		-2.189	-7.068

122)	9.20	22.56	0.11		-2.216	-7.263
123)	9.40	22.56	0.11		-2.216	-7.458
124)	9.60	22.56	0.11		-2.254	-7.652
125)	9.80	22.55	0.10		-2.313	-7.847
126)	10.00	22.55	0.10		-2.283	-8.042
127)	11.00	22.55	0.10		-2.283	-9.015
128)	12.00	22.54	0.09		-2.408	-9.988
129)	13.00	22.54	0.09		-2.408	-10.961
130)	14.00	22.54	0.09		-2.408	-11.934
131)	15.00	22.53	0.08		-2.489	-12.907
132)	16.00	22.54	0.09		-2.453	-13.880
133)	17.00	22.53	0.08		-2.564	-14.853
134)	18.00	22.53	0.08		-2.526	-15.826
135)	19.00	22.53	0.08		-2.564	-16.800
136)	20.00	22.53	0.08		-2.564	-17.773
137)	21.00	22.53	0.08		-2.564	-18.746
138)	22.00	22.53	0.08		-2.489	-19.719

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-8-29
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	15.94	feet
Water Table Depth:	15.65	feet
Aquifer Thickness:	15.94	feet
Line Fit Starting No.:	37	Min 1 to
Line Fit Ending No.:	131	Max 155
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	6.72E-02	ft./day
Error of Fit:	0.109	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	15.66	0.01		-5.116	1.345
2)	0.01	15.66	0.01		-4.711	1.345
3)	0.02	15.66	0.01		-4.711	1.344
4)	0.03	15.66	0.01		-4.711	1.344
5)	0.03	15.66	0.01		-5.116	1.344
6)	0.04	15.66	0.01		-5.116	1.343
7)	0.05	15.66	0.01		-4.711	1.343
8)	0.06	15.77	0.12		-2.120	1.342
9)	0.07	16.81	1.16		0.147	1.342
10)	0.08	16.93	1.28		0.245	1.341
11)	0.08	17.79	2.14		0.762	1.341
12)	0.09	18.69	3.04		1.113	1.340
13)	0.10	18.05	2.40		0.873	1.340
14)	0.11	19.15	3.50		1.253	1.340
15)	0.12	19.46	3.81		1.336	1.339
16)	0.13	19.89	4.24		1.443	1.339
17)	0.13	19.78	4.13		1.419	1.338
18)	0.14	19.91	4.26		1.449	1.338
19)	0.15	19.75	4.10		1.411	1.337
20)	0.16	19.77	4.12		1.417	1.337
21)	0.17	19.78	4.13		1.419	1.337
22)	0.18	19.74	4.09		1.408	1.336
23)	0.18	19.74	4.09		1.408	1.336
24)	0.19	19.74	4.09		1.408	1.335
25)	0.20	19.72	4.07		1.403	1.335
26)	0.21	19.69	4.04		1.397	1.334
27)	0.22	19.71	4.06		1.400	1.334

28)	0.23	19.70	4.05		1.397	1.333
29)	0.23	19.69	4.04		1.397	1.333
30)	0.24	19.73	4.08		1.406	1.333
31)	0.25	19.66	4.01		1.389	1.332
32)	0.26	19.66	4.01		1.389	1.332
33)	0.27	19.65	4.00		1.386	1.331
34)	0.28	19.65	4.00		1.386	1.331
35)	0.28	19.64	3.99		1.384	1.330
36)	0.29	19.61	3.96		1.375	1.330
37)	0.30	19.63	3.98		1.380	1.330
38)	0.31	19.62	3.97		1.379	1.329
39)	0.32	19.61	3.96		1.376	1.329
40)	0.33	19.60	3.95		1.374	1.328
41)	0.33	19.59	3.94		1.371	1.328
42)	0.35	19.58	3.93		1.368	1.327
43)	0.37	19.58	3.93		1.368	1.326
44)	0.38	19.56	3.91		1.364	1.325
45)	0.40	19.54	3.89		1.359	1.324
46)	0.42	19.53	3.88		1.356	1.323
47)	0.43	19.52	3.87		1.354	1.323
48)	0.45	19.51	3.86		1.351	1.322
49)	0.47	19.50	3.85		1.349	1.321
50)	0.48	19.49	3.84		1.346	1.320
51)	0.50	19.48	3.83		1.344	1.319
52)	0.52	19.48	3.83		1.342	1.318
53)	0.53	19.47	3.82		1.340	1.317
54)	0.55	19.46	3.81		1.338	1.316
55)	0.57	19.45	3.80		1.336	1.316
56)	0.58	19.44	3.79		1.333	1.315
57)	0.60	19.44	3.79		1.331	1.314
58)	0.62	19.43	3.78		1.330	1.313
59)	0.63	19.42	3.77		1.327	1.312
60)	0.65	19.41	3.76		1.325	1.311
61)	0.67	19.41	3.76		1.324	1.310
62)	0.68	19.40	3.75		1.322	1.310
63)	0.70	19.39	3.74		1.320	1.309
64)	0.72	19.39	3.74		1.319	1.308
65)	0.73	19.38	3.73		1.316	1.307
66)	0.75	19.37	3.72		1.315	1.306
67)	0.77	19.37	3.72		1.313	1.305
68)	0.78	19.36	3.71		1.311	1.304
69)	0.80	19.35	3.70		1.309	1.303
70)	0.82	19.35	3.70		1.309	1.303
71)	0.83	19.34	3.69		1.307	1.302
72)	0.85	19.34	3.69		1.305	1.301
73)	0.87	19.33	3.68		1.303	1.300
74)	0.88	19.33	3.68		1.302	1.299

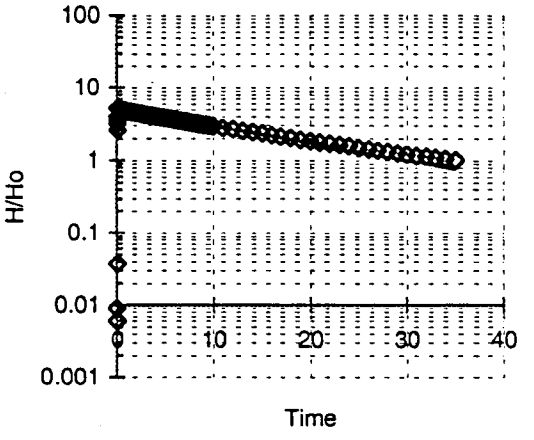
75)	0.90	19.32	3.67		1.301	1.298
76)	0.92	19.31	3.66		1.298	1.297
77)	0.93	19.31	3.66		1.297	1.296
78)	0.95	19.30	3.65		1.296	1.296
79)	0.97	19.30	3.65		1.294	1.295
80)	0.98	19.29	3.64		1.293	1.294
81)	1.00	19.28	3.63		1.290	1.293
82)	1.20	19.22	3.57		1.273	1.282
83)	1.40	19.16	3.51		1.257	1.272
84)	1.60	19.11	3.46		1.241	1.262
85)	1.80	19.06	3.41		1.227	1.251
86)	2.00	19.02	3.37		1.213	1.241
87)	2.20	18.97	3.32		1.201	1.230
88)	2.40	18.93	3.28		1.188	1.220
89)	2.60	18.88	3.23		1.173	1.209
90)	2.80	18.84	3.19		1.161	1.199
91)	3.00	18.80	3.15		1.149	1.188
92)	3.20	18.75	3.10		1.131	1.178
93)	3.40	18.72	3.07		1.122	1.167
94)	3.60	18.69	3.04		1.111	1.157
95)	3.80	18.66	3.01		1.100	1.146
96)	4.00	18.62	2.97		1.090	1.136
97)	4.20	18.59	2.94		1.079	1.126
98)	4.40	18.56	2.91		1.068	1.115
99)	4.60	18.53	2.88		1.058	1.105
100)	4.80	18.50	2.85		1.048	1.094
101)	5.00	18.48	2.83		1.039	1.084
102)	5.20	18.45	2.80		1.028	1.073
103)	5.40	18.42	2.77		1.019	1.063
104)	5.60	18.40	2.75		1.010	1.052
105)	5.80	18.37	2.72		1.001	1.042
106)	6.00	18.35	2.70		0.993	1.031
107)	6.20	18.33	2.68		0.984	1.021
108)	6.40	18.30	2.65		0.975	1.010
109)	6.60	18.28	2.63		0.967	1.000
110)	6.80	18.25	2.60		0.957	0.989
111)	7.00	18.23	2.58		0.949	0.979
112)	7.20	18.21	2.56		0.941	0.969
113)	7.40	18.19	2.54		0.933	0.958
114)	7.60	18.17	2.52		0.925	0.948
115)	7.80	18.15	2.50		0.917	0.937
116)	8.00	18.13	2.48		0.908	0.927
117)	8.20	18.11	2.46		0.902	0.916
118)	8.40	18.10	2.45		0.894	0.906
119)	8.60	18.08	2.43		0.887	0.895
120)	8.80	18.06	2.41		0.880	0.885
121)	9.00	18.05	2.40		0.873	0.874

122)	9.20	18.03	2.38		0.865	0.864
123)	9.40	18.01	2.36		0.859	0.853
124)	9.60	17.99	2.34		0.849	0.843
125)	9.80	17.98	2.33		0.844	0.833
126)	10.00	17.96	2.31		0.837	0.822
127)	11.00	17.89	2.24		0.805	0.770
128)	12.00	17.81	2.16		0.771	0.717
129)	13.00	17.75	2.10		0.741	0.665
130)	14.00	17.68	2.03		0.710	0.613
131)	15.00	17.63	1.98		0.685	0.560
132)	16.00	17.58	1.93		-5.809	0.508
133)	17.00	17.54	1.89		-5.809	0.456
134)	18.00	17.49	1.84		0.610	0.404
135)	19.00	17.45	1.80		0.588	0.351
136)	20.00	17.41	1.76		0.565	0.299
137)	21.00	17.37	1.72		0.543	0.247
138)	22.00	17.34	1.69		0.522	0.194
139)	23.00	17.30	1.65		0.500	0.142
140)	24.00	17.27	1.62		0.482	0.090
141)	25.00	17.24	1.59		0.464	0.037
142)	26.00	17.22	1.57		0.449	-0.015
143)	27.00	17.19	1.54		0.430	-0.067
144)	28.00	17.16	1.51		0.413	-0.120
145)	29.00	17.13	1.48		0.395	-0.172
146)	30.00	17.11	1.46		0.379	-0.224
147)	31.00	17.09	1.44		0.362	-0.277
148)	32.00	17.06	1.41		0.346	-0.329
149)	33.00	17.04	1.39		0.331	-0.381
150)	34.00	17.02	1.37		0.317	-0.434
151)	35.00	17.01	1.36		0.305	-0.486
152)	36.00	16.99	1.34		0.289	-0.538
153)	37.00	16.97	1.32		0.275	-0.591
154)	38.00	16.95	1.30		0.265	-0.643
155)	39.00	16.93	1.28		0.250	-0.695

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-8-56
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	35.18	feet
Water Table Depth:	23.45	feet
Aquifer Thickness:	30	feet
Line Fit Starting No.:	51	Min 1 to
Line Fit Ending No.:	131	Max 151
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	8.13E-02	ft./day
Error of Fit:	0.004	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	23.46	0.01		-5.116	1.619
2)	0.01	23.46	0.01		-5.116	1.618
3)	0.02	23.46	0.01		-4.711	1.618
4)	0.03	23.46	0.01		-5.116	1.618
5)	0.03	23.46	0.01		-5.116	1.617
6)	0.04	23.46	0.01		-5.116	1.617
7)	0.05	23.49	0.04		-3.297	1.616
8)	0.06	26.09	2.64		0.970	1.616
9)	0.07	27.02	3.57		1.274	1.615
10)	0.08	26.67	3.22		1.168	1.615
11)	0.08	27.55	4.10		1.410	1.614
12)	0.09	28.66	5.21		1.650	1.614
13)	0.10	28.77	5.32		1.671	1.613
14)	0.11	28.59	5.14		1.637	1.613
15)	0.12	28.68	5.23		1.654	1.613
16)	0.13	28.62	5.17		1.643	1.612
17)	0.13	28.59	5.14		1.638	1.612
18)	0.14	28.62	5.17		1.643	1.611
19)	0.15	28.58	5.13		1.635	1.611
20)	0.16	28.59	5.14		1.636	1.610
21)	0.17	28.58	5.13		1.635	1.610
22)	0.18	28.56	5.11		1.631	1.609
23)	0.18	28.57	5.12		1.632	1.609
24)	0.19	28.56	5.11		1.630	1.609
25)	0.20	28.55	5.10		1.629	1.608
26)	0.21	28.56	5.11		1.630	1.608
27)	0.22	28.54	5.09		1.627	1.607

28)	0.23	28.55	5.10		1.629	1.607
29)	0.23	28.54	5.09		1.627	1.606
30)	0.24	28.51	5.06		1.621	1.606
31)	0.25	28.53	5.08		1.625	1.605
32)	0.26	28.52	5.07		1.623	1.605
33)	0.27	28.50	5.05		1.620	1.604
34)	0.28	28.52	5.07		1.622	1.604
35)	0.28	28.50	5.05		1.619	1.604
36)	0.29	28.49	5.04		1.617	1.603
37)	0.30	28.49	5.04		1.617	1.603
38)	0.31	28.49	5.04		1.617	1.602
39)	0.32	28.49	5.04		1.617	1.602
40)	0.33	28.47	5.02		1.614	1.601
41)	0.33	28.47	5.02		1.614	1.601
42)	0.35	28.46	5.01		1.612	1.600
43)	0.37	28.46	5.01		1.610	1.599
44)	0.38	28.45	5.00		1.609	1.598
45)	0.40	28.45	5.00		1.609	1.597
46)	0.42	28.43	4.98		1.605	1.596
47)	0.43	28.43	4.98		1.605	1.595
48)	0.45	28.42	4.97		1.604	1.595
49)	0.47	28.42	4.97		1.603	1.594
50)	0.48	28.41	4.96		1.602	1.593
51)	0.50	28.41	4.96		1.600	1.592
52)	0.52	28.40	4.95		1.599	1.591
53)	0.53	28.40	4.95		1.598	1.590
54)	0.55	28.39	4.94		1.597	1.589
55)	0.57	28.38	4.93		1.596	1.588
56)	0.58	28.38	4.93		1.595	1.587
57)	0.60	28.37	4.92		1.593	1.586
58)	0.62	28.36	4.91		1.592	1.586
59)	0.63	28.36	4.91		1.591	1.585
60)	0.65	28.35	4.90		1.589	1.584
61)	0.67	28.35	4.90		1.588	1.583
62)	0.68	28.34	4.89		1.587	1.582
63)	0.70	28.34	4.89		1.586	1.581
64)	0.72	28.33	4.88		1.585	1.580
65)	0.73	28.32	4.87		1.584	1.579
66)	0.75	28.32	4.87		1.582	1.578
67)	0.77	28.31	4.86		1.581	1.577
68)	0.78	28.30	4.85		1.580	1.577
69)	0.80	28.30	4.85		1.579	1.576
70)	0.82	28.29	4.84		1.578	1.575
71)	0.83	28.29	4.84		1.577	1.574
72)	0.85	28.28	4.83		1.575	1.573
73)	0.87	28.28	4.83		1.574	1.572
74)	0.88	28.27	4.82		1.573	1.571

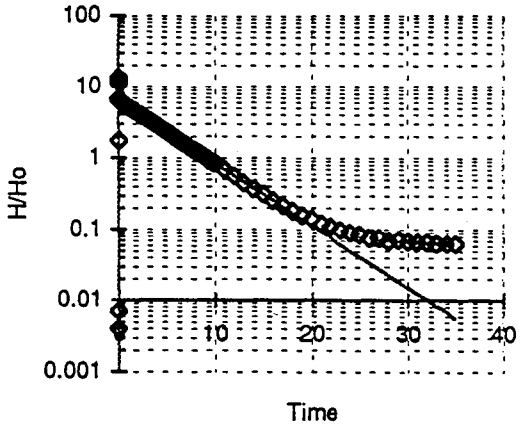
75)	0.90	28.27	4.82		1.572	1.570
76)	0.92	28.26	4.81		1.570	1.569
77)	0.93	28.26	4.81		1.570	1.568
78)	0.95	28.25	4.80		1.569	1.567
79)	0.97	28.25	4.80		1.568	1.567
80)	0.98	28.24	4.79		1.567	1.566
81)	1.00	28.23	4.78		1.565	1.565
82)	1.20	28.18	4.73		1.553	1.554
83)	1.40	28.12	4.67		1.541	1.543
84)	1.60	28.07	4.62		1.530	1.532
85)	1.80	28.01	4.56		1.517	1.522
86)	2.00	27.96	4.51		1.506	1.511
87)	2.20	27.91	4.46		1.495	1.500
88)	2.40	27.86	4.41		1.483	1.489
89)	2.60	27.81	4.36		1.473	1.478
90)	2.80	27.76	4.31		1.462	1.467
91)	3.00	27.71	4.26		1.450	1.457
92)	3.20	27.67	4.22		1.440	1.446
93)	3.40	27.63	4.18		1.429	1.435
94)	3.60	27.58	4.13		1.418	1.424
95)	3.80	27.53	4.08		1.407	1.413
96)	4.00	27.49	4.04		1.397	1.403
97)	4.20	27.45	4.00		1.386	1.392
98)	4.40	27.41	3.96		1.375	1.381
99)	4.60	27.37	3.92		1.365	1.370
100)	4.80	27.32	3.87		1.354	1.359
101)	5.00	27.28	3.83		1.343	1.349
102)	5.20	27.25	3.80		1.334	1.338
103)	5.40	27.20	3.75		1.323	1.327
104)	5.60	27.17	3.72		1.313	1.316
105)	5.80	27.13	3.68		1.302	1.305
106)	6.00	27.09	3.64		1.291	1.294
107)	6.20	27.05	3.60		1.281	1.284
108)	6.40	27.01	3.56		1.270	1.273
109)	6.60	26.97	3.52		1.260	1.262
110)	6.80	26.93	3.48		1.248	1.251
111)	7.00	26.90	3.45		1.237	1.240
112)	7.20	26.85	3.40		1.225	1.230
113)	7.40	26.82	3.37		1.214	1.219
114)	7.60	26.78	3.33		1.201	1.208
115)	7.80	26.74	3.29		1.191	1.197
116)	8.00	26.70	3.25		1.179	1.186
117)	8.20	26.66	3.21		1.168	1.176
118)	8.40	26.63	3.18		1.157	1.165
119)	8.60	26.60	3.15		1.147	1.154
120)	8.80	26.57	3.12		1.137	1.143
121)	9.00	26.54	3.09		1.127	1.132

122)	9.20	26.50	3.05		1.116	1.121
123)	9.40	26.48	3.03		1.107	1.111
124)	9.60	26.45	3.00		1.097	1.100
125)	9.80	26.42	2.97		1.087	1.089
126)	10.00	26.38	2.93		1.076	1.078
127)	11.00	26.25	2.80		1.029	1.024
128)	12.00	26.11	2.66		0.980	0.970
129)	13.00	25.99	2.54		0.931	0.916
130)	14.00	25.87	2.42		0.884	0.862
131)	15.00	25.76	2.31		0.838	0.808
132)	16.00	25.65	2.20		-5.809	0.754
133)	17.00	25.56	2.11		-5.809	0.700
134)	18.00	25.46	2.01		0.700	0.646
135)	19.00	25.38	1.93		0.655	0.592
136)	20.00	25.29	1.84		0.611	0.538
137)	21.00	25.21	1.76		0.568	0.483
138)	22.00	25.14	1.69		0.524	0.429
139)	23.00	25.07	1.62		0.481	0.375
140)	24.00	25.01	1.56		0.441	0.321
141)	25.00	24.94	1.49		0.400	0.267
142)	26.00	24.88	1.43		0.359	0.213
143)	27.00	24.82	1.37		0.316	0.159
144)	28.00	24.77	1.32		0.278	0.105
145)	29.00	24.72	1.27		0.240	0.051
146)	30.00	24.67	1.22		0.201	-0.003
147)	31.00	24.63	1.18		0.162	-0.057
148)	32.00	24.59	1.14		0.127	-0.111
149)	33.00	24.54	1.09		0.090	-0.165
150)	34.00	24.51	1.06		0.054	-0.219
151)	35.00	24.47	1.02		0.018	-0.273

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-9-29
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	21.47	feet
Water Table Depth:	7.28	feet
Aquifer Thickness:	21.47	feet
Line Fit Starting No.:	13	Min 1 to
Line Fit Ending No.:	121	Max 151
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	2.76E-01	ft./day
Error of Fit:	0.008	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet	Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	7.28	0.00	-5.521	1.854
2)	0.01	7.28	0.00	-5.521	1.852
3)	0.02	7.28	0.00	-5.521	1.851
4)	0.03	7.27	0.01	-4.962	1.849
5)	0.03	7.28	0.00	-	1.847
6)	0.04	7.28	0.00	-	1.846
7)	0.05	9.01	1.73	0.546	1.844
8)	0.06	18.96	11.68	2.458	1.842
9)	0.07	20.69	13.41	2.596	1.841
10)	0.08	18.44	11.16	2.412	1.839
11)	0.08	14.19	6.91	1.932	1.837
12)	0.09	13.89	6.61	1.888	1.836
13)	0.10	13.76	6.48	1.869	1.834
14)	0.11	13.73	6.45	1.864	1.832
15)	0.12	13.66	6.38	1.853	1.830
16)	0.13	13.62	6.34	1.847	1.829
17)	0.13	13.61	6.33	1.845	1.827
18)	0.14	13.56	6.28	1.837	1.825
19)	0.15	13.56	6.28	1.837	1.824
20)	0.16	13.53	6.25	1.833	1.822
21)	0.17	13.52	6.24	1.830	1.820
22)	0.18	13.50	6.22	1.827	1.819
23)	0.18	13.47	6.19	1.823	1.817
24)	0.19	13.46	6.18	1.821	1.815
25)	0.20	13.44	6.16	1.819	1.814
26)	0.21	13.41	6.13	1.813	1.812
27)	0.22	13.40	6.12	1.811	1.810

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28)	0.23	13.36	6.08		1.805	1.809
29)	0.23	13.36	6.08		1.805	1.807
30)	0.24	13.35	6.07		1.803	1.805
31)	0.25	13.34	6.06		1.801	1.804
32)	0.26	13.33	6.05		1.801	1.802
33)	0.27	13.31	6.03		1.796	1.800
34)	0.28	13.30	6.02		1.795	1.799
35)	0.28	13.27	5.99		1.790	1.797
36)	0.29	13.26	5.98		1.789	1.795
37)	0.30	13.25	5.97		1.786	1.793
38)	0.31	13.24	5.96		1.784	1.792
39)	0.32	13.22	5.94		1.782	1.790
40)	0.33	13.21	5.93		1.780	1.788
41)	0.33	13.20	5.92		1.779	1.787
42)	0.35	13.18	5.90		1.775	1.783
43)	0.37	13.16	5.88		1.771	1.780
44)	0.38	13.14	5.86		1.767	1.777
45)	0.40	13.12	5.84		1.764	1.773
46)	0.42	13.09	5.81		1.760	1.770
47)	0.43	13.08	5.80		1.757	1.767
48)	0.45	13.06	5.78		1.754	1.763
49)	0.47	13.04	5.76		1.750	1.760
50)	0.48	13.02	5.74		1.747	1.756
51)	0.50	13.00	5.72		1.744	1.753
52)	0.52	12.98	5.70		1.741	1.750
53)	0.53	12.96	5.68		1.738	1.746
54)	0.55	12.95	5.67		1.735	1.743
55)	0.57	12.93	5.65		1.732	1.740
56)	0.58	12.91	5.63		1.729	1.736
57)	0.60	12.90	5.62		1.726	1.733
58)	0.62	12.88	5.60		1.723	1.730
59)	0.63	12.87	5.59		1.720	1.726
60)	0.65	12.85	5.57		1.717	1.723
61)	0.67	12.84	5.56		1.715	1.719
62)	0.68	12.82	5.54		1.712	1.716
63)	0.70	12.80	5.52		1.709	1.713
64)	0.72	12.79	5.51		1.707	1.709
65)	0.73	12.77	5.49		1.703	1.706
66)	0.75	12.75	5.47		1.700	1.703
67)	0.77	12.73	5.45		1.696	1.699
68)	0.78	12.72	5.44		1.693	1.696
69)	0.80	12.70	5.42		1.690	1.693
70)	0.82	12.68	5.40		1.686	1.689
71)	0.83	12.66	5.38		1.683	1.686
72)	0.85	12.64	5.36		1.679	1.682
73)	0.87	12.62	5.34		1.676	1.679
74)	0.88	12.60	5.32		1.672	1.676

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75)	0.90	12.59	5.31		1.669	1.672
76)	0.92	12.57	5.29		1.666	1.669
77)	0.93	12.55	5.27		1.662	1.666
78)	0.95	12.53	5.25		1.659	1.662
79)	0.97	12.52	5.24		1.656	1.659
80)	0.98	12.50	5.22		1.652	1.656
81)	1.00	12.48	5.20		1.649	1.652
82)	1.20	12.29	5.01		1.612	1.612
83)	1.40	12.11	4.83		1.575	1.571
84)	1.60	11.93	4.65		1.538	1.531
85)	1.80	11.76	4.48		1.501	1.491
86)	2.00	11.60	4.32		1.462	1.450
87)	2.20	11.41	4.13		1.419	1.410
88)	2.40	11.24	3.96		1.375	1.369
89)	2.60	11.08	3.80		1.334	1.329
90)	2.80	10.92	3.64		1.292	1.289
91)	3.00	10.78	3.50		1.252	1.248
92)	3.20	10.64	3.36		1.213	1.208
93)	3.40	10.51	3.23		1.173	1.168
94)	3.60	10.38	3.10		1.132	1.127
95)	3.80	10.27	2.99		1.095	1.087
96)	4.00	10.15	2.87		1.054	1.046
97)	4.20	10.04	2.76		1.017	1.006
98)	4.40	9.93	2.65		0.976	0.966
99)	4.60	9.83	2.55		0.937	0.925
100)	4.80	9.73	2.45		0.894	0.885
101)	5.00	9.62	2.34		0.849	0.845
102)	5.20	9.53	2.25		0.809	0.804
103)	5.40	9.43	2.15		0.767	0.764
104)	5.60	9.33	2.05		0.719	0.723
105)	5.80	9.26	1.98		0.685	0.683
106)	6.00	9.18	1.90		0.642	0.643
107)	6.20	9.11	1.83		0.603	0.602
108)	6.40	9.04	1.76		0.562	0.562
109)	6.60	8.97	1.69		0.522	0.521
110)	6.80	8.90	1.62		0.482	0.481
111)	7.00	8.83	1.55		0.440	0.441
112)	7.20	8.77	1.49		0.399	0.400
113)	7.40	8.71	1.43		0.355	0.360
114)	7.60	8.65	1.37		0.314	0.320
115)	7.80	8.60	1.32		0.275	0.279
116)	8.00	8.55	1.27		0.235	0.239
117)	8.20	8.49	1.21		0.194	0.198
118)	8.40	8.45	1.17		0.154	0.158
119)	8.60	8.40	1.12		0.113	0.118
120)	8.80	8.36	1.08		0.072	0.077
121)	9.00	8.31	1.03		0.031	0.037

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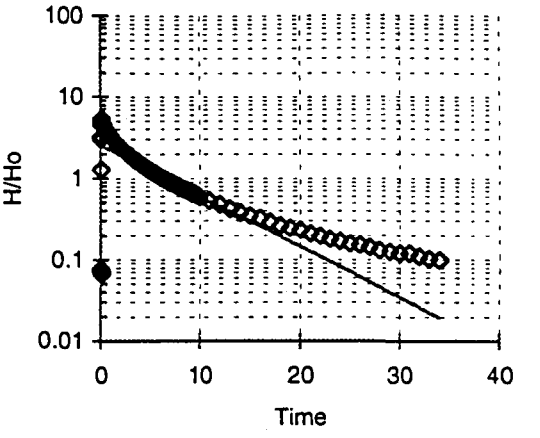
122)	9.20	8.27	0.99		-0.013	-0.004
123)	9.40	8.23	0.95		-0.049	-0.044
124)	9.60	8.19	0.91		-0.090	-0.084
125)	9.80	8.16	0.88		-0.132	-0.125
126)	10.00	8.12	0.84		-0.170	-0.165
127)	11.00	7.97	0.69		-0.377	-0.367
128)	12.00	7.84	0.56		-0.574	-0.569
129)	13.00	7.74	0.46		-0.787	-0.771
130)	14.00	7.65	0.37		-0.994	-0.973
131)	15.00	7.59	0.31		-1.171	-1.175
132)	16.00	7.54	0.26		-1.363	-1.376
133)	17.00	7.50	0.22		-1.523	-1.578
134)	18.00	7.46	0.18		-1.698	-1.780
135)	19.00	7.44	0.16		-1.845	-1.982
136)	20.00	7.42	0.14		-1.973	-2.184
137)	21.00	7.40	0.12		-2.120	-2.386
138)	22.00	7.39	0.11		-2.207	-2.588
139)	23.00	7.38	0.10		-2.323	-2.790
140)	24.00	7.37	0.09		-2.397	-2.992
141)	25.00	7.37	0.09		-2.465	-3.194
142)	26.00	7.36	0.08		-2.590	-3.396
143)	27.00	7.36	0.08		-2.590	-3.597
144)	28.00	7.35	0.07		-2.674	-3.799
145)	29.00	7.35	0.07		-2.631	-4.001
146)	30.00	7.35	0.07		-2.674	-4.203
147)	31.00	7.35	0.07		-2.718	-4.405
148)	32.00	7.35	0.07		-2.718	-4.607
149)	33.00	7.34	0.06		-2.765	-4.809
150)	34.00	7.34	0.06		-2.765	-5.011
151)	35.00	7.34	0.06		-2.765	-5.213

NWT 002791

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-10-61
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	49	feet
Water Table Depth:	14.79	feet
Aquifer Thickness:	30	feet
Line Fit Starting No.:	91	Min 1 to
Line Fit Ending No.:	131	Max 150
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	2.27E-01	ft./day
Error of Fit:	0.137	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	14.71	0.08		-2.564	0.930
2)	0.01	14.72	0.07		-2.659	0.929
3)	0.02	14.71	0.08		-2.564	0.928
4)	0.03	14.72	0.07		-2.617	0.926
5)	0.03	14.72	0.07		-2.659	0.925
6)	0.04	14.72	0.07		-2.617	0.924
7)	0.05	14.72	0.07		-2.703	0.923
8)	0.06	14.72	0.07		-2.659	0.922
9)	0.07	16.07	1.28		0.247	0.921
10)	0.08	17.98	3.19		1.160	0.919
11)	0.08	18.03	3.24		1.175	0.918
12)	0.09	17.79	3.00		1.100	0.917
13)	0.10	19.21	4.42		1.486	0.916
14)	0.11	20.18	5.39		1.684	0.915
15)	0.12	19.80	5.01		1.611	0.913
16)	0.13	19.68	4.89		1.587	0.912
17)	0.13	19.75	4.96		1.601	0.911
18)	0.14	19.62	4.83		1.574	0.910
19)	0.15	19.62	4.83		1.574	0.909
20)	0.16	19.58	4.79		1.565	0.907
21)	0.17	19.53	4.74		1.555	0.906
22)	0.18	19.51	4.72		1.551	0.905
23)	0.18	19.48	4.69		1.545	0.904
24)	0.19	19.46	4.67		1.541	0.903
25)	0.20	19.42	4.63		1.533	0.901
26)	0.21	19.40	4.61		1.528	0.900
27)	0.22	19.38	4.59		1.524	0.899

28)	0.23	19.37	4.58		1.521	0.898
29)	0.23	19.33	4.54		1.512	0.897
30)	0.24	19.32	4.53		1.512	0.895
31)	0.25	19.30	4.51		1.505	0.894
32)	0.26	19.27	4.48		1.499	0.893
33)	0.27	19.25	4.46		1.496	0.892
34)	0.28	19.23	4.44		1.491	0.891
35)	0.28	19.21	4.42		1.485	0.890
36)	0.29	19.19	4.40		1.482	0.888
37)	0.30	19.17	4.38		1.478	0.887
38)	0.31	19.20	4.41		1.483	0.886
39)	0.32	19.14	4.35		1.470	0.885
40)	0.33	19.15	4.36		1.473	0.884
41)	0.33	19.04	4.25		1.448	0.882
42)	0.35	19.06	4.27		1.452	0.880
43)	0.37	19.03	4.24		1.444	0.878
44)	0.38	19.00	4.21		1.436	0.875
45)	0.40	18.96	4.17		1.428	0.873
46)	0.42	18.94	4.15		1.423	0.870
47)	0.43	18.90	4.11		1.413	0.868
48)	0.45	18.87	4.08		1.406	0.866
49)	0.47	18.84	4.05		1.398	0.863
50)	0.48	18.81	4.02		1.392	0.861
51)	0.50	18.78	3.99		1.384	0.859
52)	0.52	18.75	3.96		1.376	0.856
53)	0.53	18.72	3.93		1.369	0.854
54)	0.55	18.70	3.91		1.363	0.851
55)	0.57	18.67	3.88		1.356	0.849
56)	0.58	18.65	3.86		1.350	0.847
57)	0.60	18.62	3.83		1.342	0.844
58)	0.62	18.59	3.80		1.336	0.842
59)	0.63	18.56	3.77		1.328	0.839
60)	0.65	18.54	3.75		1.321	0.837
61)	0.67	18.52	3.73		1.316	0.835
62)	0.68	18.49	3.70		1.309	0.832
63)	0.70	18.46	3.67		1.301	0.830
64)	0.72	18.44	3.65		1.296	0.828
65)	0.73	18.42	3.63		1.290	0.825
66)	0.75	18.40	3.61		1.284	0.823
67)	0.77	18.37	3.58		1.276	0.820
68)	0.78	18.36	3.57		1.271	0.818
69)	0.80	18.33	3.54		1.264	0.816
70)	0.82	18.31	3.52		1.259	0.813
71)	0.83	18.29	3.50		1.252	0.811
72)	0.85	18.27	3.48		1.246	0.808
73)	0.87	18.24	3.45		1.240	0.806
74)	0.88	18.23	3.44		1.234	0.804

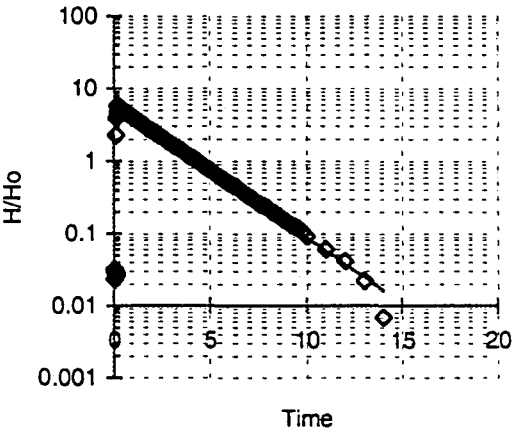
75)	0.90	18.21	3.42		1.228	0.801
76)	0.92	18.18	3.39		1.221	0.799
77)	0.93	18.16	3.37		1.216	0.797
78)	0.95	18.14	3.35		1.209	0.794
79)	0.97	18.12	3.33		1.204	0.792
80)	0.98	18.11	3.32		1.198	0.789
81)	1.00	18.08	3.29		1.192	0.787
82)	1.20	17.87	3.08		1.124	0.758
83)	1.40	17.67	2.88		1.059	0.730
84)	1.60	17.51	2.72		0.999	0.701
85)	1.80	17.35	2.56		0.939	0.673
86)	2.00	17.21	2.42		0.883	0.644
87)	2.20	17.08	2.29		0.829	0.615
88)	2.40	16.96	2.17		0.775	0.587
89)	2.60	16.85	2.06		0.721	0.558
90)	2.80	16.75	1.96		0.674	0.530
91)	3.00	16.66	1.87		0.626	0.501
92)	3.20	16.59	1.80		0.586	0.472
93)	3.40	16.49	1.70		0.532	0.444
94)	3.60	16.42	1.63		0.490	0.415
95)	3.80	16.36	1.57		0.449	0.387
96)	4.00	16.29	1.50		0.407	0.358
97)	4.20	16.23	1.44		0.364	0.329
98)	4.40	16.18	1.39		0.328	0.301
99)	4.60	16.12	1.33		0.288	0.272
100)	4.80	16.08	1.29		0.252	0.244
101)	5.00	16.03	1.24		0.214	0.215
102)	5.20	15.99	1.20		0.178	0.186
103)	5.40	15.94	1.15		0.137	0.158
104)	5.60	15.90	1.11		0.101	0.129
105)	5.80	15.86	1.07		0.066	0.101
106)	6.00	15.83	1.04		0.035	0.072
107)	6.20	15.79	1.00		-0.002	0.043
108)	6.40	15.76	0.97		-0.027	0.015
109)	6.60	15.73	0.94		-0.058	-0.014
110)	6.80	15.70	0.91		-0.099	-0.042
111)	7.00	15.67	0.88		-0.127	-0.071
112)	7.20	15.66	0.87		-0.142	-0.100
113)	7.40	15.63	0.84		-0.174	-0.128
114)	7.60	15.60	0.81		-0.206	-0.157
115)	7.80	15.59	0.80		-0.229	-0.185
116)	8.00	15.56	0.77		-0.265	-0.214
117)	8.20	15.54	0.75		-0.294	-0.243
118)	8.40	15.52	0.73		-0.316	-0.271
119)	8.60	15.49	0.70		-0.352	-0.300
120)	8.80	15.48	0.69		-0.365	-0.328
121)	9.00	15.46	0.67		-0.402	-0.357

122)	9.20	15.45	0.66		-0.422	-0.386
123)	9.40	15.43	0.64		-0.442	-0.414
124)	9.60	15.41	0.62		-0.472	-0.443
125)	9.80	15.40	0.61		-0.498	-0.471
126)	10.00	15.38	0.59		-0.524	-0.500
127)	11.00	15.32	0.53		-0.637	-0.643
128)	12.00	15.27	0.48		-0.744	-0.786
129)	13.00	15.21	0.42		-0.865	-0.929
130)	14.00	15.17	0.38		-0.968	-1.072
131)	15.00	15.14	0.35		-1.047	-1.215
132)	16.00	15.11	0.32		-5.809	-1.358
133)	17.00	15.08	0.29		-5.809	-1.501
134)	18.00	15.05	0.26		-1.336	-1.644
135)	19.00	15.04	0.25		-1.398	-1.787
136)	20.00	15.02	0.23		-1.452	-1.930
137)	21.00	15.00	0.21		-1.565	-2.073
138)	22.00	14.99	0.20		-1.630	-2.216
139)	23.00	14.97	0.18		-1.715	-2.359
140)	24.00	14.96	0.17		-1.784	-2.502
141)	25.00	14.95	0.16		-1.845	-2.645
142)	26.00	14.94	0.15		-1.884	-2.788
143)	27.00	14.93	0.14		-1.952	-2.931
144)	28.00	14.92	0.13		-2.040	-3.074
145)	29.00	14.92	0.13		-2.071	-3.217
146)	30.00	14.91	0.12		-2.120	-3.360
147)	31.00	14.91	0.12		-2.120	-3.503
148)	32.00	14.90	0.11		-2.207	-3.646
149)	33.00	14.89	0.10		-2.293	-3.789
150)	34.00	14.89	0.10		-2.323	-3.932

Bouwer & Rice Method for Calculating Hydraulic Conductivity

Project Name: RI/FS
Project No.: 2708
Client Name: Northwest Natural Gas Company
Identification: MW-12-36
Analysis By: RBE
Run Date: 3/28/96

Riser Pipe Diameter:	0.167	feet
Intake Diameter:	0.923	feet
Intake Length:	10	feet
Saturated Column Length:	29.05	feet
Water Table Depth:	9.74	feet
Aquifer Thickness:	29.05	feet
Line Fit Starting No.:	21	Min 1 to
Line Fit Ending No.:	130	Max 130
Specify Output Units:	3	1 to 9
Hyd. Cond., K(h):	6.19E-01	ft./day
Error of Fit:	0.813	



Meas. #	Time minutes	Field Meas. feet	Drawdown/up feet		Line Fit To LN(Yt)	Regression On LN(Yt)
1)	0.00	9.71	0.03		-3.442	1.829
2)	0.01	9.72	0.02		-3.772	1.826
3)	0.02	9.71	0.03		-3.442	1.822
4)	0.03	9.71	0.03		-3.540	1.818
5)	0.03	9.72	0.02		-3.772	1.815
6)	0.04	9.72	0.02		-3.772	1.811
7)	0.05	9.71	0.03		-3.650	1.808
8)	0.06	9.71	0.03		-3.650	1.804
9)	0.07	9.71	0.03		-3.650	1.801
10)	0.08	9.71	0.03		-3.650	1.797
11)	0.08	9.71	0.03		-3.650	1.794
12)	0.09	9.71	0.03		-3.650	1.790
13)	0.10	9.71	0.03		-3.540	1.786
14)	0.11	9.71	0.03		-3.650	1.783
15)	0.12	9.71	0.03		-3.650	1.779
16)	0.13	12.04	2.30		0.832	1.776
17)	0.13	13.64	3.90		1.362	1.772
18)	0.14	13.80	4.06		1.402	1.769
19)	0.15	14.53	4.79		1.567	1.765
20)	0.16	15.51	5.77		1.753	1.762
21)	0.17	15.62	5.88		1.772	1.758
22)	0.18	15.58	5.84		1.765	1.755
23)	0.18	15.52	5.78		1.754	1.751
24)	0.19	15.51	5.77		1.753	1.747
25)	0.20	15.48	5.74		1.747	1.744
26)	0.21	15.46	5.72		1.744	1.740
27)	0.22	15.43	5.69		1.738	1.737

28)	0.23	15.41	5.67		1.734	1.733
29)	0.23	15.38	5.64		1.730	1.730
30)	0.24	15.35	5.61		1.724	1.726
31)	0.25	15.33	5.59		1.720	1.723
32)	0.26	15.31	5.57		1.718	1.719
33)	0.27	15.29	5.55		1.714	1.715
34)	0.28	15.25	5.51		1.707	1.712
35)	0.28	15.24	5.50		1.704	1.708
36)	0.29	15.21	5.47		1.699	1.705
37)	0.30	15.18	5.44		1.694	1.701
38)	0.31	15.17	5.43		1.691	1.698
39)	0.32	15.13	5.39		1.684	1.694
40)	0.33	15.10	5.36		1.679	1.691
41)	0.33	15.08	5.34		1.676	1.687
42)	0.35	15.04	5.30		1.668	1.680
43)	0.37	15.00	5.26		1.660	1.673
44)	0.38	14.96	5.22		1.652	1.666
45)	0.40	14.92	5.18		1.645	1.659
46)	0.42	14.88	5.14		1.638	1.652
47)	0.43	14.85	5.11		1.630	1.644
48)	0.45	14.81	5.07		1.623	1.637
49)	0.47	14.77	5.03		1.615	1.630
50)	0.48	14.73	4.99		1.608	1.623
51)	0.50	14.70	4.96		1.601	1.616
52)	0.52	14.66	4.92		1.593	1.609
53)	0.53	14.62	4.88		1.586	1.602
54)	0.55	14.59	4.85		1.579	1.595
55)	0.57	14.56	4.82		1.572	1.588
56)	0.58	14.52	4.78		1.564	1.581
57)	0.60	14.49	4.75		1.557	1.573
58)	0.62	14.45	4.71		1.550	1.566
59)	0.63	14.42	4.68		1.543	1.559
60)	0.65	14.39	4.65		1.536	1.552
61)	0.67	14.35	4.61		1.529	1.545
62)	0.68	14.32	4.58		1.522	1.538
63)	0.70	14.29	4.55		1.514	1.531
64)	0.72	14.26	4.52		1.508	1.524
65)	0.73	14.23	4.49		1.501	1.517
66)	0.75	14.19	4.45		1.493	1.510
67)	0.77	14.16	4.42		1.486	1.502
68)	0.78	14.13	4.39		1.480	1.495
69)	0.80	14.10	4.36		1.473	1.488
70)	0.82	14.07	4.33		1.466	1.481
71)	0.83	14.04	4.30		1.459	1.474
72)	0.85	14.01	4.27		1.452	1.467
73)	0.87	13.98	4.24		1.445	1.460
74)	0.88	13.95	4.21		1.437	1.453

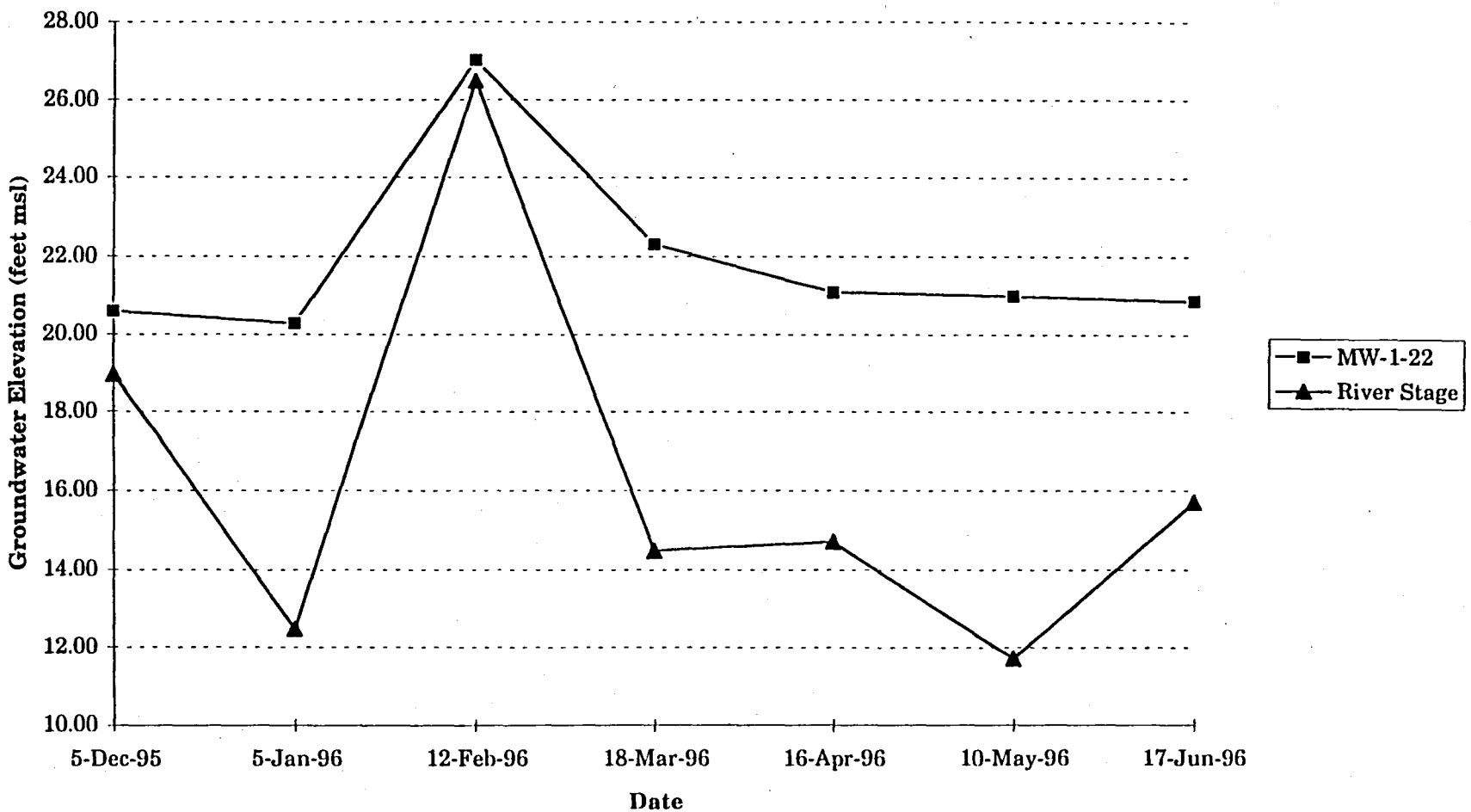
75)	0.90	13.92	4.18		1.430	1.446
76)	0.92	13.89	4.15		1.422	1.439
77)	0.93	13.86	4.12		1.415	1.431
78)	0.95	13.83	4.09		1.408	1.424
79)	0.97	13.80	4.06		1.401	1.417
80)	0.98	13.77	4.03		1.393	1.410
81)	1.00	13.75	4.01		1.388	1.403
82)	1.20	13.42	3.68		1.302	1.318
83)	1.40	13.12	3.38		1.217	1.233
84)	1.60	12.85	3.11		1.134	1.147
85)	1.80	12.60	2.86		1.052	1.062
86)	2.00	12.37	2.63		0.969	0.977
87)	2.20	12.17	2.43		0.886	0.892
88)	2.40	11.97	2.23		0.803	0.806
89)	2.60	11.80	2.06		0.720	0.721
90)	2.80	11.63	1.89		0.635	0.636
91)	3.00	11.49	1.75		0.557	0.551
92)	3.20	11.34	1.60		0.471	0.466
93)	3.40	11.22	1.48		0.389	0.380
94)	3.60	11.10	1.36		0.304	0.295
95)	3.80	10.97	1.23		0.209	0.210
96)	4.00	10.88	1.14		0.134	0.125
97)	4.20	10.79	1.05		0.053	0.039
98)	4.40	10.71	0.97		-0.031	-0.046
99)	4.60	10.63	0.89		-0.113	-0.131
100)	4.80	10.56	0.82		-0.202	-0.216
101)	5.00	10.49	0.75		-0.284	-0.301
102)	5.20	10.44	0.70		-0.362	-0.387
103)	5.40	10.38	0.64		-0.453	-0.472
104)	5.60	10.33	0.59		-0.529	-0.557
105)	5.80	10.28	0.54		-0.614	-0.642
106)	6.00	10.24	0.50		-0.693	-0.728
107)	6.20	10.20	0.46		-0.772	-0.813
108)	6.40	10.16	0.42		-0.858	-0.898
109)	6.60	10.13	0.39		-0.944	-0.983
110)	6.80	10.09	0.35		-1.038	-1.068
111)	7.00	10.07	0.33		-1.112	-1.154
112)	7.20	10.04	0.30		-1.191	-1.239
113)	7.40	10.02	0.28		-1.280	-1.324
114)	7.60	9.99	0.25		-1.374	-1.409
115)	7.80	9.98	0.24		-1.427	-1.495
116)	8.00	9.96	0.22		-1.496	-1.580
117)	8.20	9.94	0.20		-1.599	-1.665
118)	8.40	9.93	0.19		-1.661	-1.750
119)	8.60	9.91	0.17		-1.766	-1.835
120)	8.80	9.90	0.15		-1.864	-1.921
121)	9.00	9.89	0.15		-1.931	-2.006

122)	9.20	9.87	0.13		-2.017	-2.091
123)	9.40	9.87	0.13		-2.071	-2.176
124)	9.60	9.86	0.12		-2.146	-2.262
125)	9.80	9.85	0.11		-2.235	-2.347
126)	10.00	9.83	0.09		-2.397	-2.432
127)	11.00	9.80	0.06		-2.813	-2.858
128)	12.00	9.78	0.04		-3.194	-3.284
129)	13.00	9.76	0.02		-3.817	-3.710
130)	14.00	9.73	0.01		-4.962	-4.136

APPENDIX E

Groundwater Elevation Hydrographs

Groundwater Hydrograph
Well MW-1
Northwest Natural Gas Company - Gasco Facility

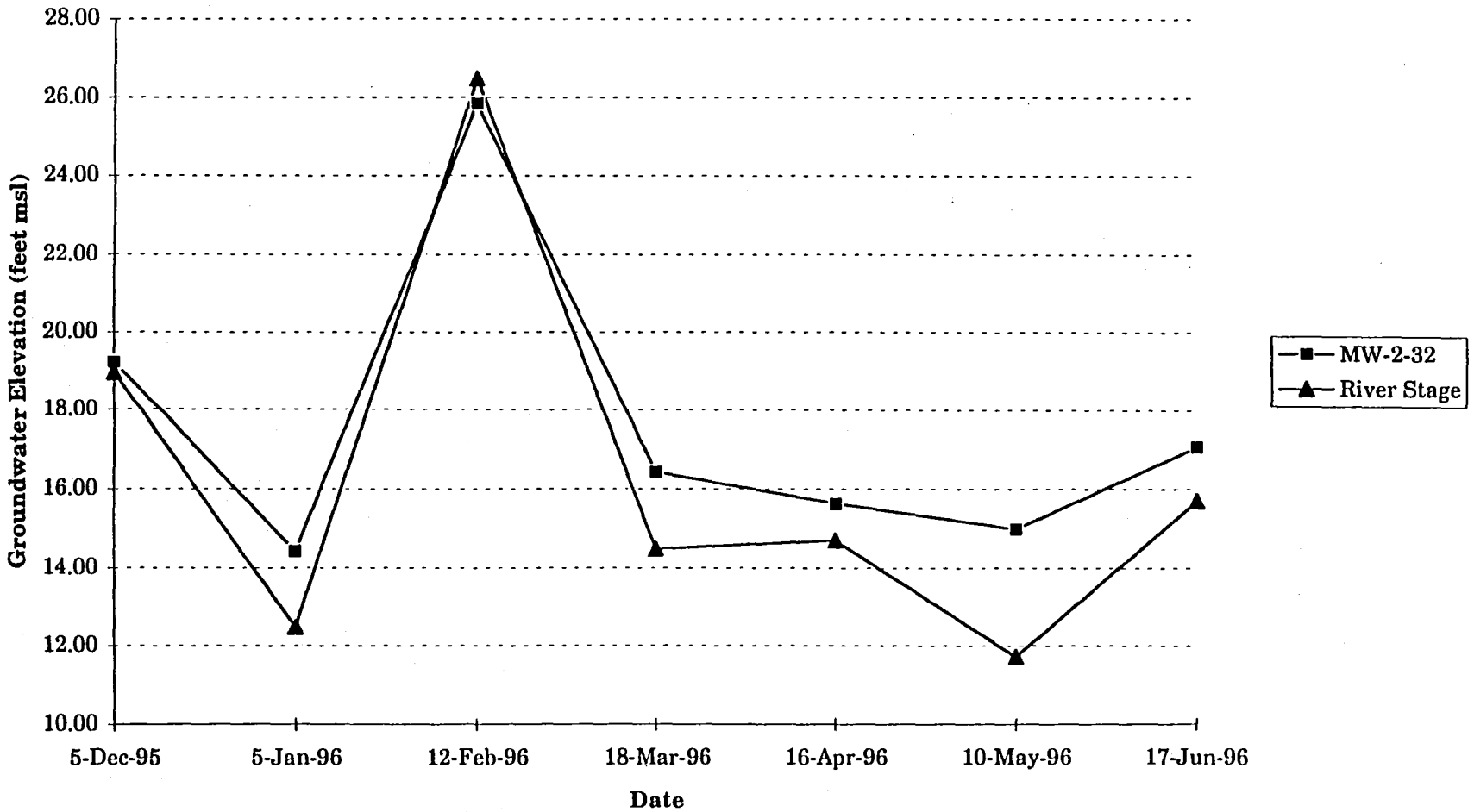


Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-1

HAHN AND ASSOCIATES, INC.
Project # 2708

NWT 002801

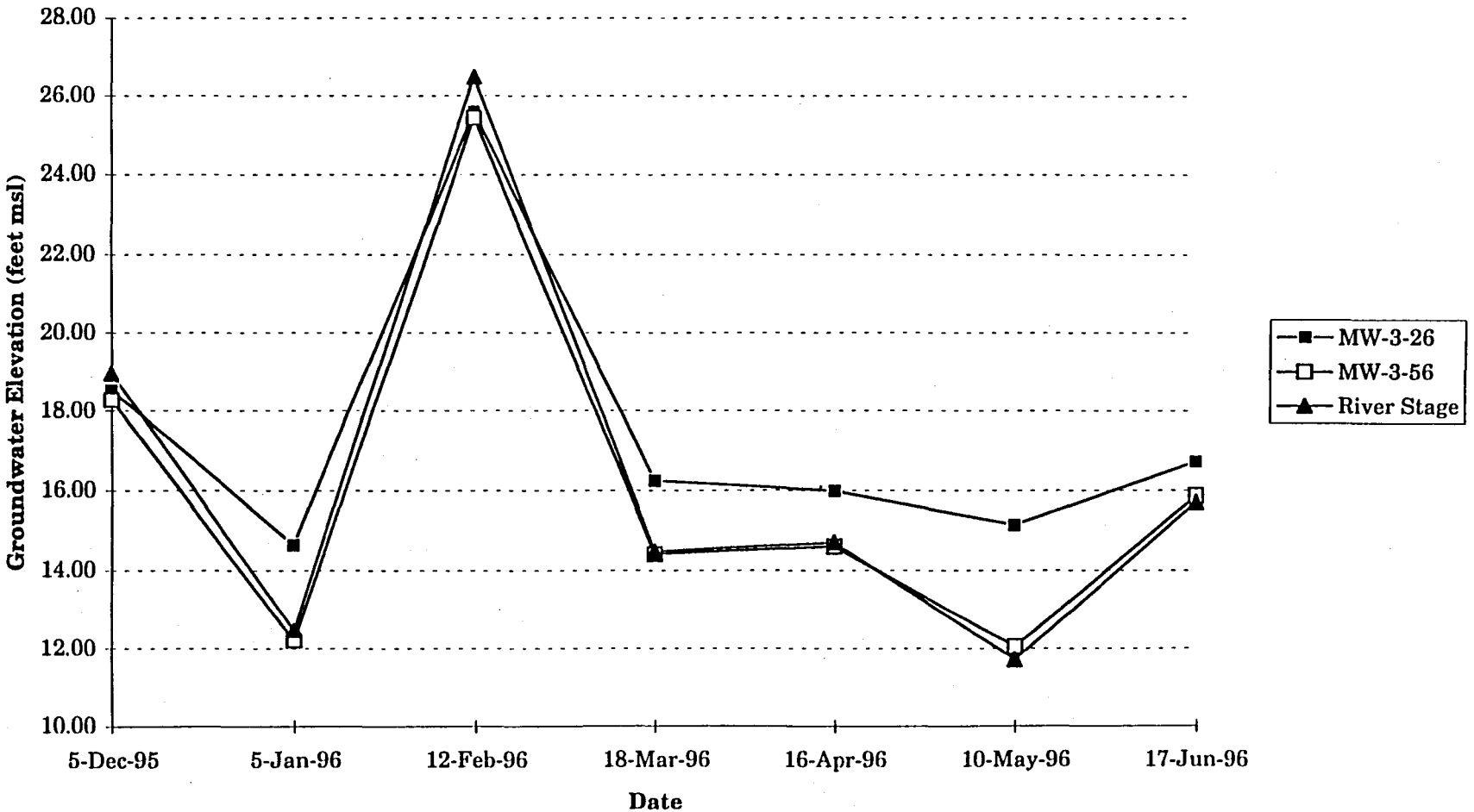
Groundwater Hydrograph
Well MW-2
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-2

HAHN AND ASSOCIATES, INC.
Project # 2708

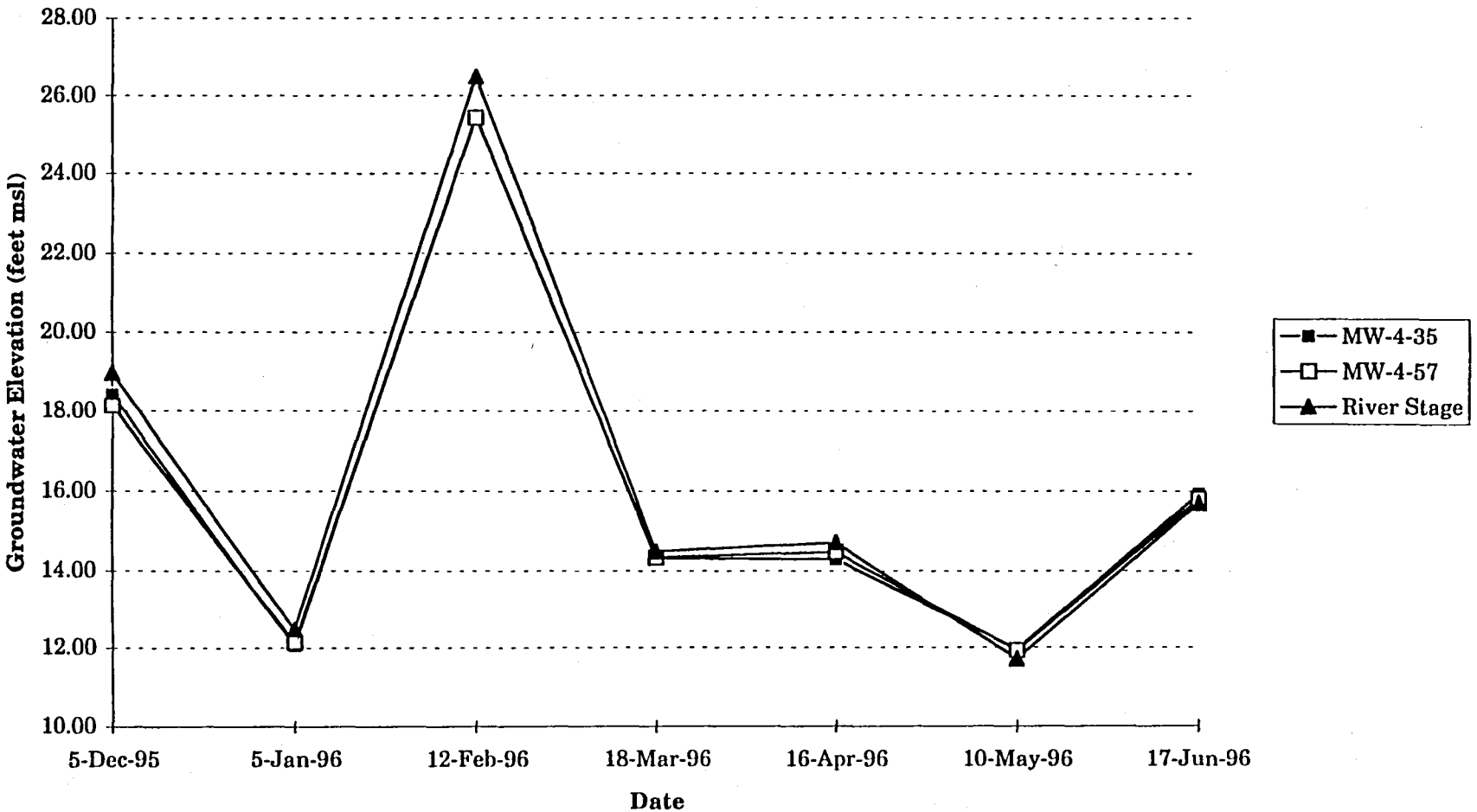
Groundwater Hydrograph
MW-3 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-3 Cluster Hydrograph

HAHN AND ASSOCIATES, INC.
Project # 2708

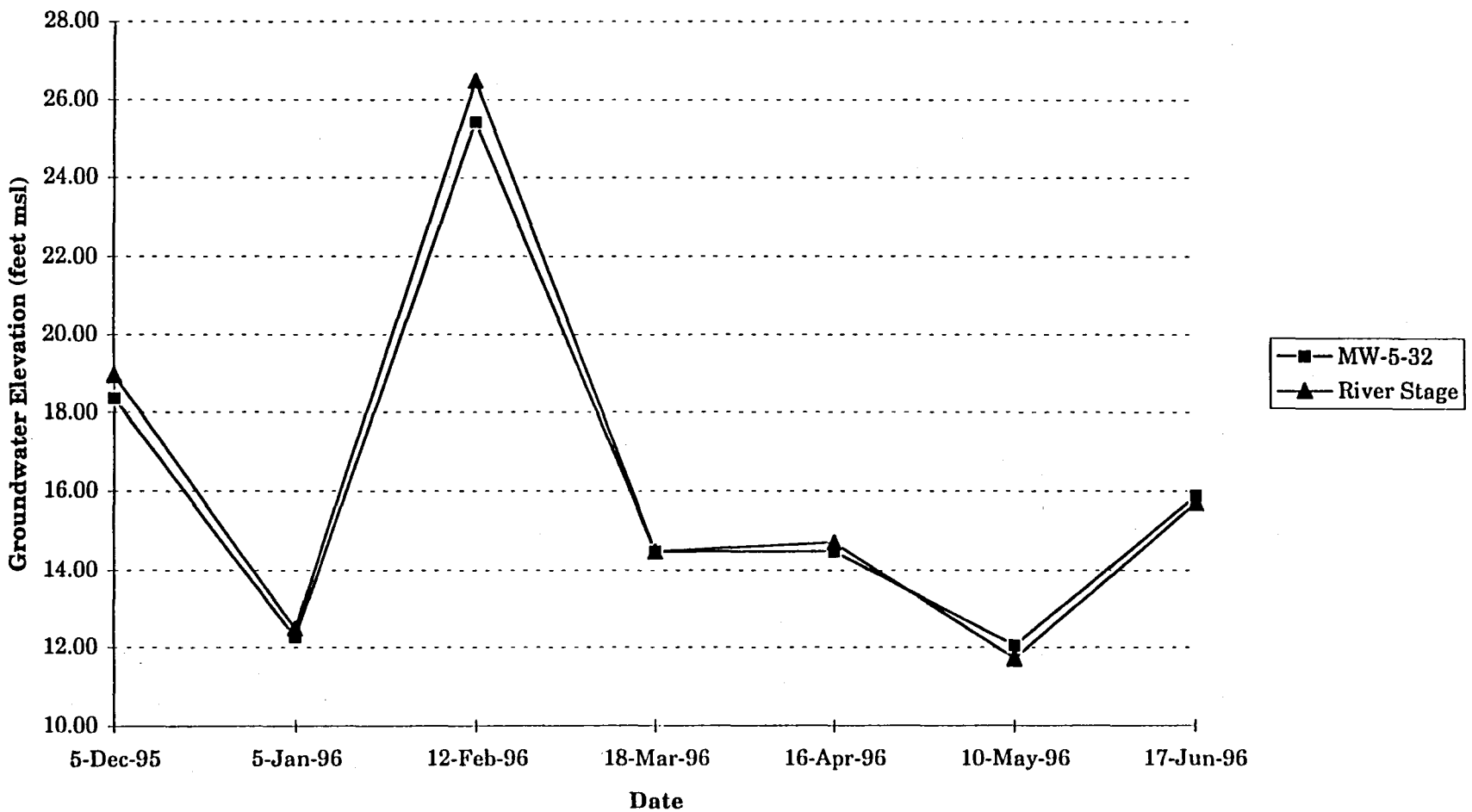
Groundwater Hydrograph
MW-4 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated 7/5/96 RBE
File2708 GW Elevations

HAHN AND ASSOCIATES, INC.
Project # 2708

Groundwater Hydrograph
Well MW-5
Northwest Natural Gas Company - Gasco Facility

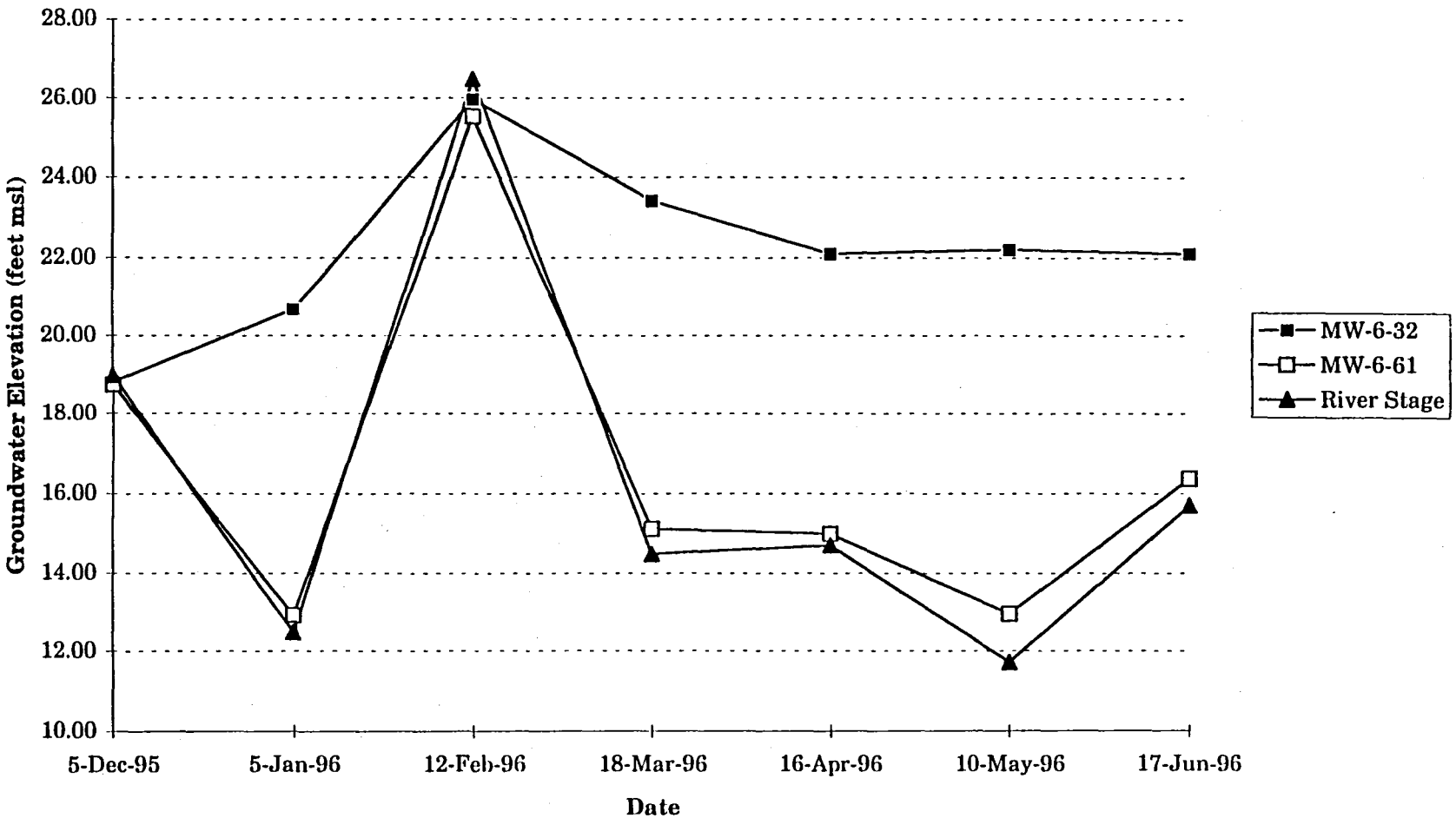


Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-5

HAHN AND ASSOCIATES, INC.
Project # 2708

NWT 002805

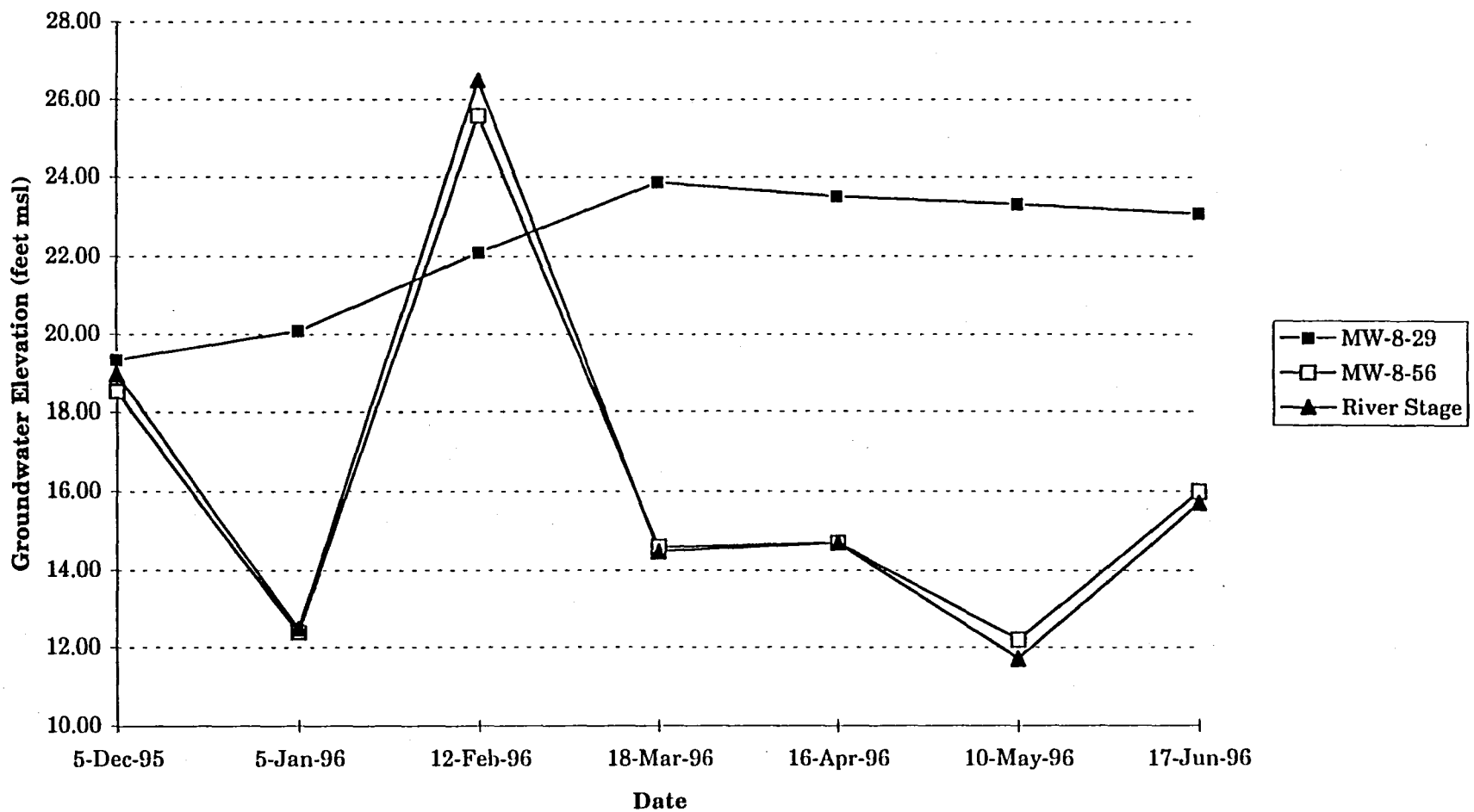
Groundwater Hydrograph
MW-6 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-6 Cluster Hydrograph

HAHN AND ASSOCIATES, INC.
Project # 2708

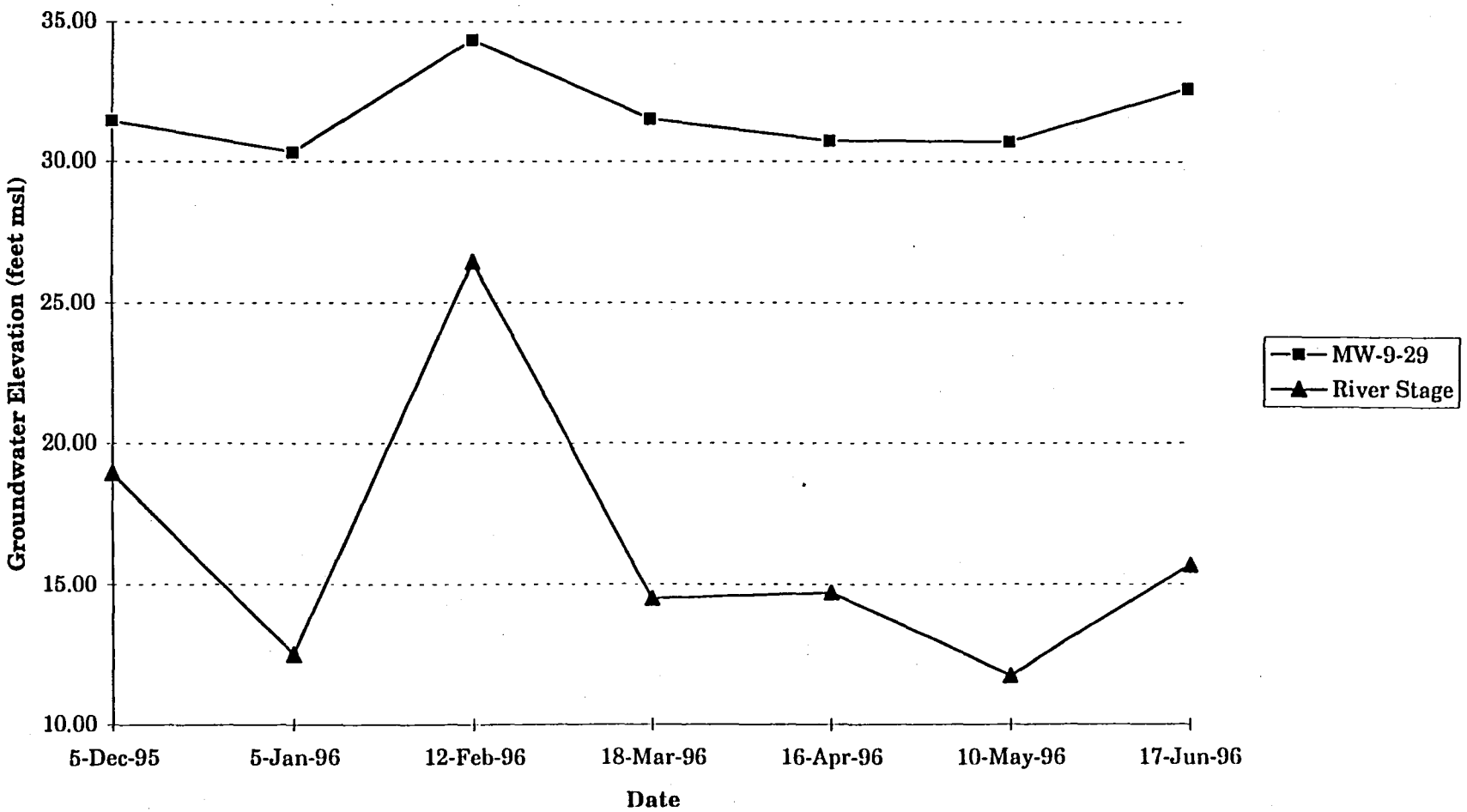
Groundwater Hydrograph
MW-8 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-8 Cluster Hydrograph

HAHN AND ASSOCIATES, INC.
Project # 2708

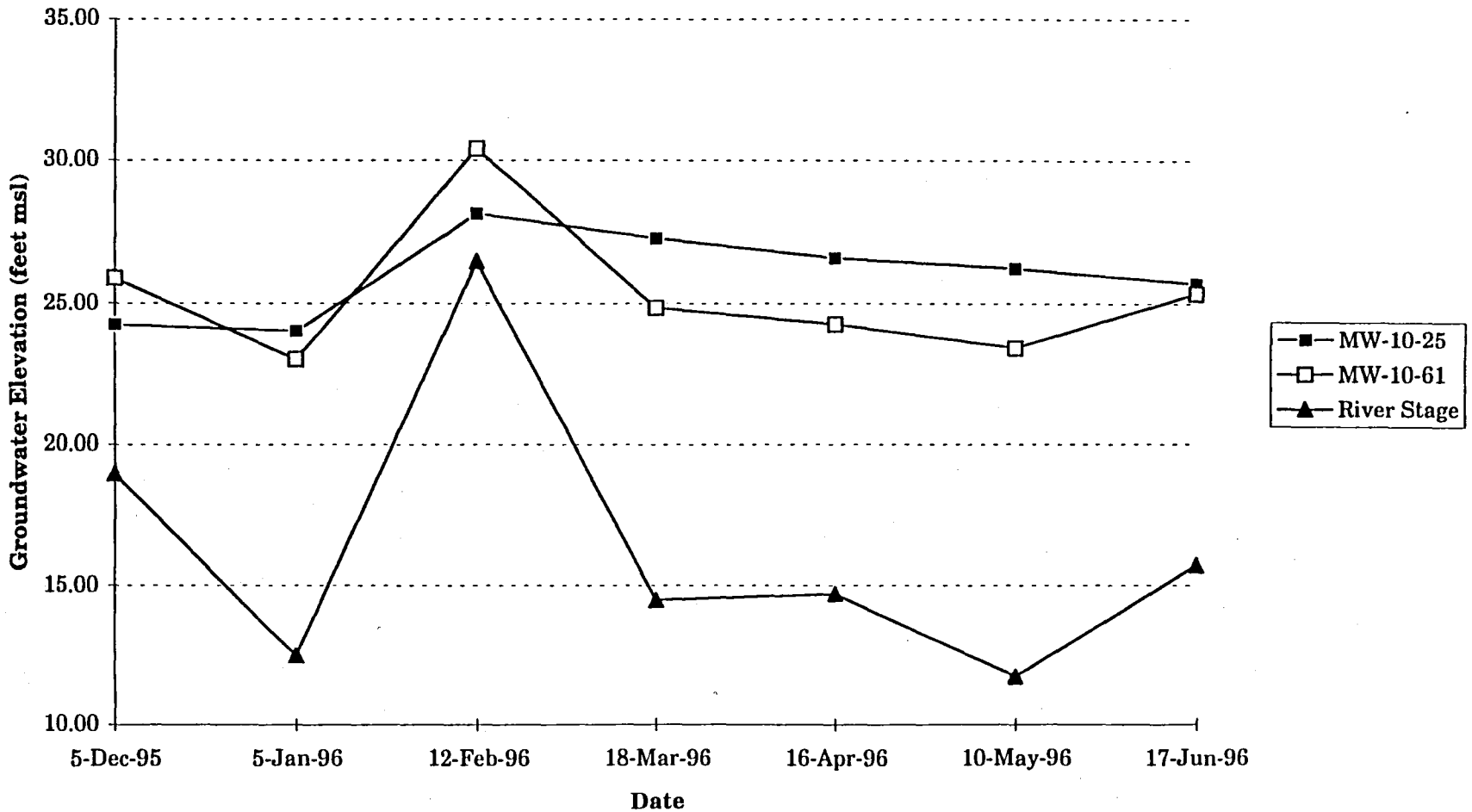
Groundwater Hydrograph
Well MW-9
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-9

HAHN AND ASSOCIATES, INC.
Project # 2708

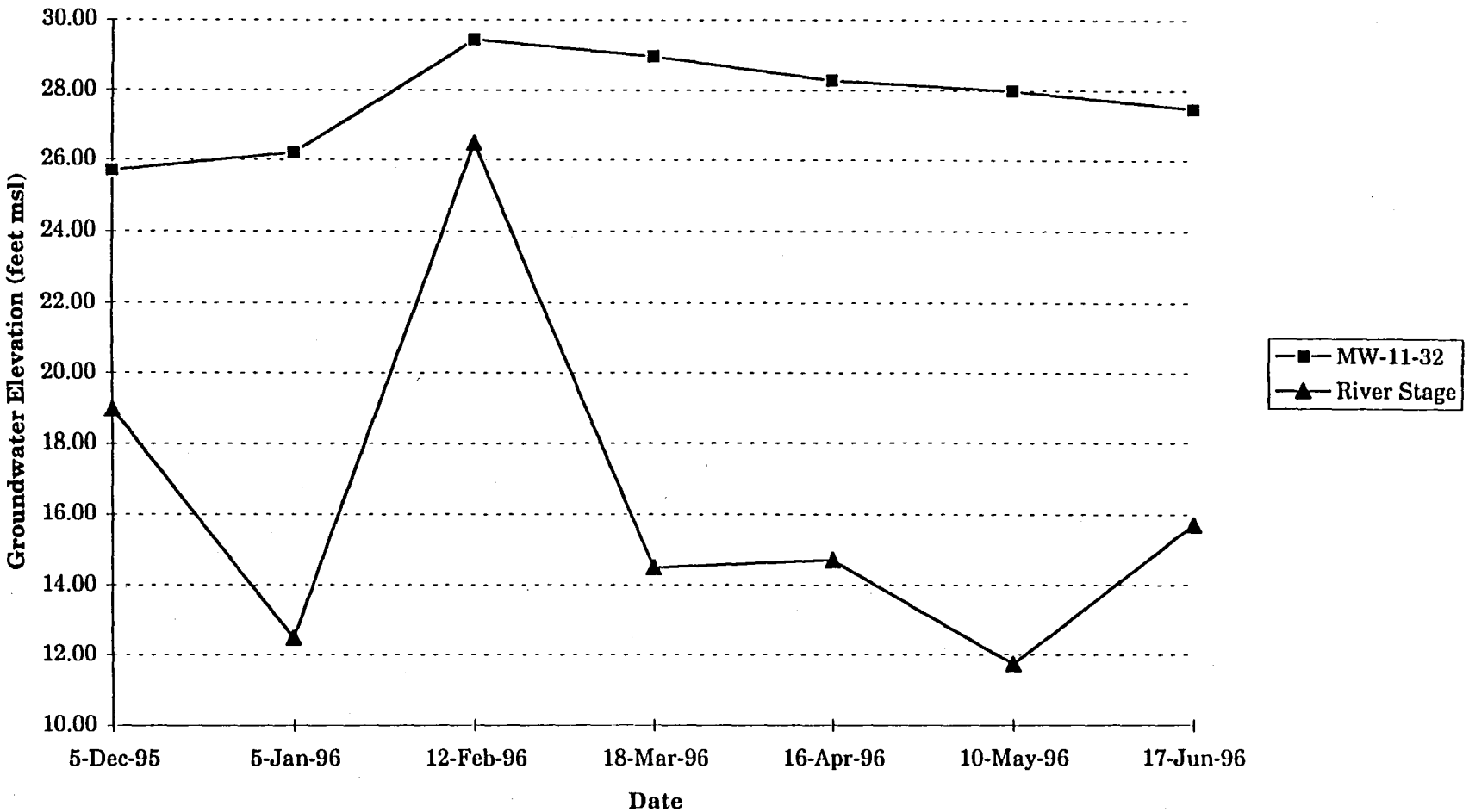
Groundwater Hydrograph
MW-10 Well Cluster
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-10 Cluster Hydrograph

HAHN AND ASSOCIATES, INC.
Project # 2708

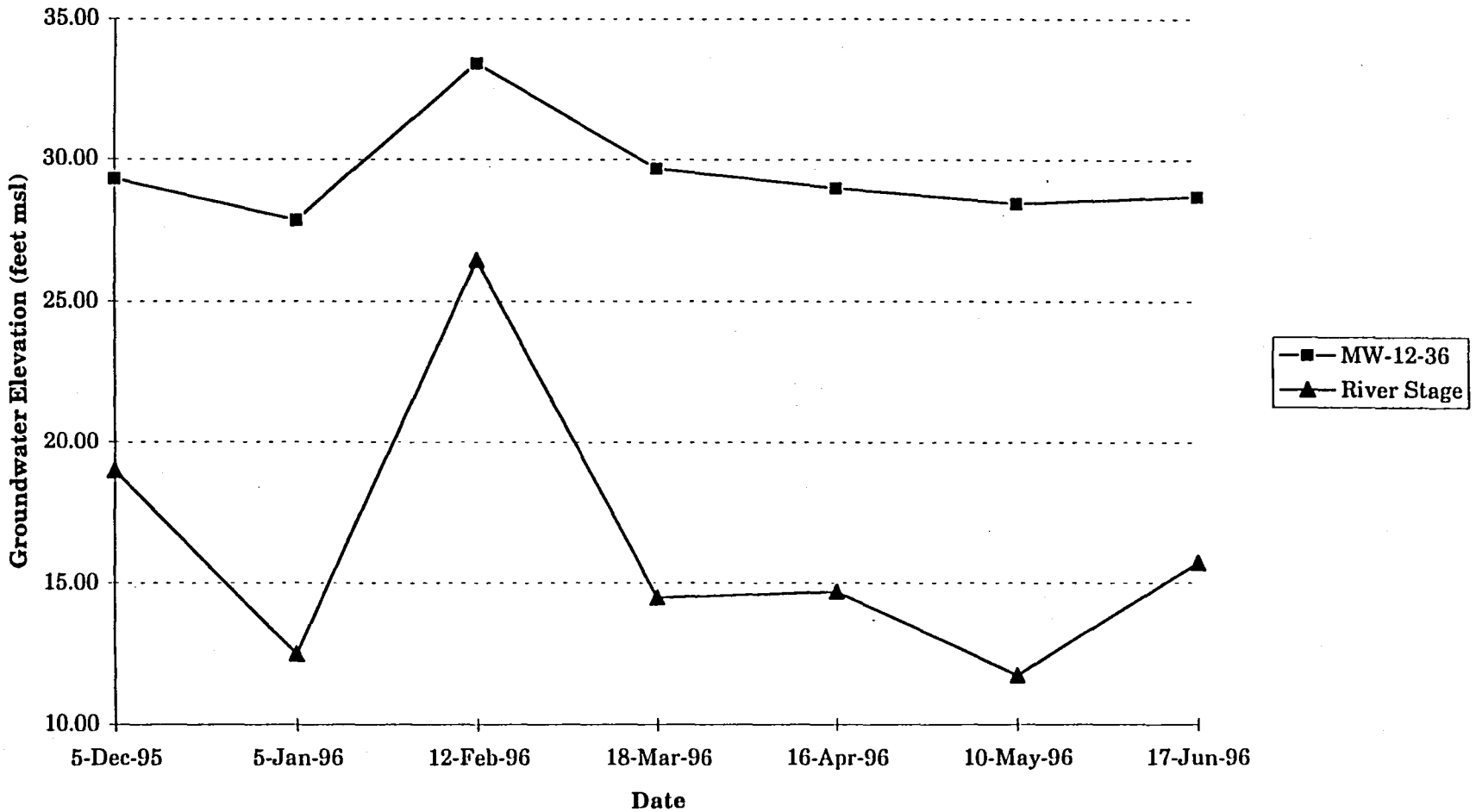
Groundwater Hydrograph
Well MW-11
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-11

HAHN AND ASSOCIATES, INC.
Project # 2708

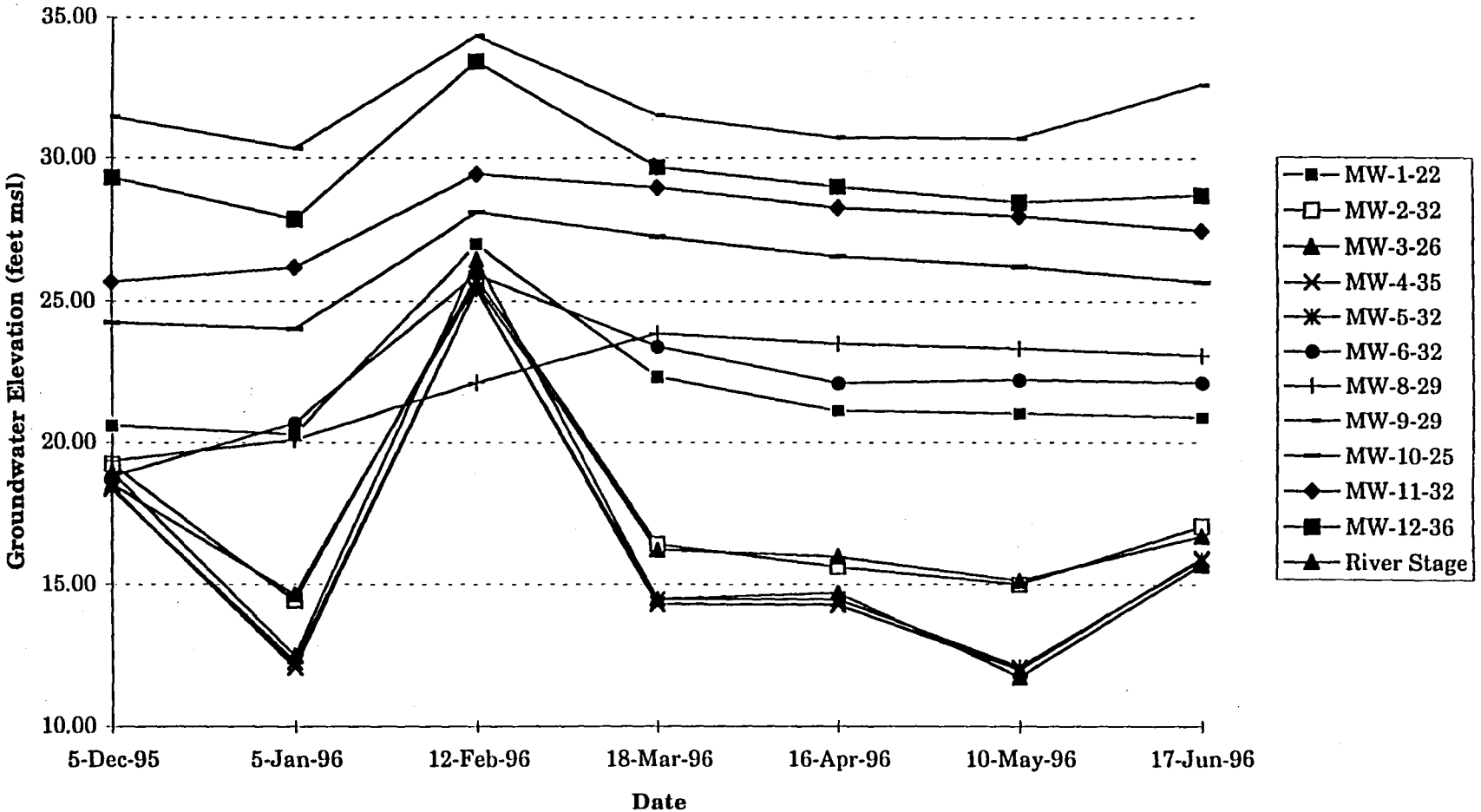
Groundwater Hydrograph
Well MW-12
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ MW-12

HAHN AND ASSOCIATES, INC.
Project # 2708

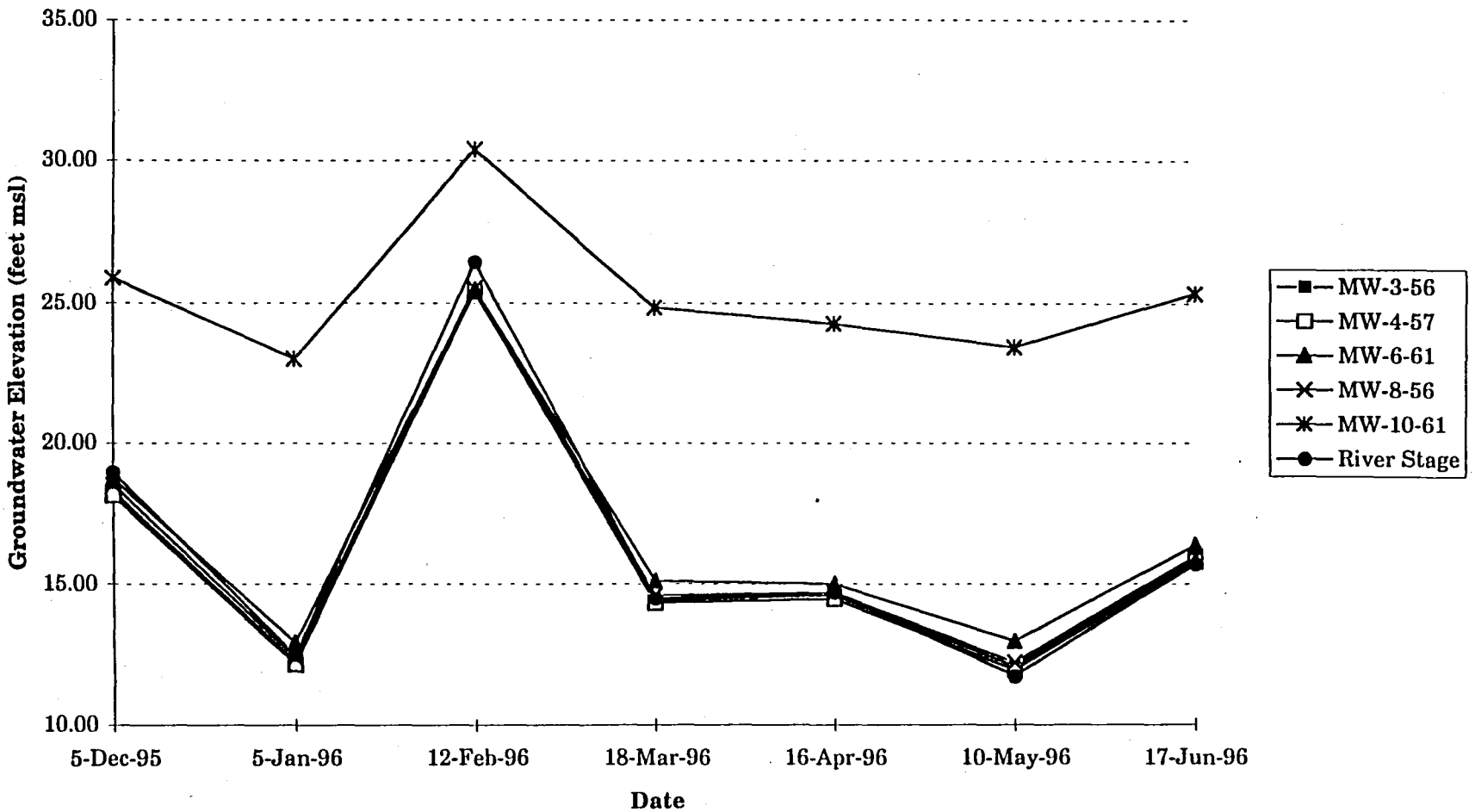
Groundwater Hydrograph
Shallow Depth Aquifer Zone Monitoring Wells
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ Hydrograph - Shallow Wells

HAHN AND ASSOCIATES, INC.
Project # 2708

Groundwater Hydrograph
Intermediate Depth Aquifer Zone Monitoring Wells
Northwest Natural Gas Company - Gasco Facility



Updated: 7/5/96 RBE
File: 2708 GW Elevations/ Hydrograph - Deep Wells

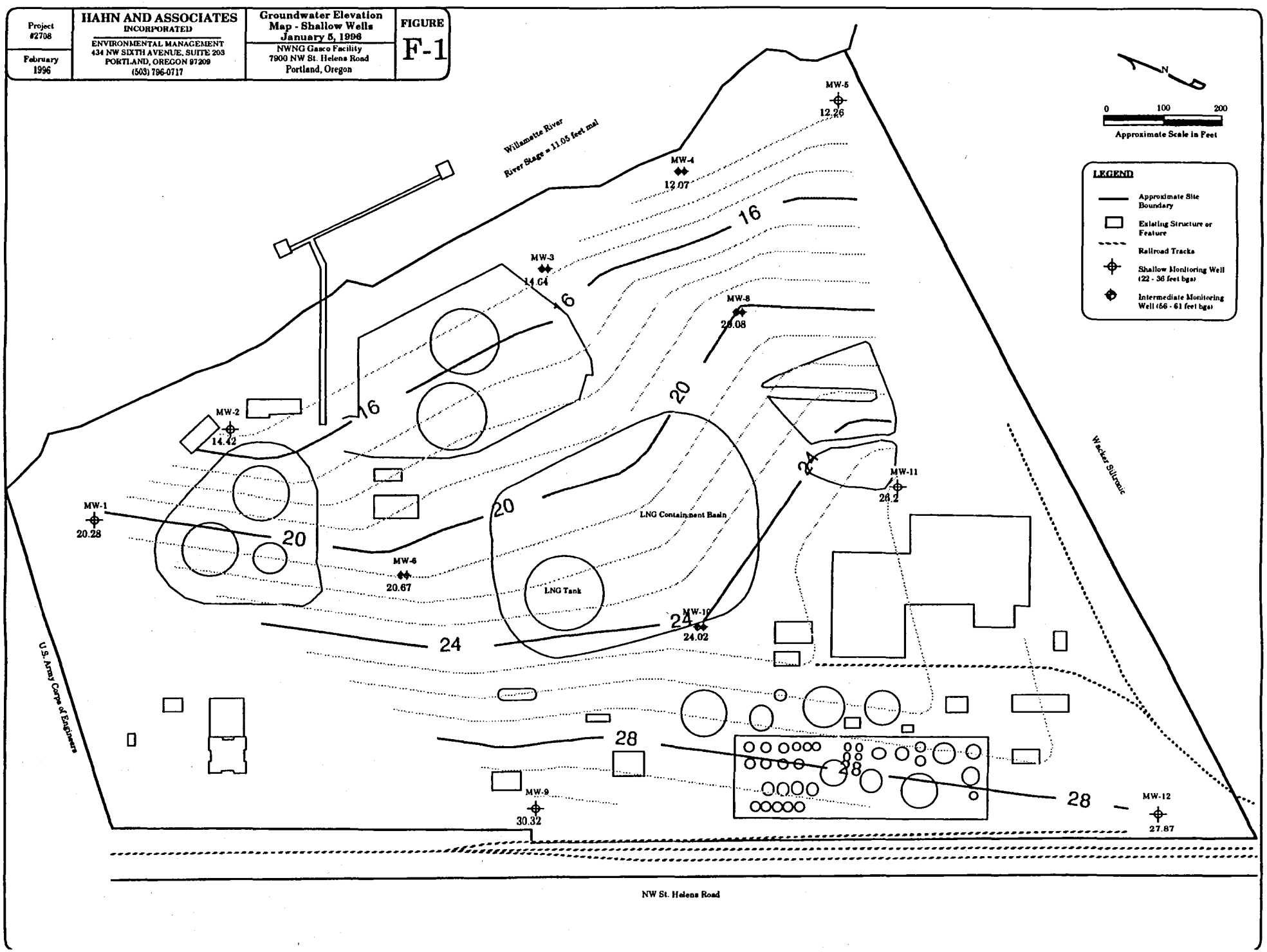
HAHN AND ASSOCIATES, INC.
Project # 2708

APPENDIX F

Groundwater Elevation Maps - Shallow Wells
January 1996 - June 1996

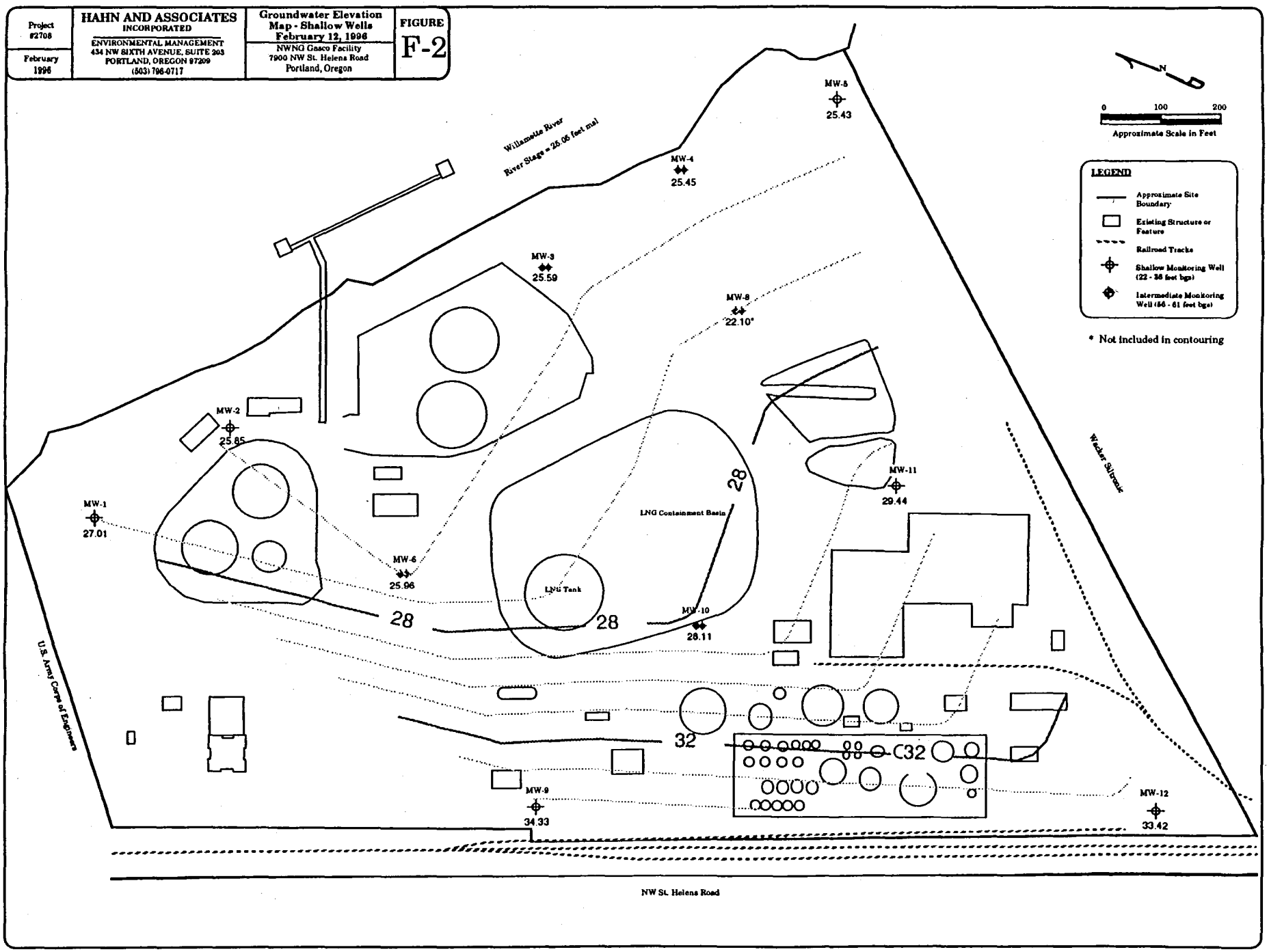
NWT 002814

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells January 5, 1996	FIGURE F-1
February 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



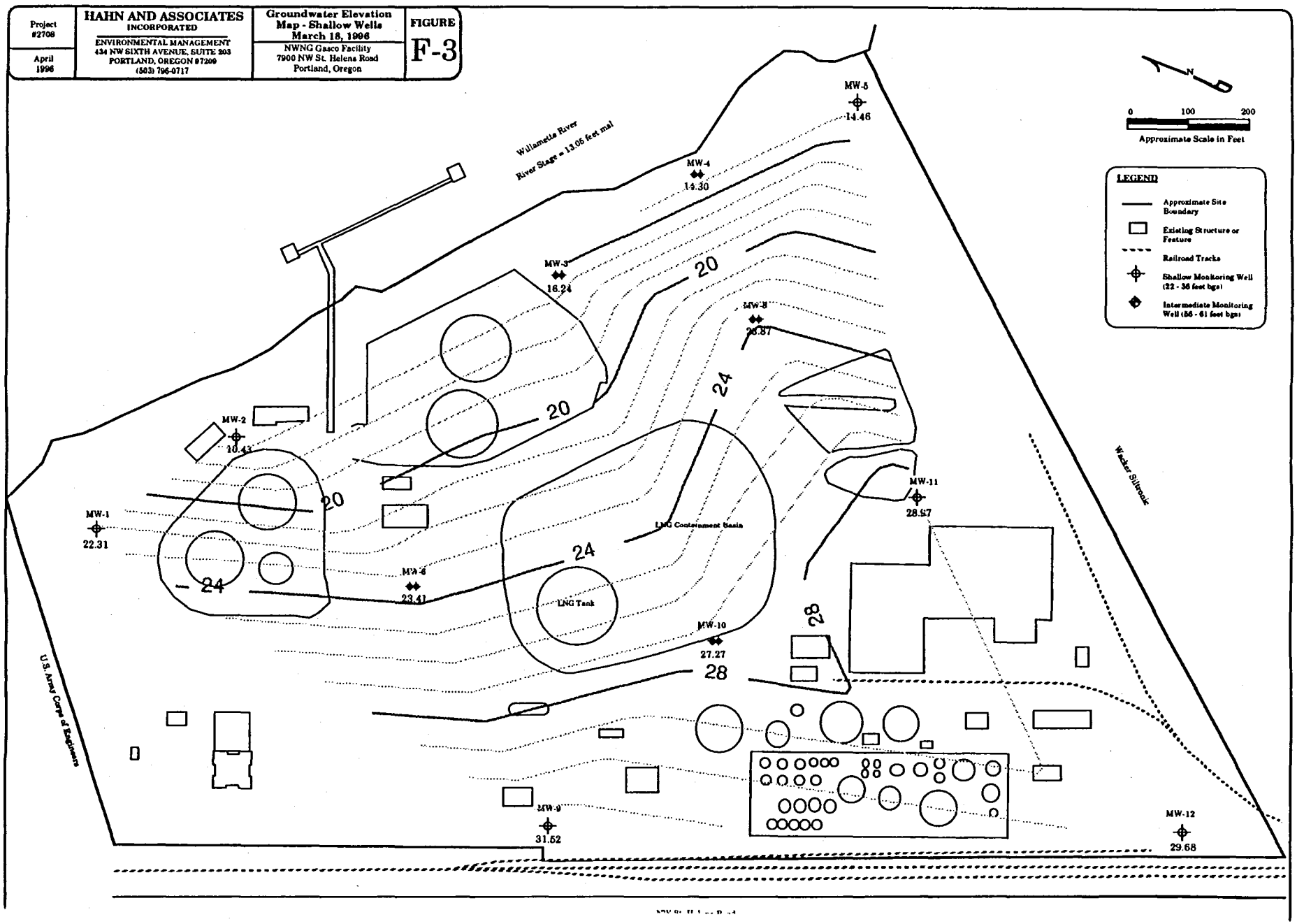
NWT 002815

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells February 12, 1996	FIGURE F-2
February 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



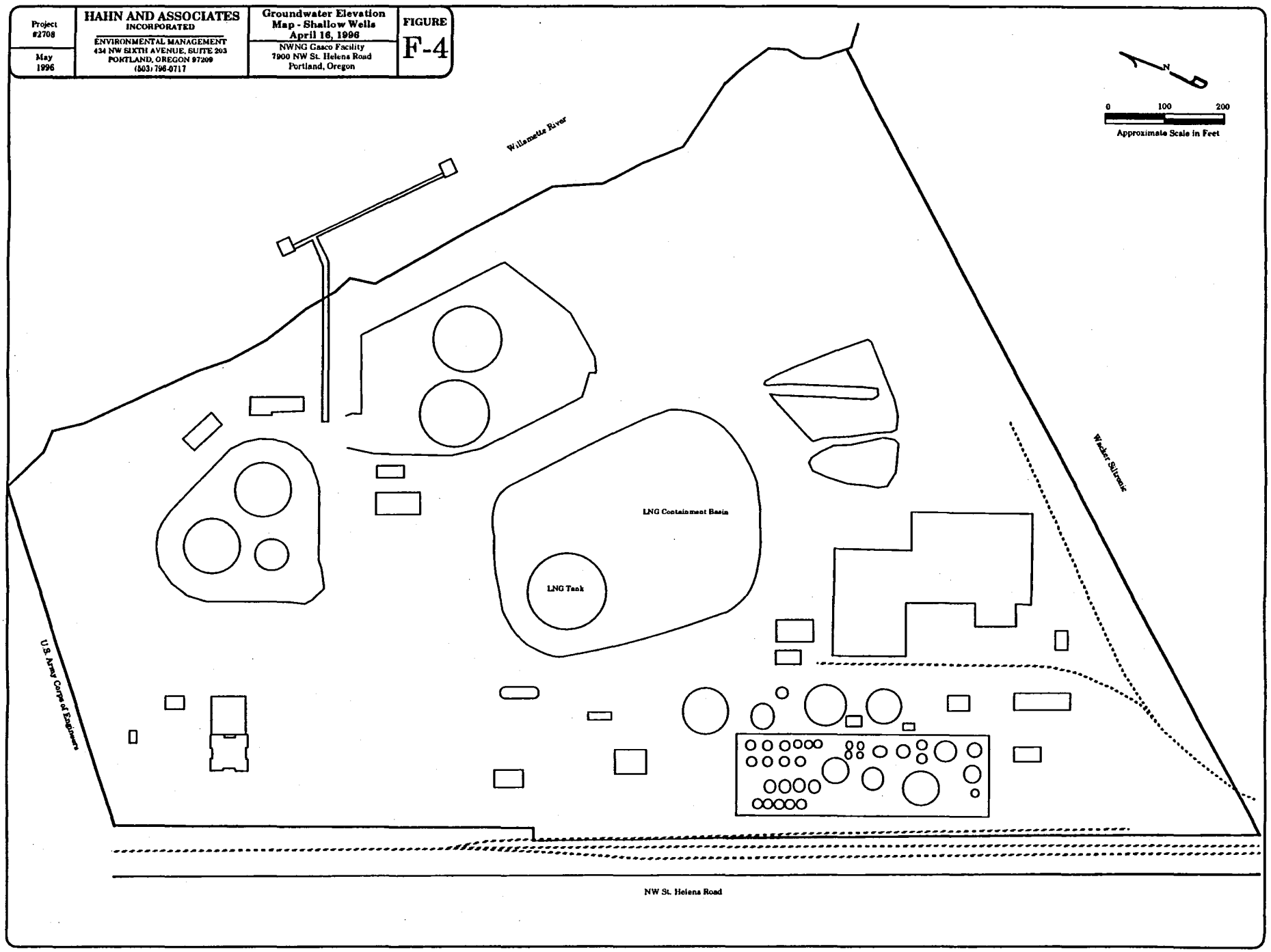
NWT 002816

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells March 18, 1996	FIGURE F-3
April 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



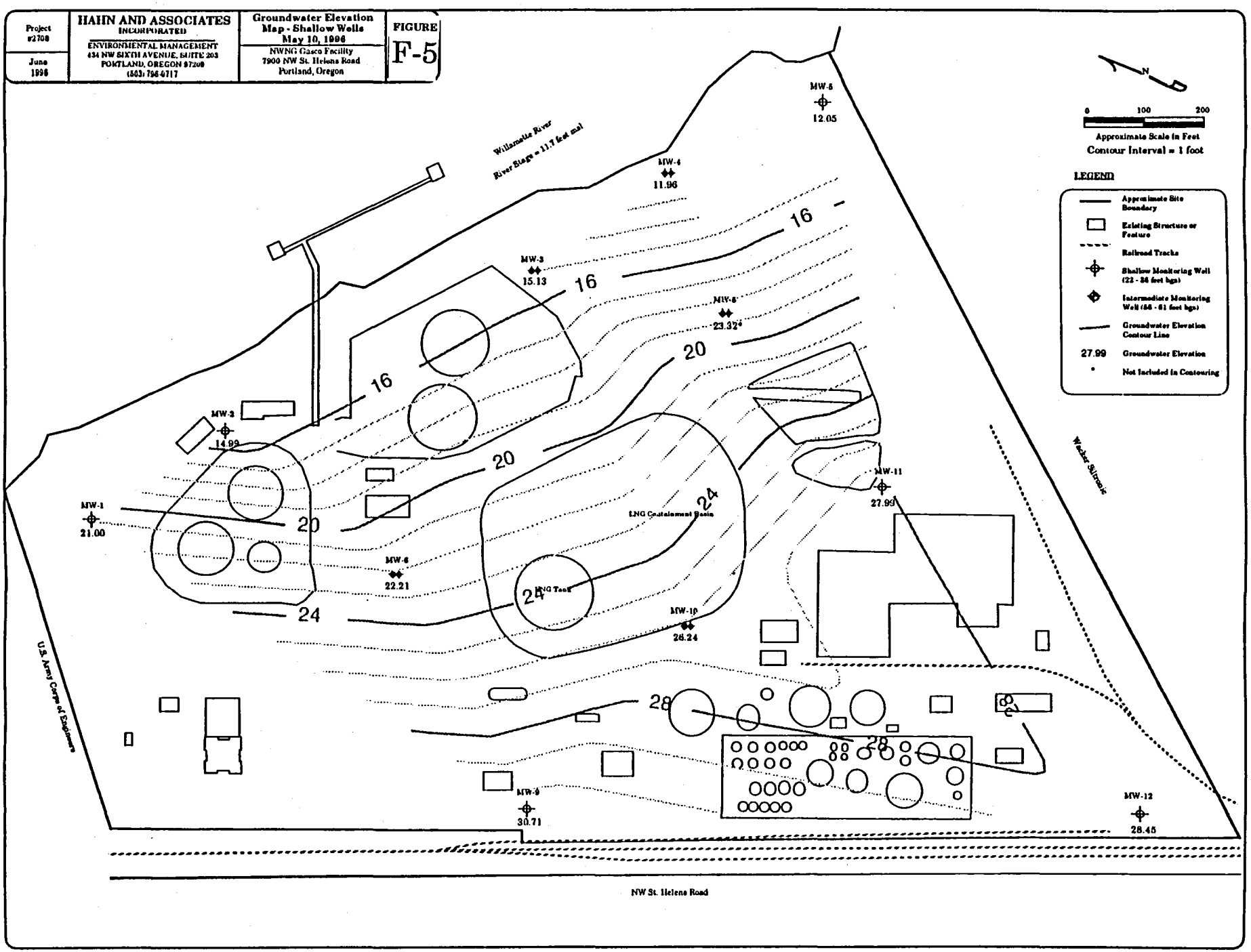
NWT 002817

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells April 16, 1996	FIGURE F-4
May 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



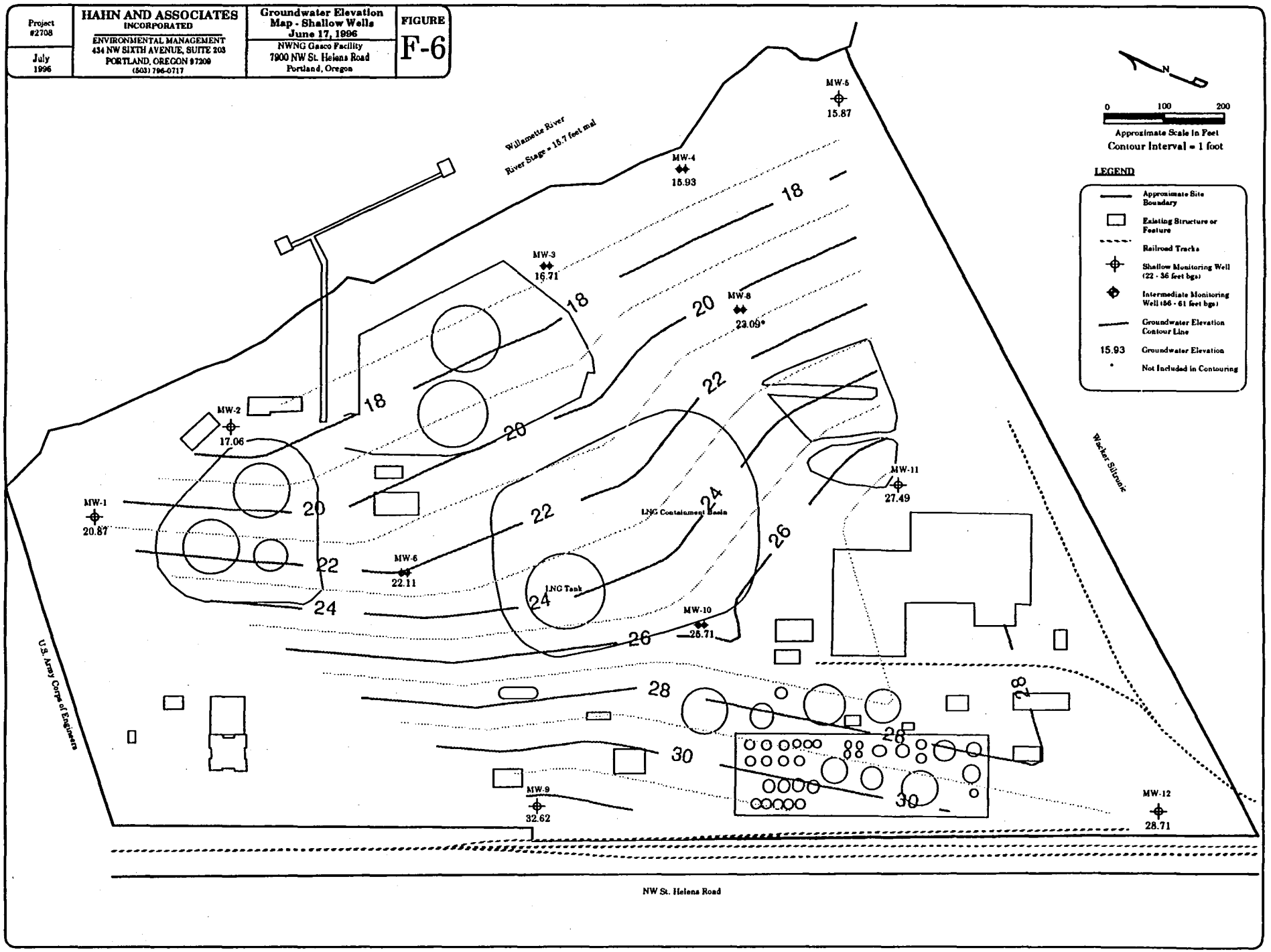
NWT 002818

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Shallow Wells May 10, 1996	FIGURE F-5
June 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



NWT 002819

Project #2708	HAHN AND ASSOCIATES INCORPORATED ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	Groundwater Elevation Map - Shallow Wells June 17, 1996 NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	FIGURE F-6
July 1996			



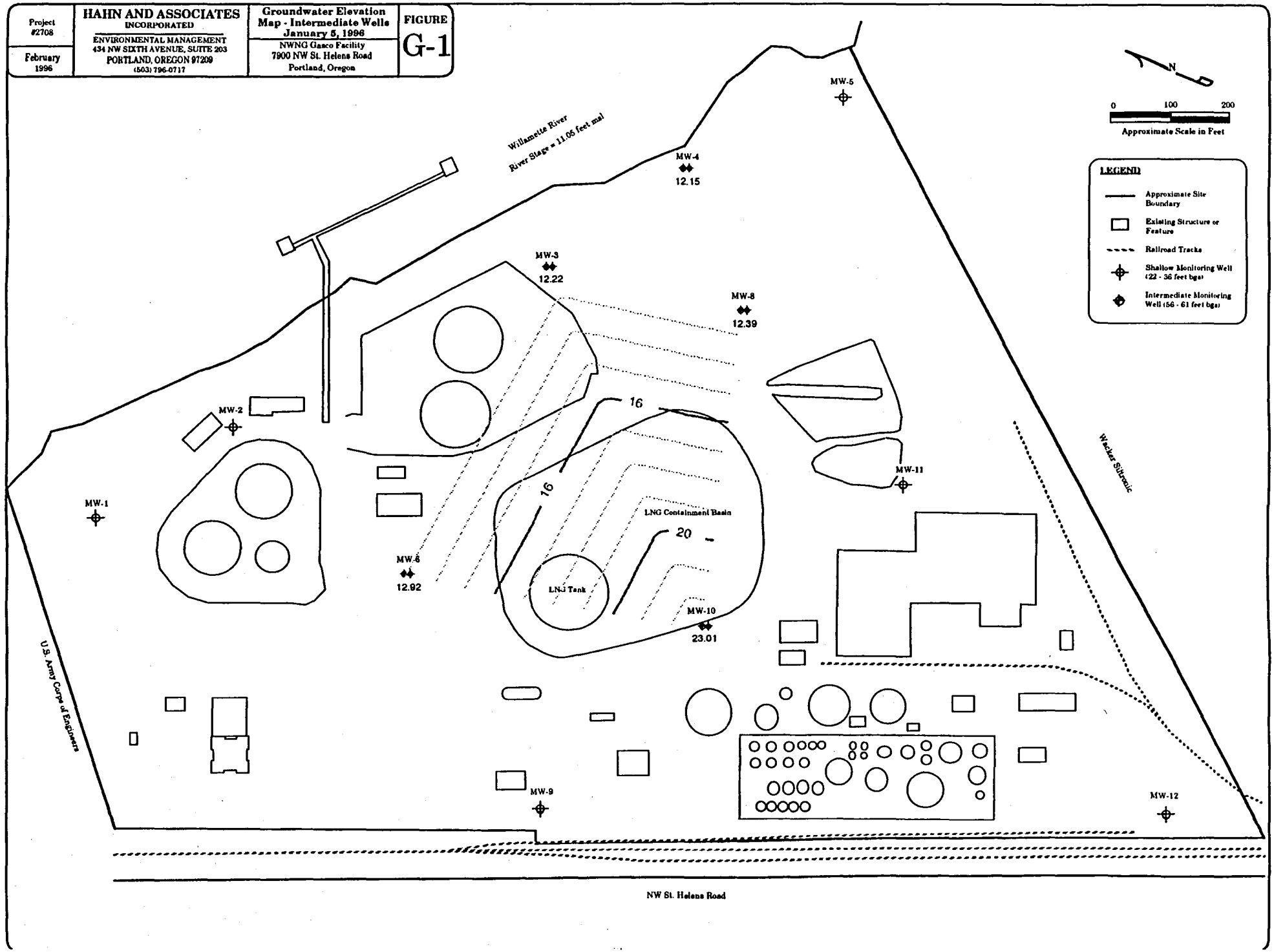
NWT 002820

APPENDIX G

Groundwater Elevation Maps - Intermediate Wells
January 1996 - June 1996

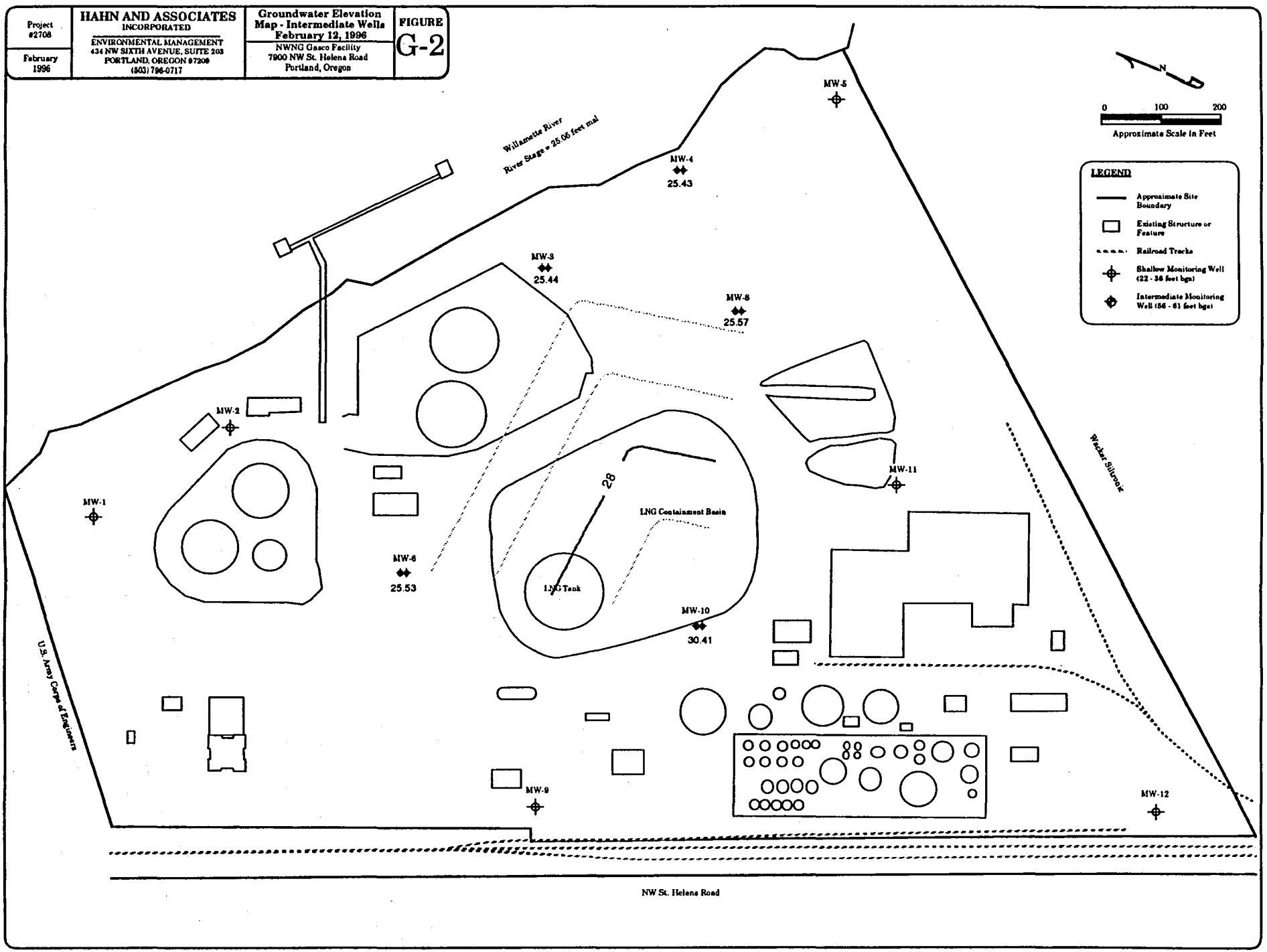
NWT 002821

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells January 5, 1996	FIGURE G-1
February 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



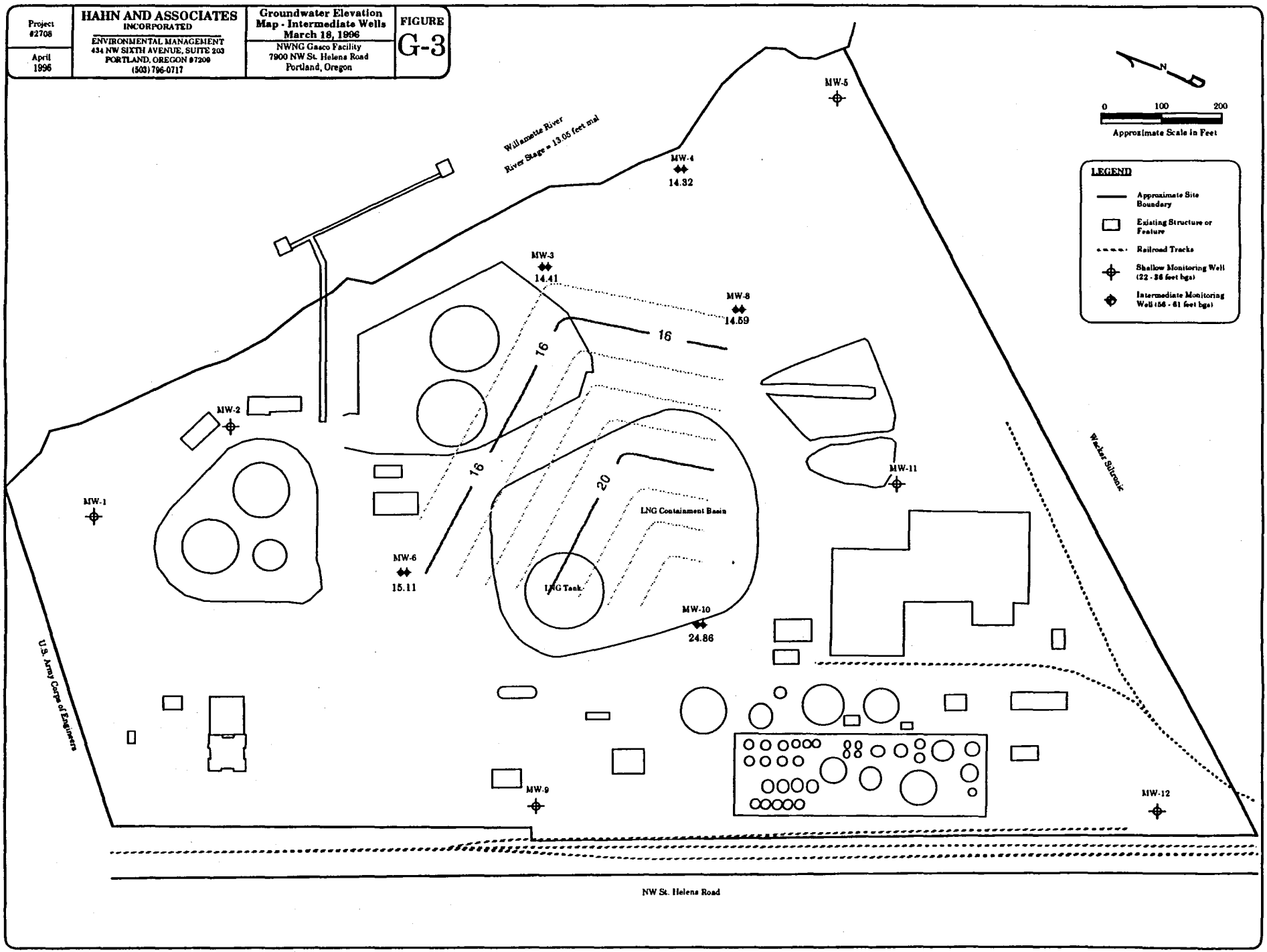
NWT 002822

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells February 12, 1996	FIGURE G-2
February 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



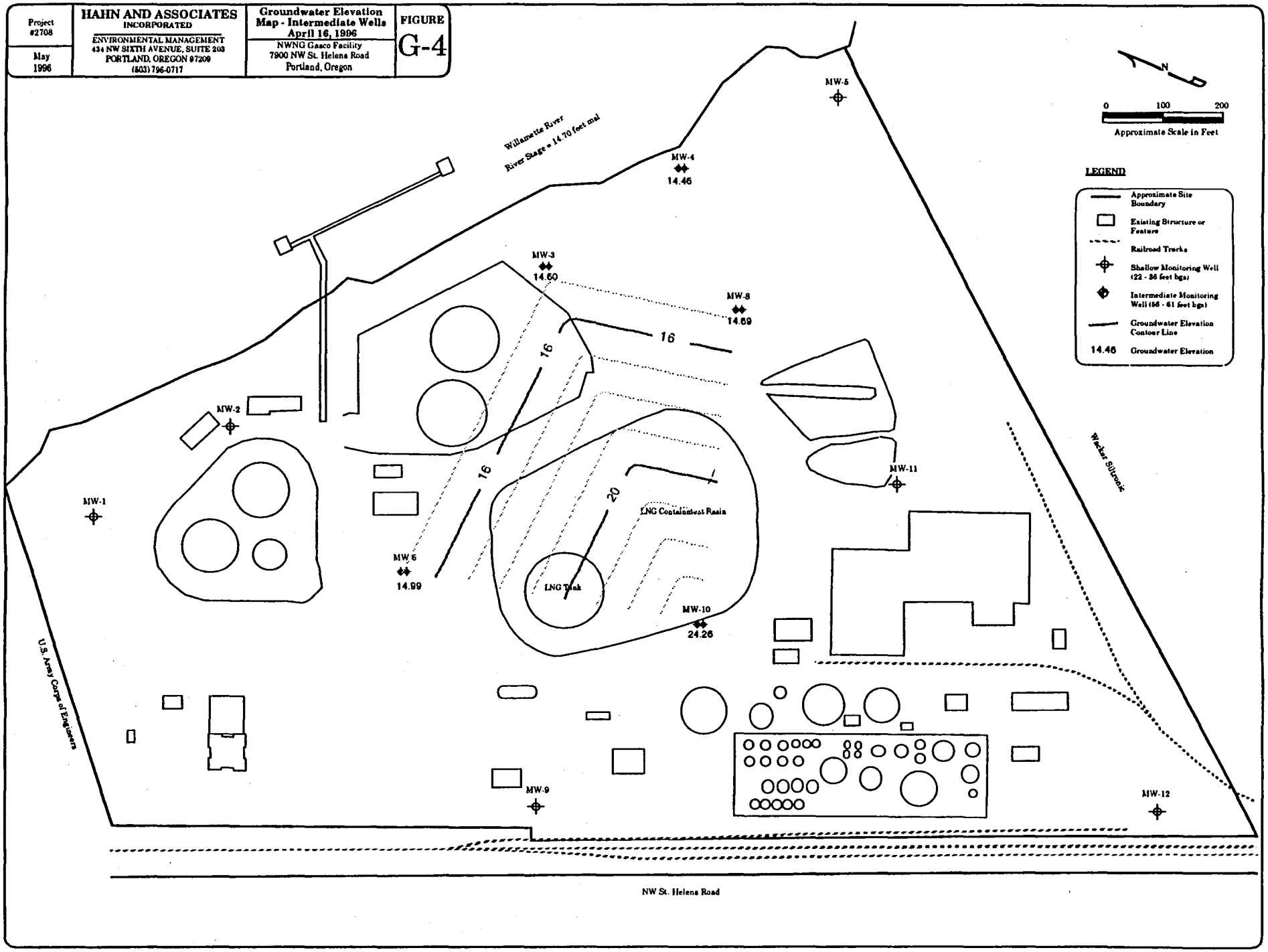
NWT 002823

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells March 18, 1996	FIGURE G-3
April 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



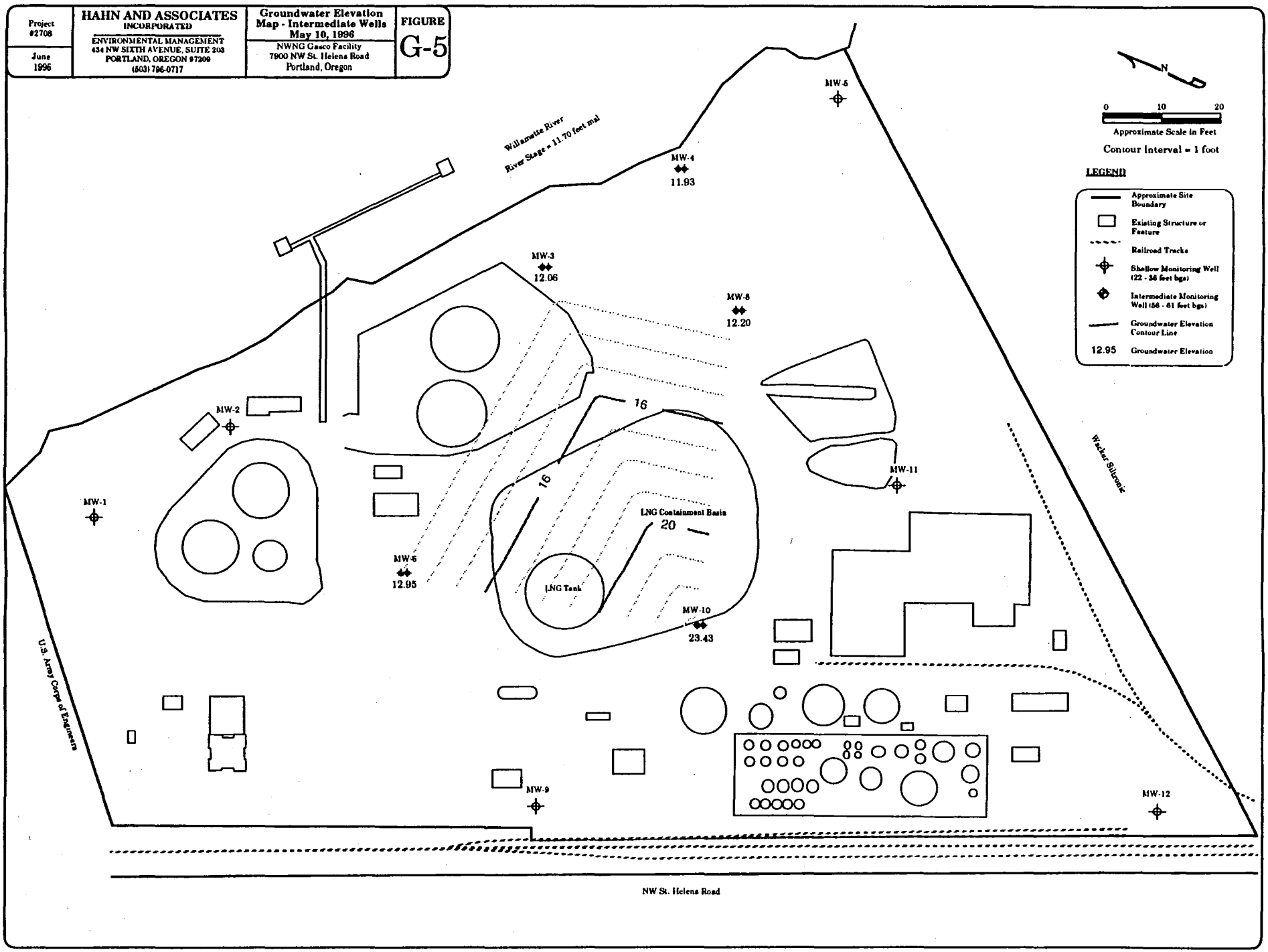
NWT 002824

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells April 16, 1996	FIGURE G-4
May 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



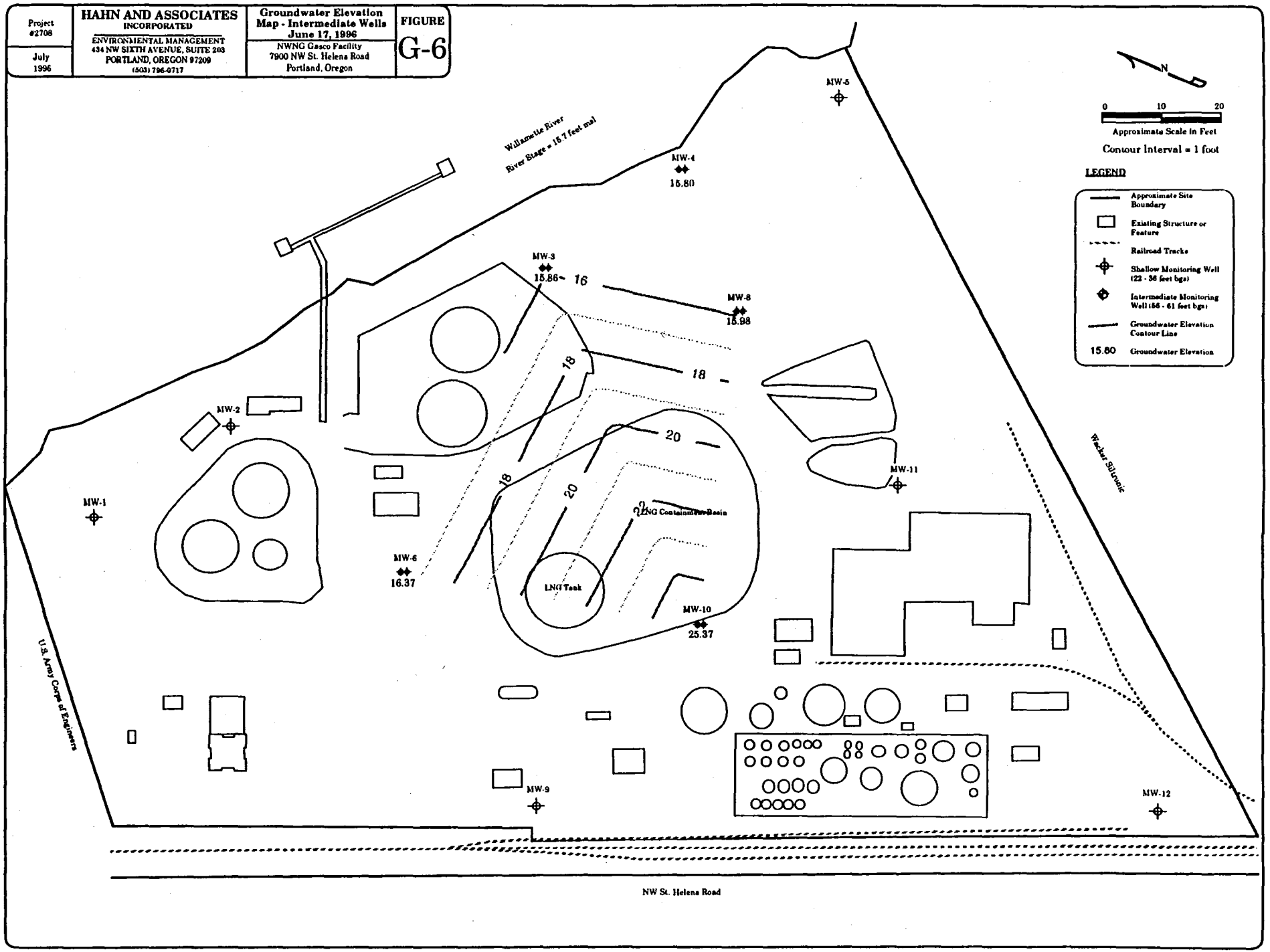
NWT 002825

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells May 10, 1996	FIGURE G-5
June 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	



NWT 002826

Project #2708	HAHN AND ASSOCIATES INCORPORATED	Groundwater Elevation Map - Intermediate Wells June 17, 1996	FIGURE
July 1996	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	G-6



NWT 002827

APPENDIX H

Groundwater Iso-Concentration Maps - Shallow Wells
March 1996

NWT 002828

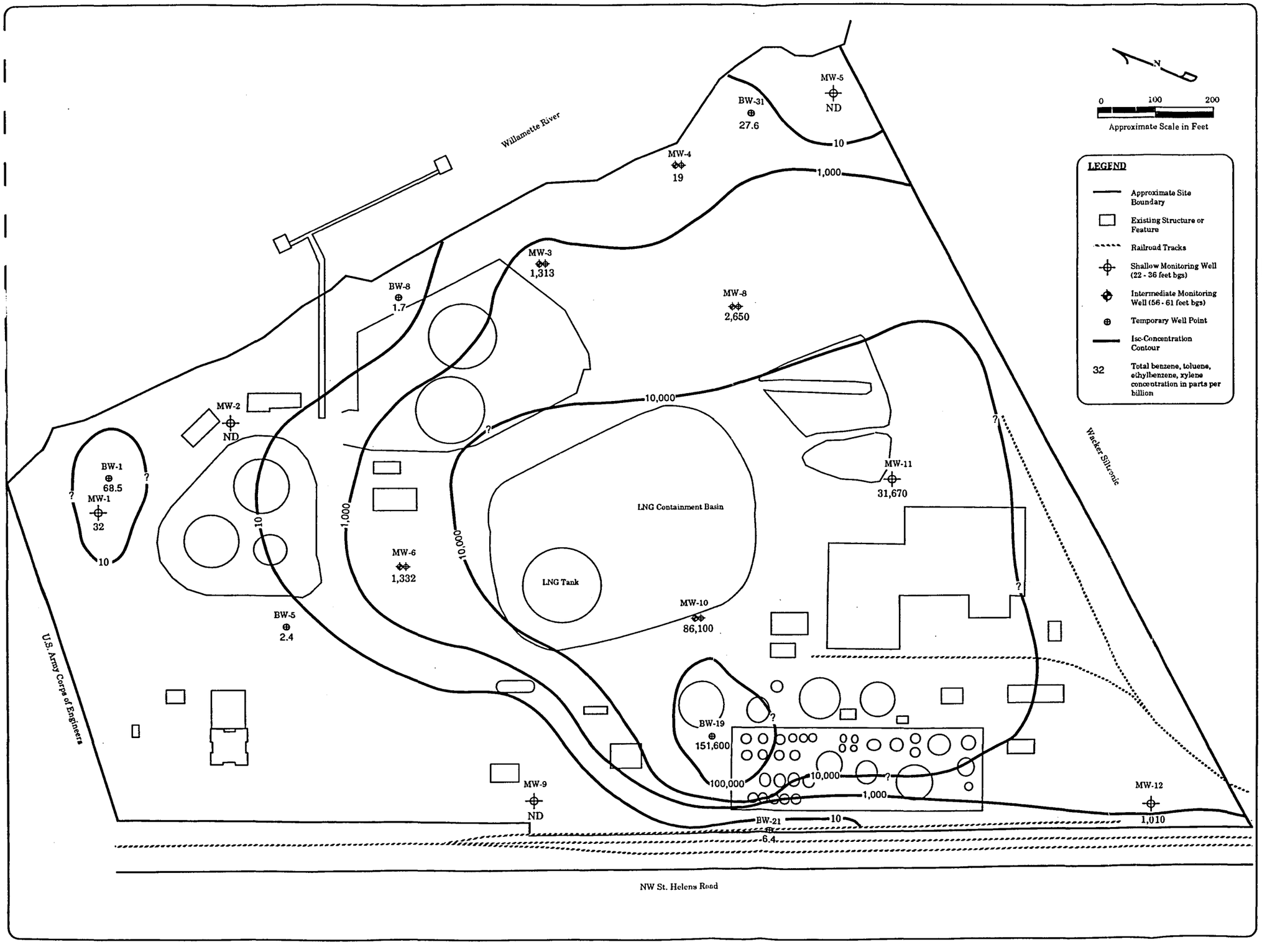


Figure H-1

Groundwater Iso-Concentration Map for Total BTEX: Shallow Wells March 1996

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

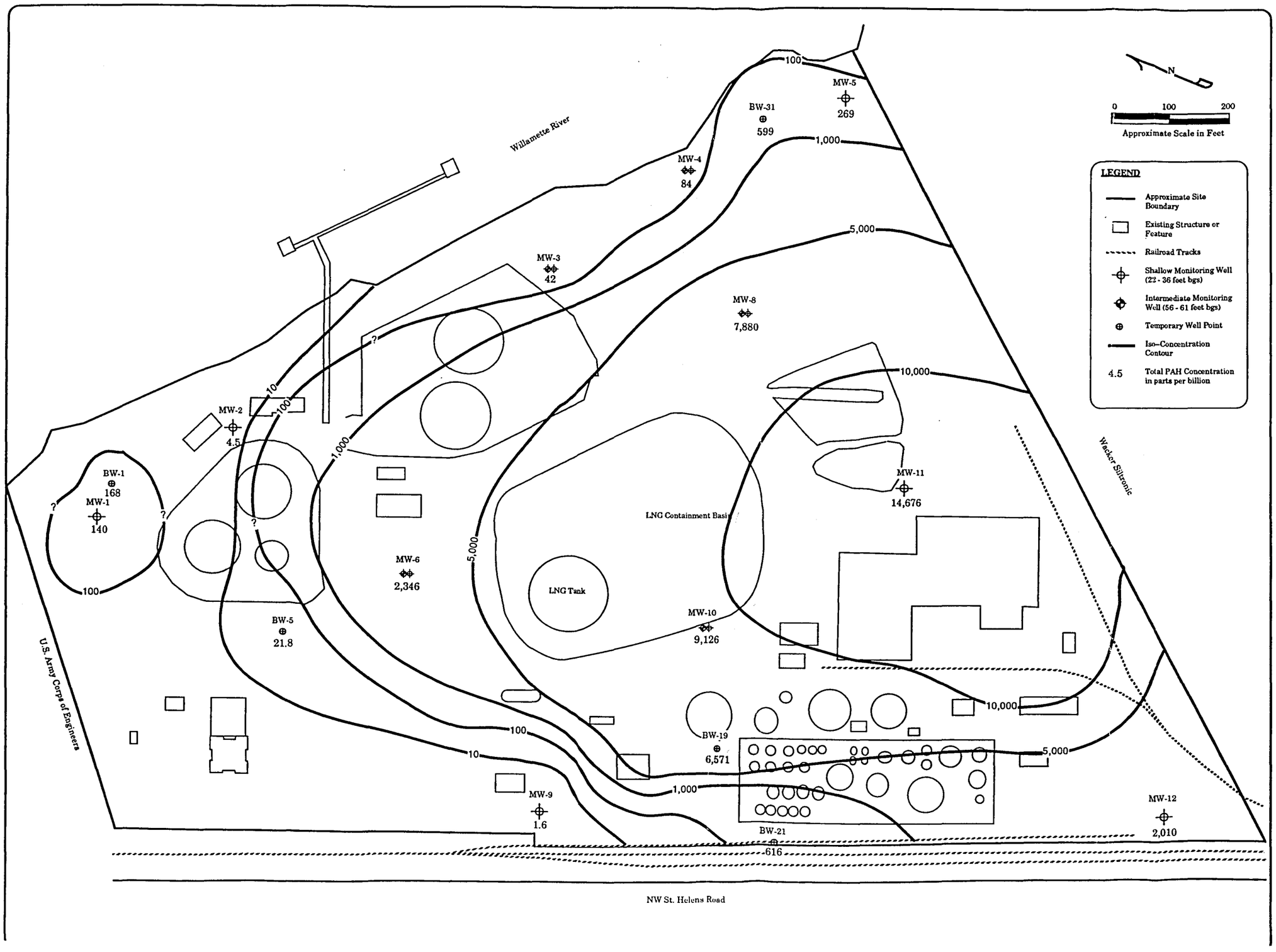


Figure H-2

Groundwater Iso-Concentration Map for Total PAHs: Shallow Wells March 1996

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

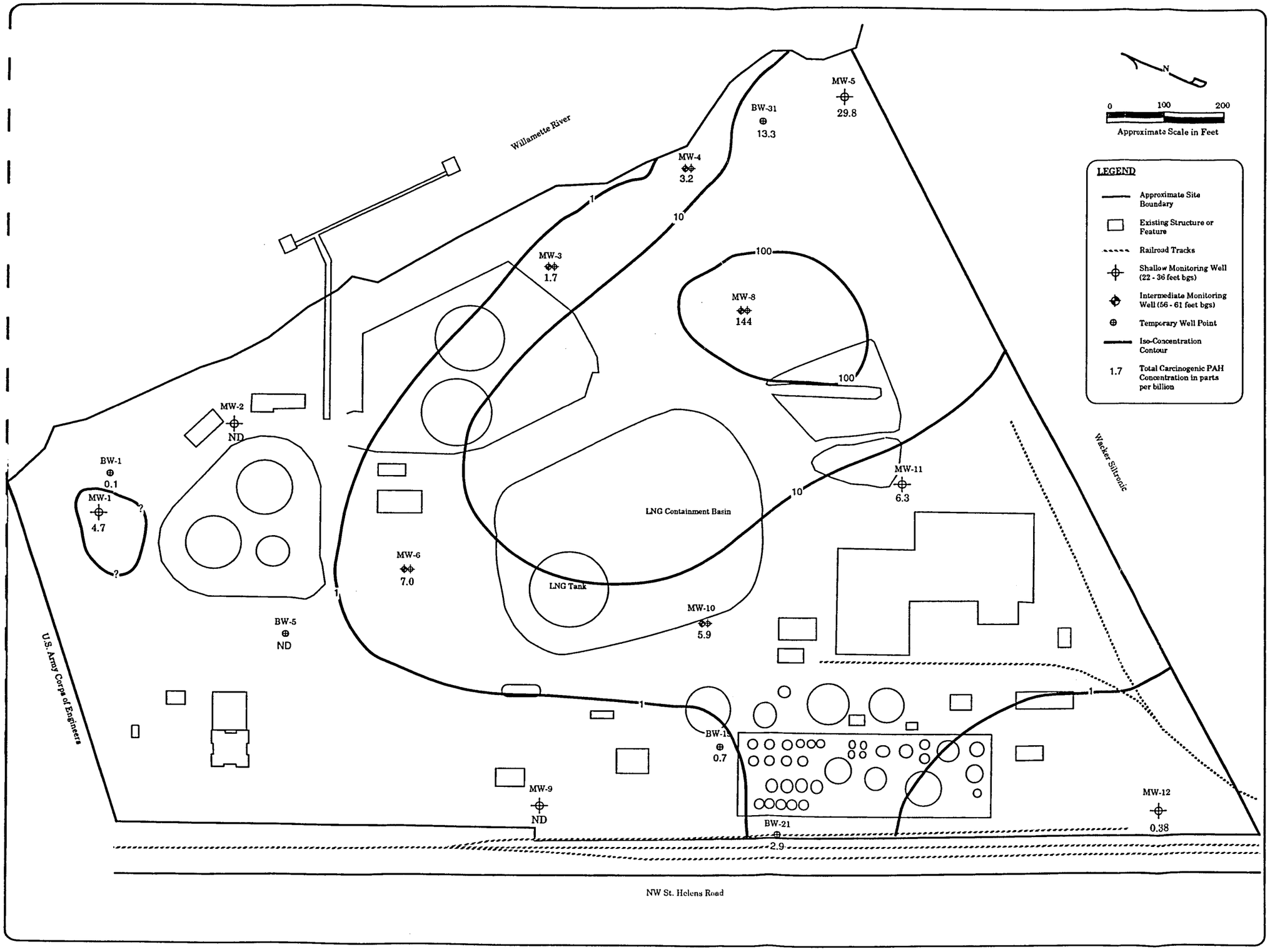


Figure H-3

Groundwater Iso-Concentration Map for Total Carcinogenic PAHs: Shallow Wells - March 1996

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

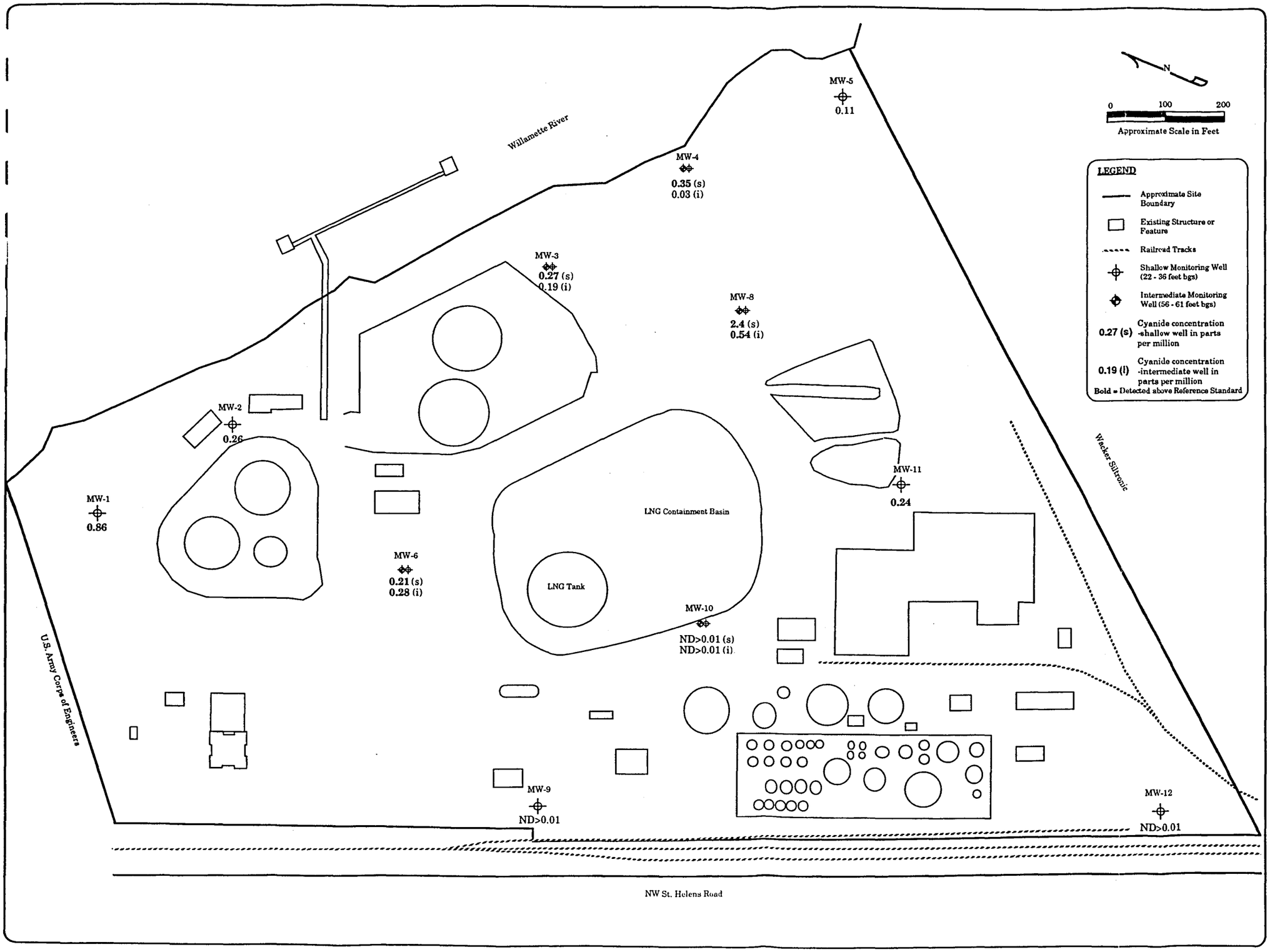


Figure H-4

Groundwater Posting Map for Cyanide: Shallow and Intermediate Wells - March 1996

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

APPENDIX I

Groundwater Iso-Concentration Maps - Intermediate Wells
March 1996

NWT 002833

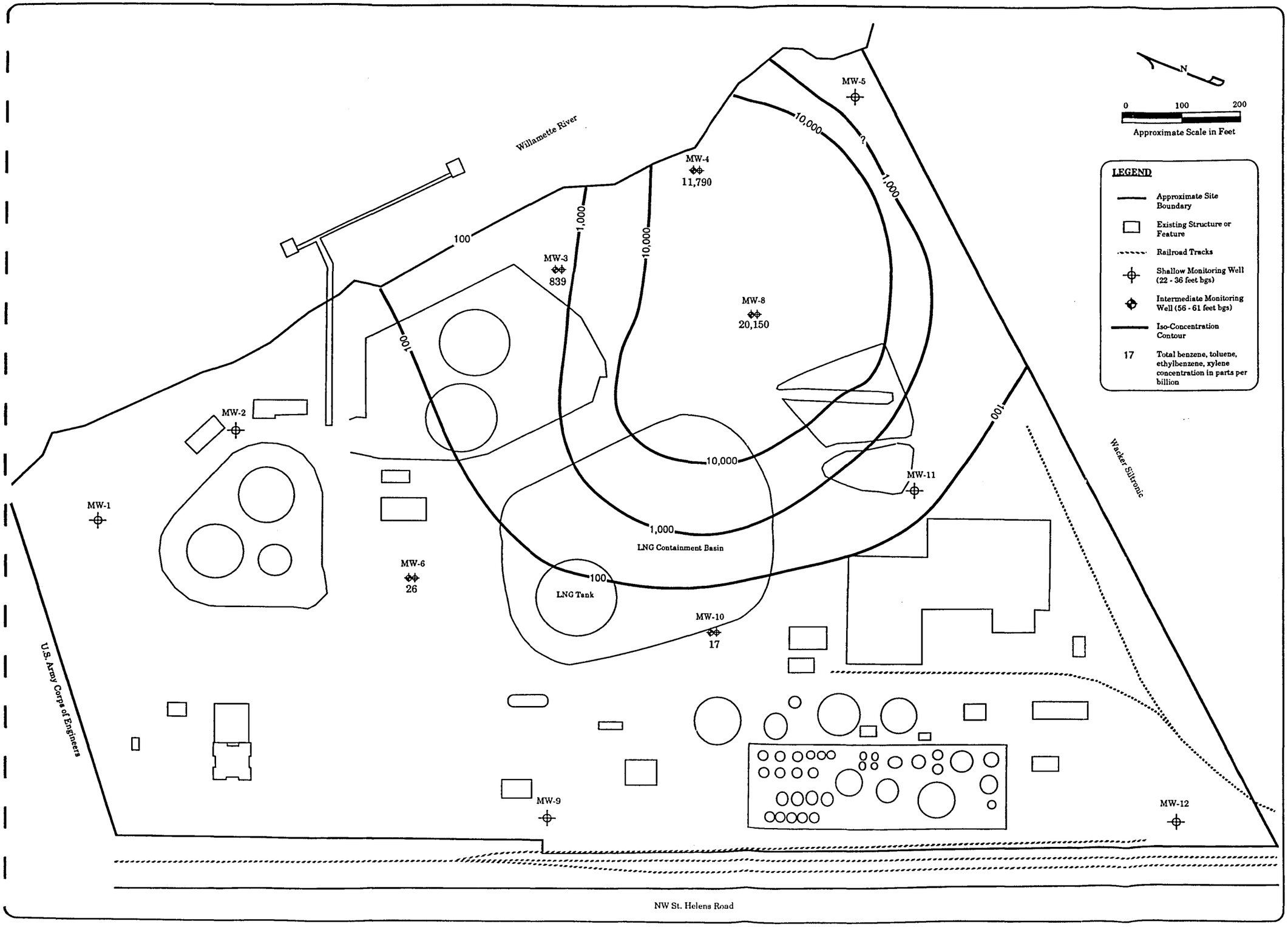


Figure I-1

Groundwater Iso-Concentration Map for Total BTEX: Intermediate Wells - March 1996

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

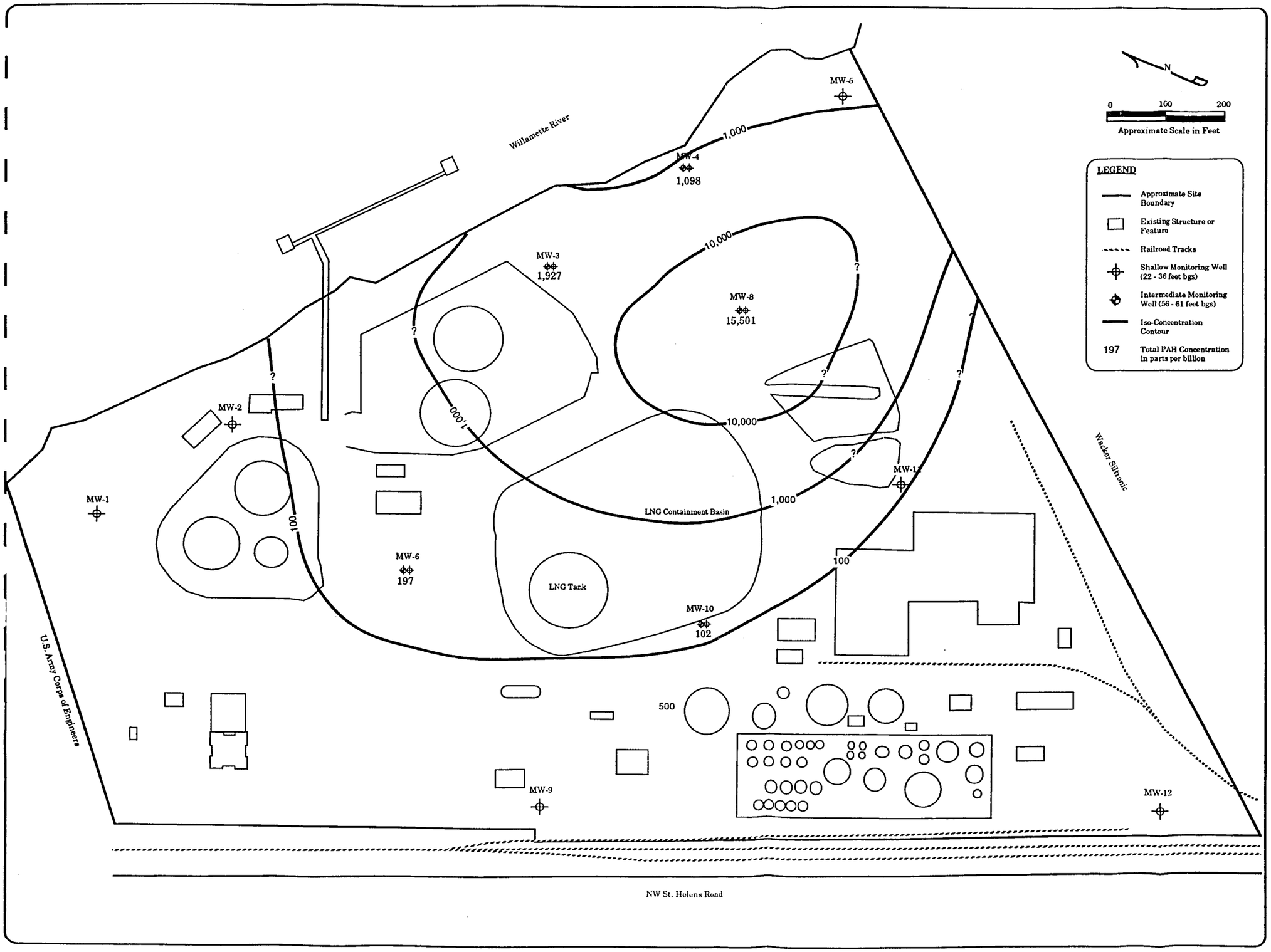


Figure I-2

Groundwater Iso-Concentration Map for Total PAHs: Intermediate Wells - March 1996

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

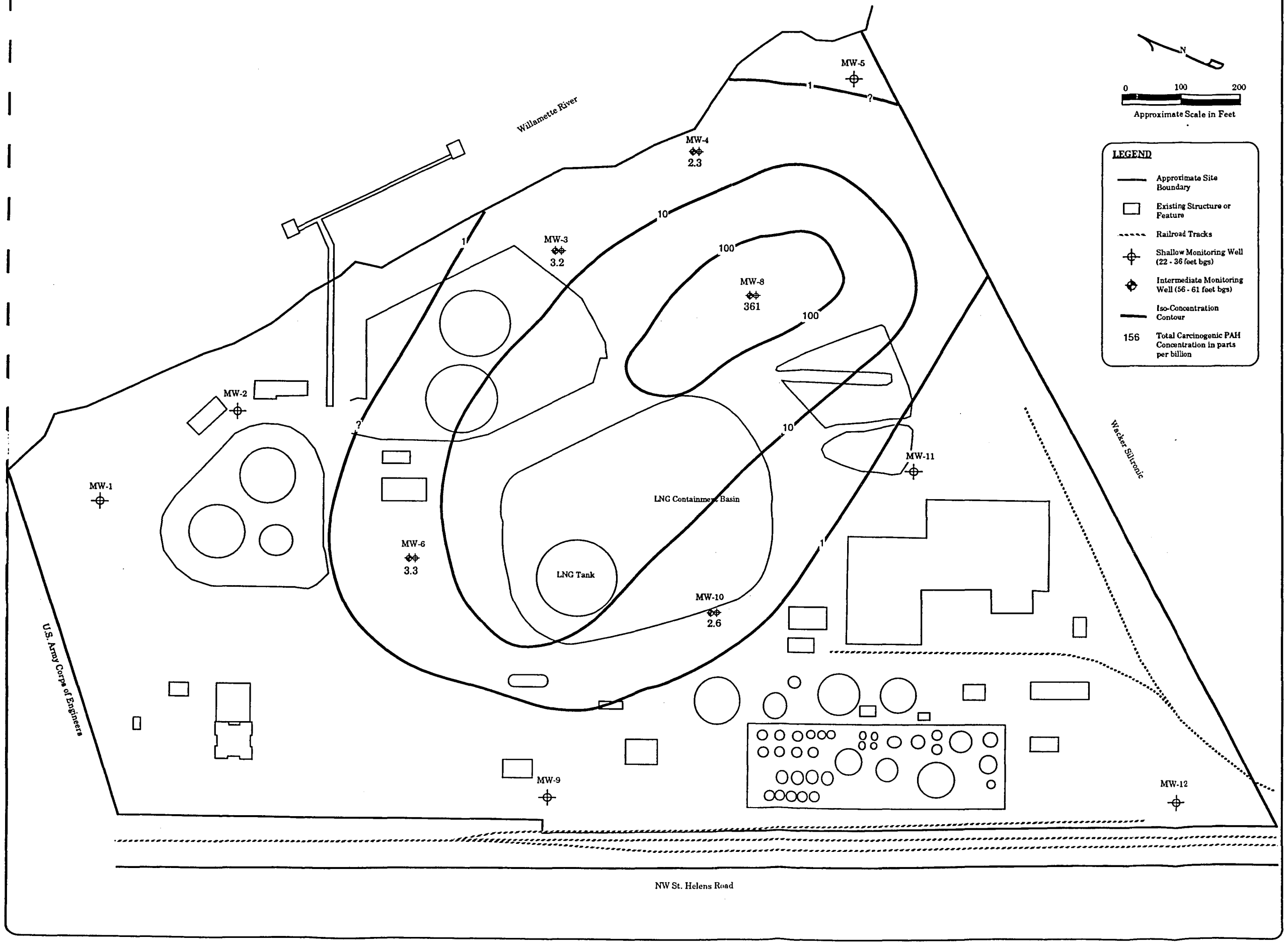


Figure I-3

Groundwater Iso-Concentration Map for Total Carcinogenic PAHs: Intermediate Wells - March 1996

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

APPENDIX J

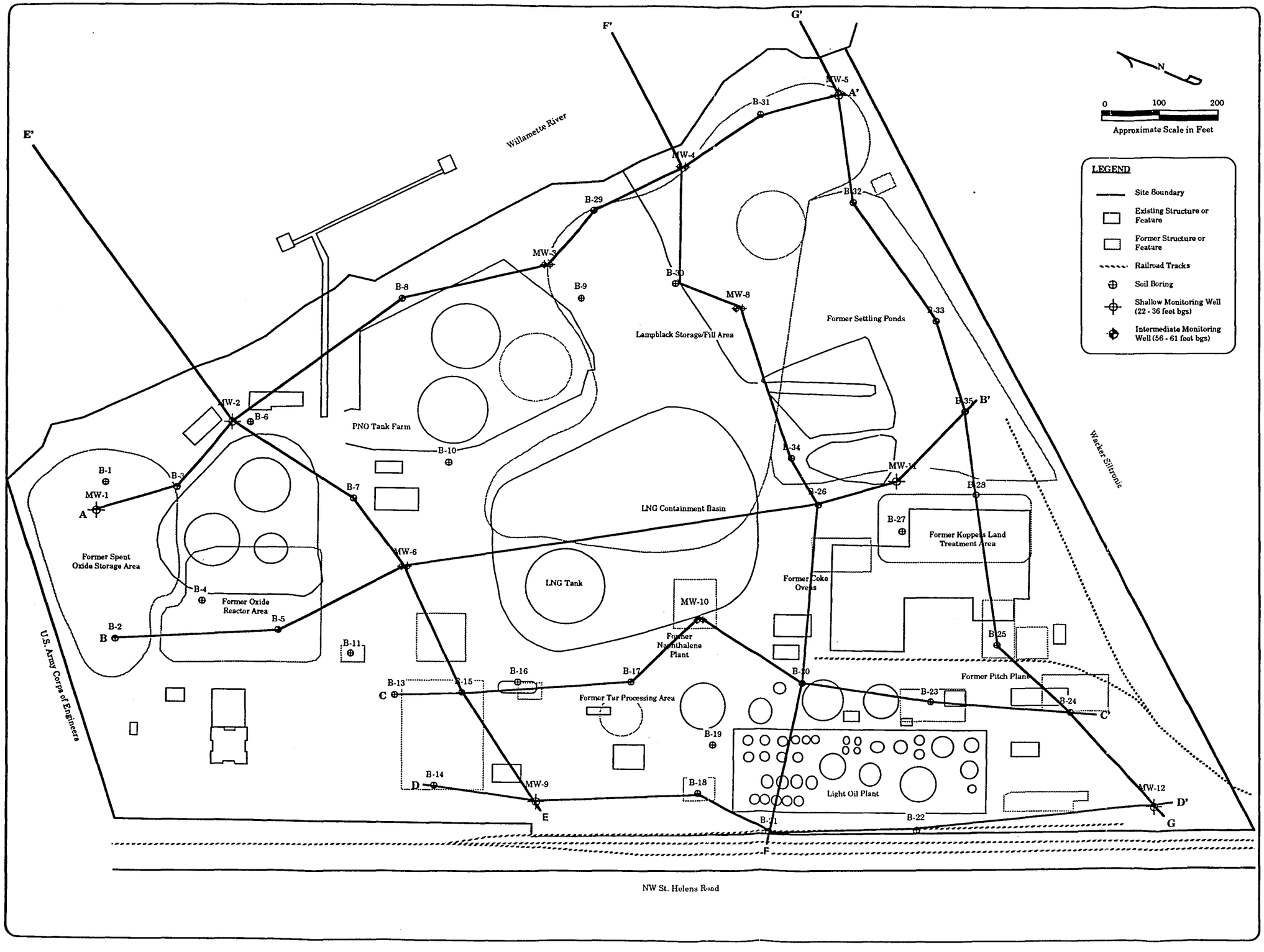
Cross-Sections
Total BTEX Concentrations in Groundwater
December 1995 and March 1996

NWT 002837

Figure
J-1

Cross-Section Location Map

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon



HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708

NWT 002838

A
NW

A'
SE

Elevation (feet msl)

50
40
30
20
10
0
-10
-20
-30
-40

MW-1
MW-2
B-8
MW-3-26
MW-3-56
MW-4-35
MW-4-57
B-31
MW-5-32

Q1: 13/2.0/1.8/3.2
Q2: 3.5/3.5/2.3/23

Q1: 6.0/ND/4.2/2.4
Q2: ND/ND/ND/ND

Fill Unit

Q1: 30/0.98/0.65/1.4
Q2: 1,300/5.0/2.2/5.6

Q1: 0.54/ND/ND/ND
Q2: 18/0.8/ND/2.1

Silt Unit

ND/0.85/ND/0.86

3.0/1.6/10/13

Q1: ND/ND/ND/ND
Q2: ND/ND/ND/ND

Alluvial Unit

Q1: 1,200/24/34/90
Q2: 730/16/27/66

Q1: 9,600/72/590/298
Q2: 11,000/ND/520/270

Note: Analytical results for monitoring wells are for December 1995 and March 1996; analytical results for temporary well points are for various dates

LEGEND

MW-1 — Monitoring Well Location

Screened Interval

Potentiometric Surface or Water Table (1/5/96)

Q1: 6.0/ND/4.2/2.4 First Quarter (December 1995) concentrations of benzene/toluene/ethylbenzene/xylene in Groundwater in parts per billion

Q2: 3.5/3.5/2.3/23 Second Quarter (March 1996) concentrations of bezene/toluene/ethylbenzene/xylene in groundwater in parts per billion

0 100 200
Approximate Scale in Feet

Vertical Exaggeration 10X

Figure

J-2

Hydrogeologic Cross Section A - A'
Water Quality - BTEX

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708

B
NW

B'
SE

B-5

MW-6

MW-11

Fill Unit

ND/0.97/ND/1.4

Q1: 3,000/150/960/740
Q2: 640/22/400/270

Q1: 25,000/5,400/480/2,800
Q2: 24,000/4,300/970/2,400

Silt Unit

Q1: 6.7/0.71/8.9/5.8
Q2: 11/0.68/9.2/5.3

Alluvial Unit

Elevation (feet msl)

50
40
30
20
10
0
-10
-20
-30
-40

Note: Analytical results for monitoring wells are for December 1995 and March 1996; analytical results for temporary well points are for various dates

LEGEND

MW-1 — Monitoring Well Location

Screened Interval

Potentiometric Surface or Water Table (1/5/96)

Q1: 6.7/0.7/8.9/5.8 — First Quarter (December 1995) concentration of benzene/toluene/ethylbenzene/xylene in Groundwater in parts per billion

Q2: 11/0.68/9.2/5.3 — Second Quarter (March 1996) concentration of benzene/toluene/ethylbenzene/xylene in Groundwater in parts per billion

0 100 200

Approximate Scale in Feet

Vertical Exaggeration 10X

Figure

J-3

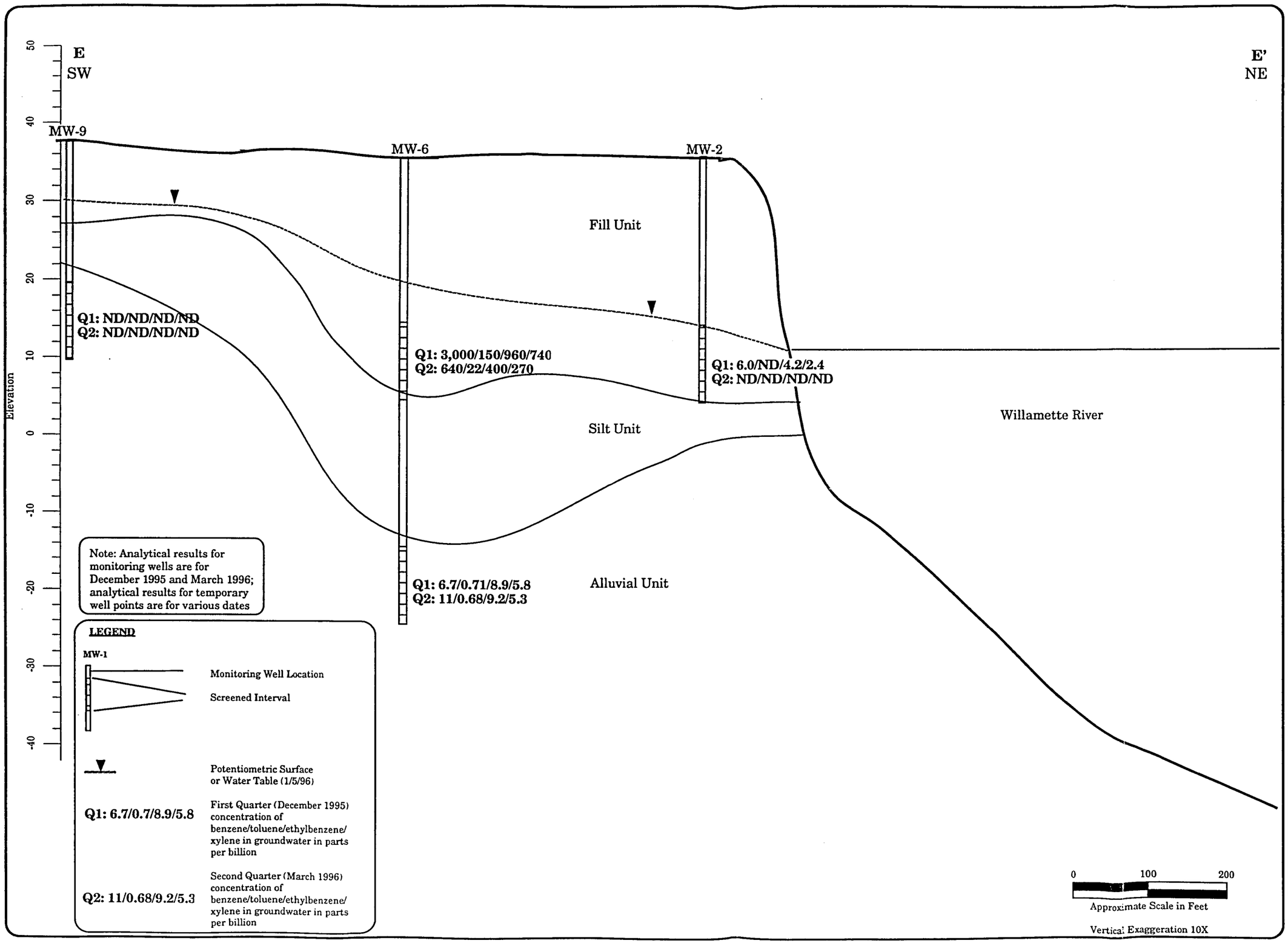
Hydrogeologic Cross Section B - B'
Water Quality - BTEX

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708



Figure

J-4

Hydrogeologic Cross Section E - E'
Water Quality - BTEX

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708

F
SW

F'
NE

B-21

MW-8-29
MW-8-56

MW-4-35
MW-4-57

195

ND/1.2/1.9/3.3

Fill Unit

Q1: 2,100/510/200/320
Q2: 1,700/380/170/400

Willamette River

Q1: 0.54/ND/ND/ND
Q2: 17/0.96/ND/1.3

Silt Unit

Alluvial Unit

Q1: 13,000/1,700/850/1,30(
Q2: 17,000/820/730/1,600

Q1: 9,600/72/590/290
Q2: 11,000/ND/520/270

Elevation (feet msl)

50
40
30
20
10
0
-10
-20
-30
-40

Note: Analytical results for monitoring wells are for December 1995 and March 1996; analytical results for temporary well points are for various dates

LEGEND

MW-1

Monitoring Well Location

Screened Interval

Potentiometric Surface or Water Table (1/5/96)

Q1: ND/1.2/1.9/3.3 First Quarter (December 1995) concentrations of benzene/toluene/ethylbenzene/xylene in groundwater in parts per billion

Q2: 17/0.96/ND/1.3 Second Quarter (March 196) concentrations of benzene/toluene/ethylbenzene/xylene in groundwater in parts per billion

0 100 200

Approximate Scale in Feet

Vertical Exaggeration 10X

Figure

J-5

Hydrogeologic Cross Section F - F'
Water Quality - BTEX

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708

APPENDIX K

Cross-Sections
Total PAHs and Total Carcinogenic PAHs in Groundwater
December 1995 and March 1996

NWT 002843

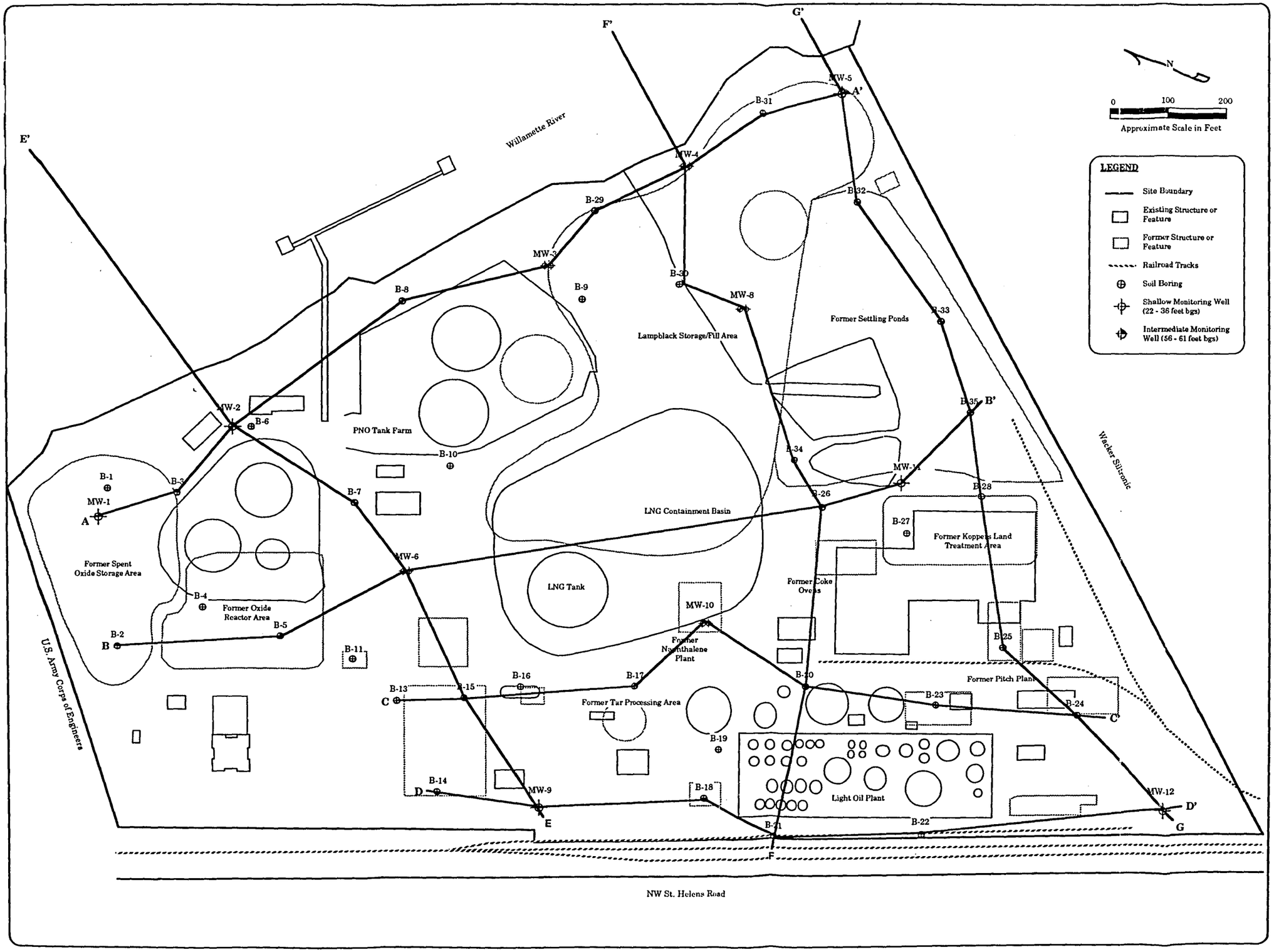


Figure K-1

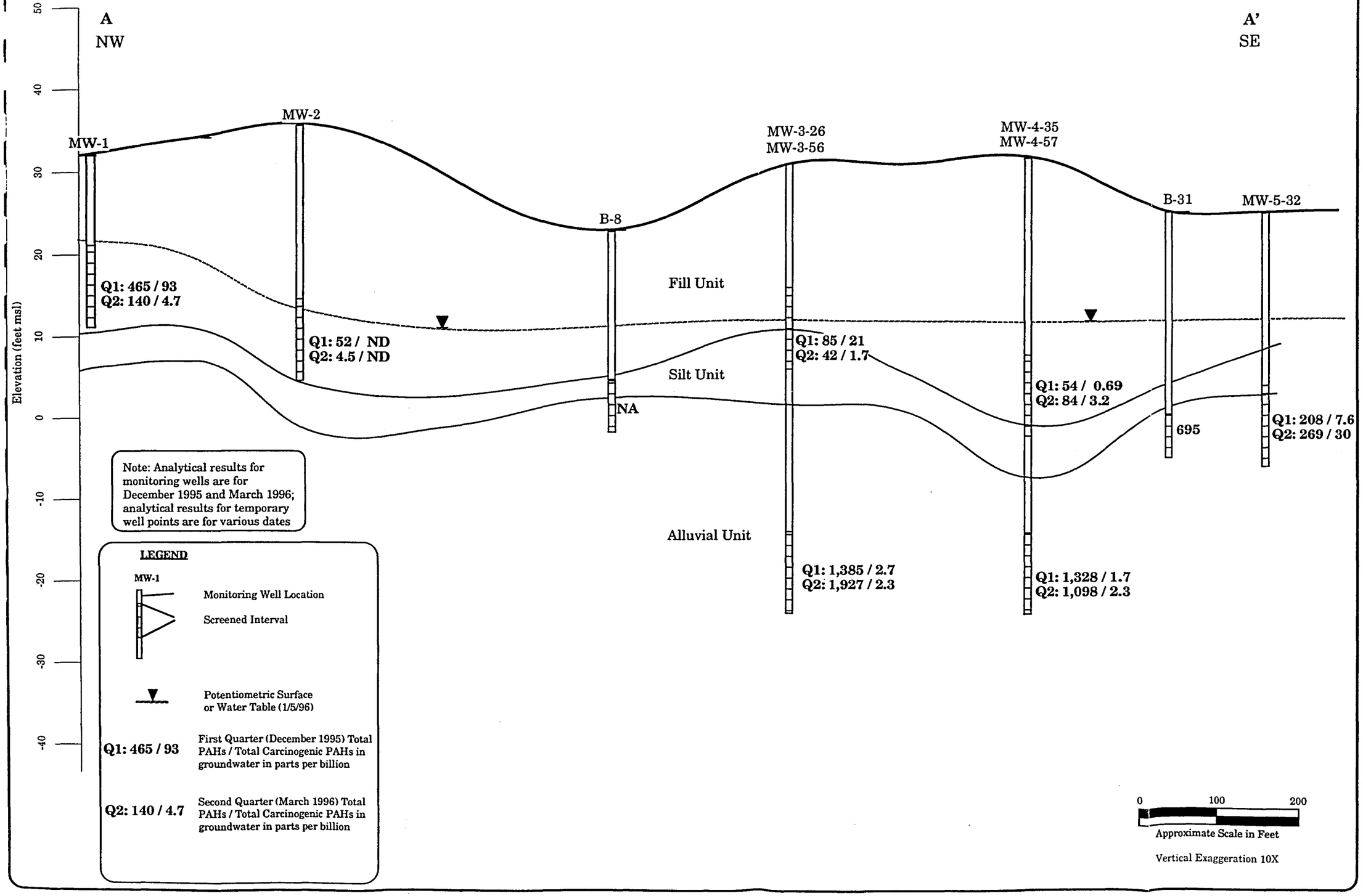
Cross-Section Location Map

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

July 1996

Project #2708



Figure

K-2

Hydrogeologic Cross Section A - A'
Water Quality - PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708

B
NW

B'
SE

B-5

MW-6

MW-11

Fill Unit

35 / ND

Q1: 199,570 / 7,470
Q2: 2,346 / 6.6

Q1: 22,365 / 20
Q2: 14,676 / 6.3

Silt Unit

Q1: 745 / 8.2
Q2: 197 / 3.3

Alluvial Unit

Elevation (feet msl)

50
40
30
20
10
0
-10
-20
-30
-40

Note: Analytical results for monitoring wells are for December 1995 and March 1996; analytical results for temporary well points are for various dates

LEGEND

MW-6 — Monitoring Well Location; Screened Interval

Potentiometric Surface or Water Table (1/5/96)

Q1: 745 / 82 — First Quarter (December 1995) Total PAHs / Total Carcinogenic PAHs in groundwater in parts per billion

Q2: 197 / 3.3 — Second Quarter (March 1996) Total PAHs / Total Carcinogenic PAHs in groundwater in parts per billion

0 100 200
Approximate Scale in Feet

Vertical Exaggeration 10X

Figure

K-3

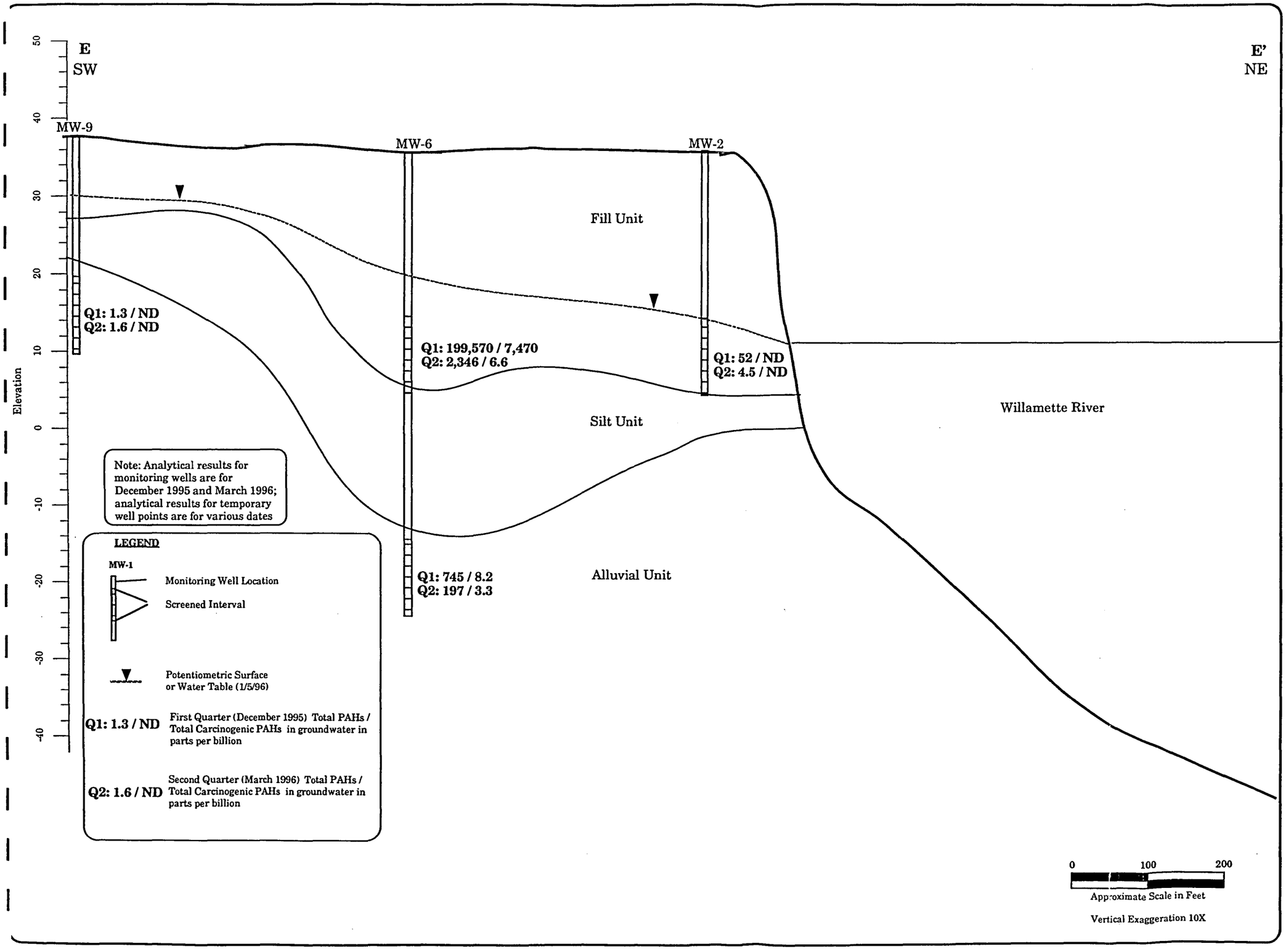
Hydrogeologic Cross Section B - B'
Water Quality - PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708



Figure

K-4

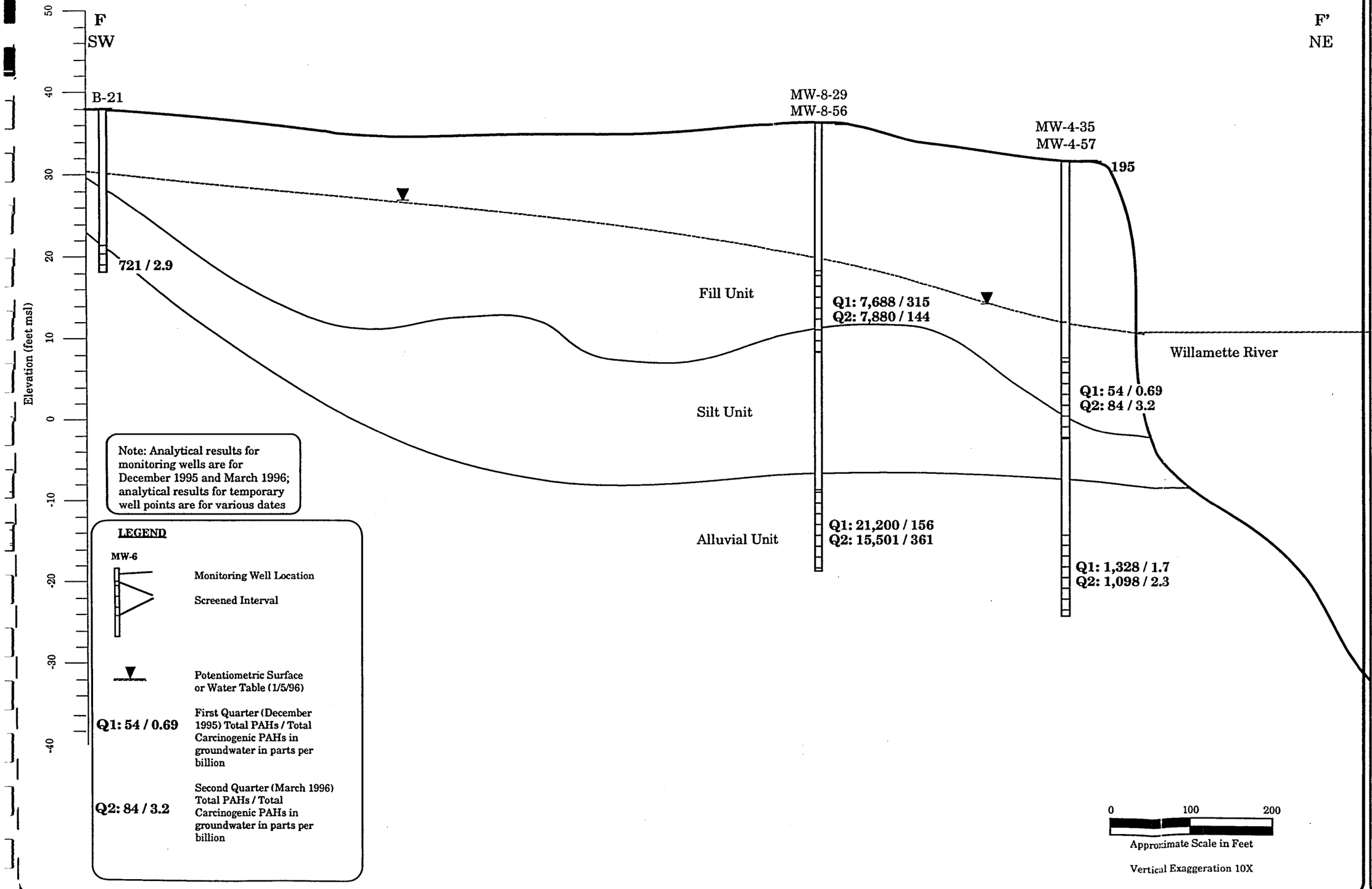
Hydrogeologic Cross Section E - E'
Water Quality - PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708



Figure

K-5

Hydrogeologic Cross Section F - F'
Water Quality - PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

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APPENDIX L

Cross-Sections
Total PAH Concentrations in Soil

NWT 002849

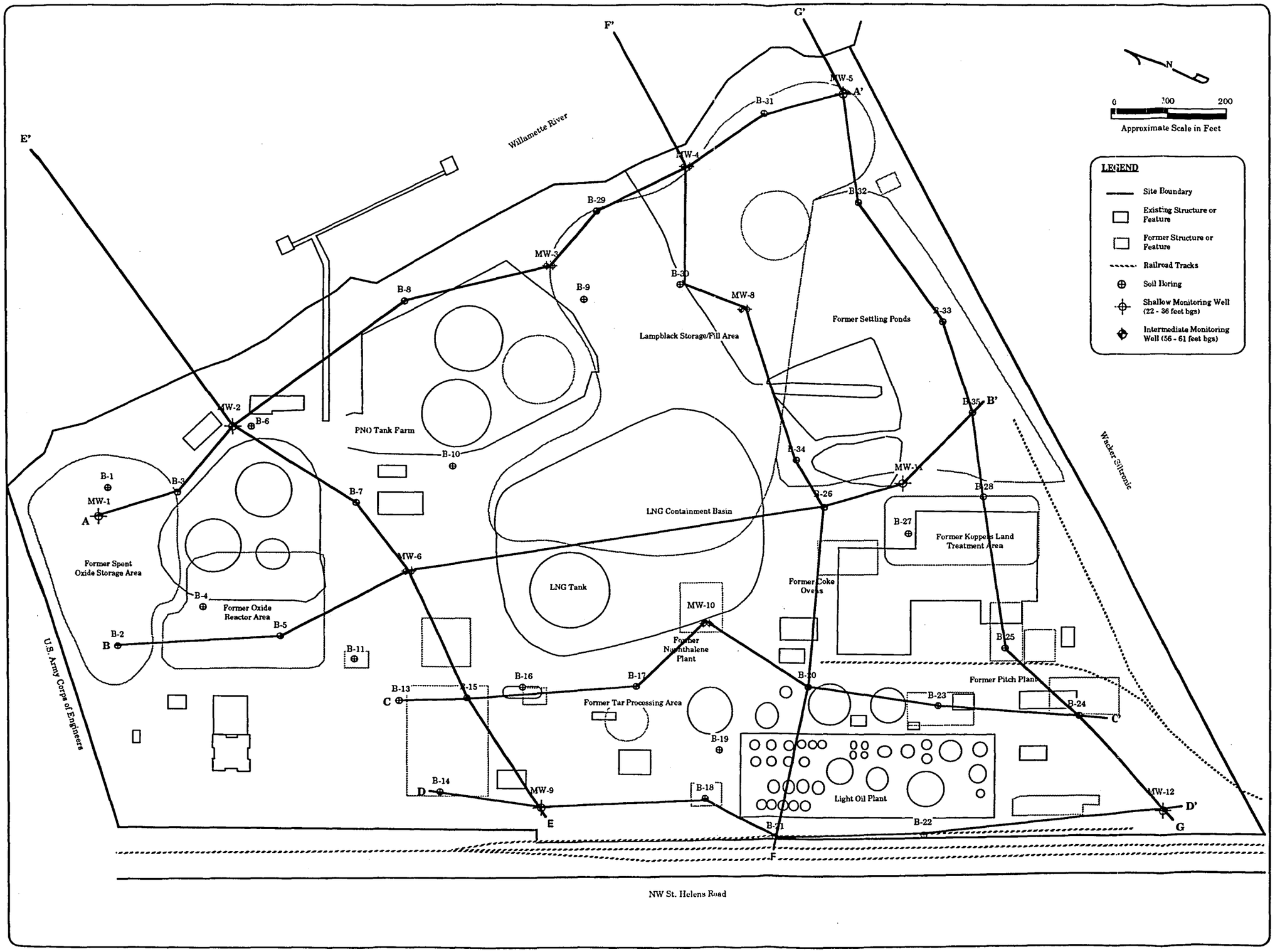

Figure L-1

Cross-Section Location Map

RI/FS
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

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A
NW

A'
SE

Elevation (feet msl)

50
40
30
20
10
0
-10
-20
-30
-40

MW-1
5.8
12.8
0.46

B-3
49
ND

MW-2
10
0.43

B-8
338
0.24

MW-3-26
MW-3-56
10.1
ND
ND

B-29
230
16
0.18

MW-4-35
MW-4-57
195
3,261
0.26

B-31
38
12,666
5.5
ND

MW-5-32
1.4
1,942
0.91
ND

Fill Unit

Silt Unit

Alluvial Unit

LEGEND

Hydrogeologic Boundary

MW- Monitoring Well / Boring Location

Lithologig Log

Sheen Observed in Soil at Indicated Depth Interval

Soil Sample Location

Residual Product Observed in Soil at Indicated Depth Interval

Screened Interval

Potentiometric Surface or Water Table (1/5/96)

338 Total PAHs detected in soil in parts per million

LITHOLOGY KEY

- Gravels/Gravel Sand Mixtures
- Silty Gravels
- Sands, Gravelly Sands
- Silty Sands
- Silts

0 100 200
Approximate Scale in Feet

Vertical Exaggeration 10X

Figure

L-2

Hydrogeologic Cross Section A - A'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708

B
NW

B'
SE

B-2
B-5
MW-6
B-26
MW-11
B-35

ND
3.6
20,614
1.8
0.06
9.3
15,530
1.1
106
7.9
11
39
41,602
9.3

Fill Unit

Silt Unit

Alluvial Unit

Elevation (feet msl)

50
40
30
20
10
0
-10
-20
-30
-40

LEGEND

- Hydrogeologic Boundary
- MW- Monitoring Well / Boring
- Lithologic Log
- Sheen Observed in Soil at Indicated Depth Interval
- Soil Sample Location
- Residual Product Observed in Soil at Indicated Depth Interval
- Screened Interval
- Potentiometric Surface or Water Table (1/5/96)
- 106 Total PAHs detected in soil in parts per million

LITHOLOGY KEY

- Gravels/Gravel Sand Mixtures
- Silty Gravels
- Sands, Gravelly Sands
- Silty Sands
- Silts

0 100 200
Approximate Scale in Feet

Vertical Exaggeration 10X

Figure

L-3

Hydrogeologic Cross Section B - B'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

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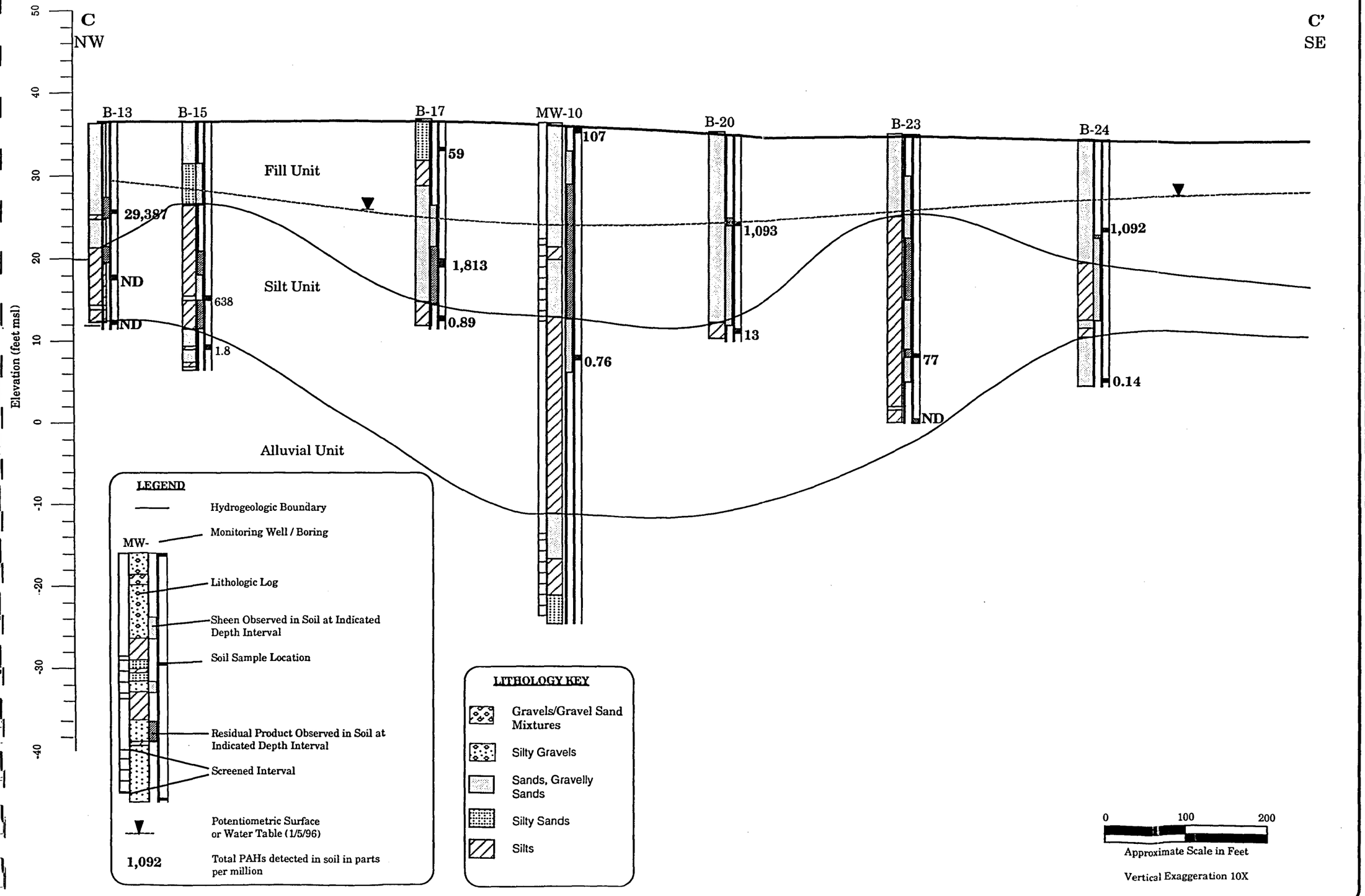


Figure

L-4

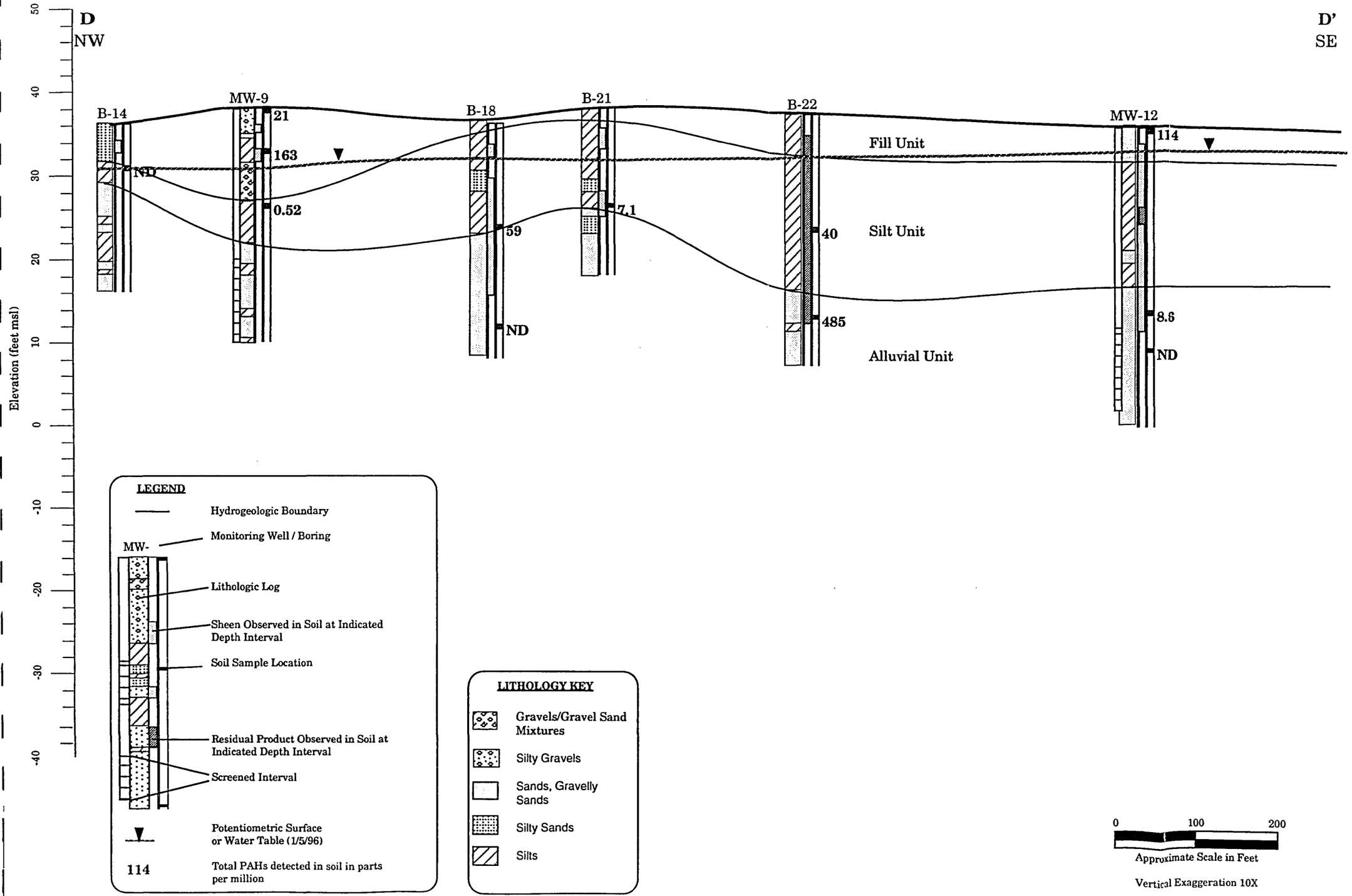
Hydrogeologic Cross Section C-C'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708



Figure

L-5

Hydrogeologic Cross Section D-D'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
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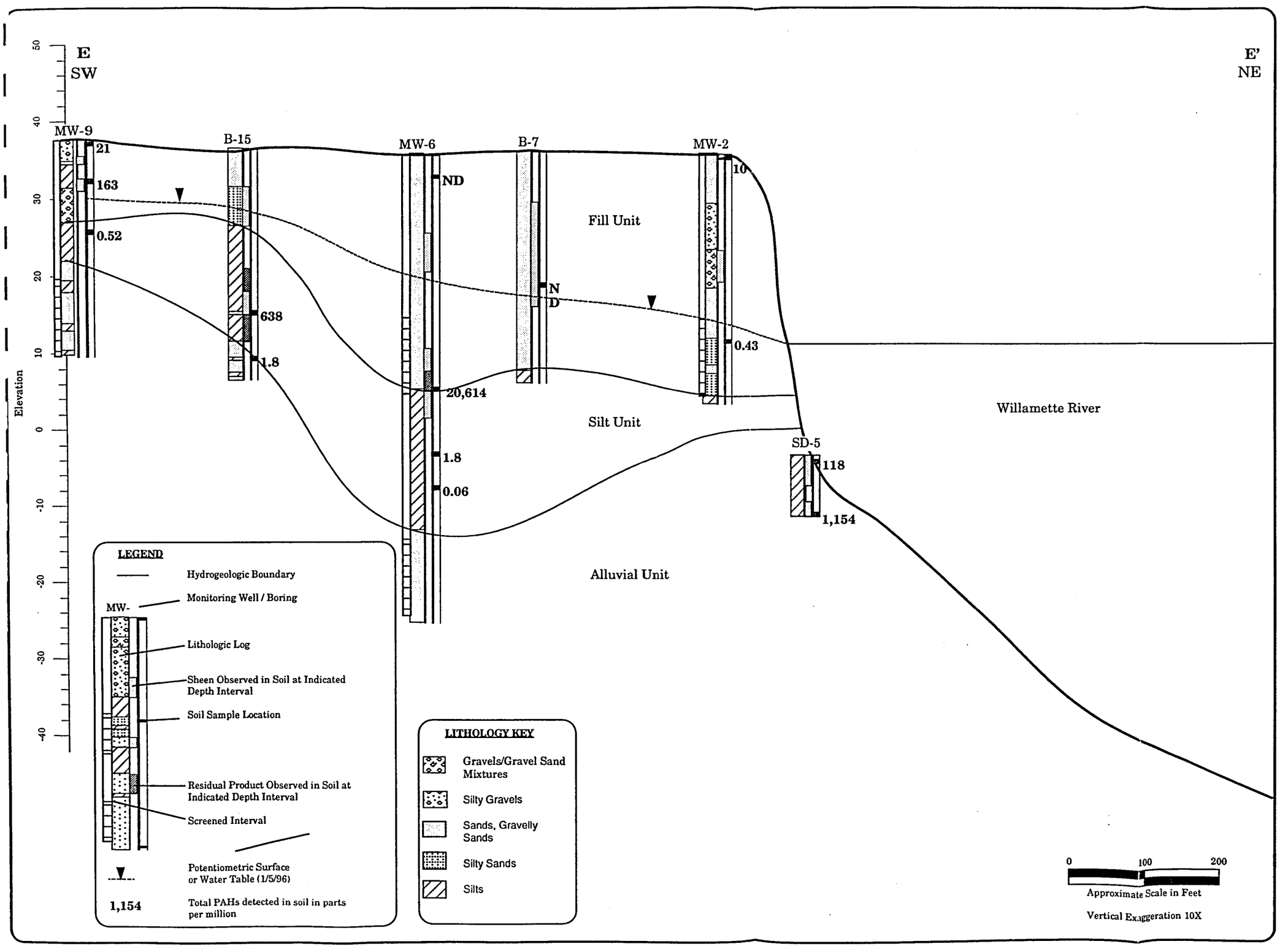

Figure

L-6

Hydrogeologic Cross Section E - E'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
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Project #2708

F
SW

F'
NE

B-21
B-20
B-26
B-34
MW-8
B-30
MW-4
SD-8

7.1
1,093
13
9.3
15,530
1.1
94
13,499
281
8.1
0.64
965
6,776
853
195
3,261
875
3,254
0.26

Fill Unit
Silt Unit
Alluvial Unit
Willamette River

Elevation (feet msl)
50
40
30
20
10
0
-10
-20
-30
-40

LEGEND
Hydrogeologic Boundary
MW- Monitoring Well / Boring
Lithologic Log
Sheen Observed in Soil at Indicated Depth Interval
Soil Sample Location
Residual Product Observed in Soil at Indicated Depth Interval
Screened Interval
Potentiometric Surface or Water Table (1/5/96)
3,254 Total PAHs detected in soil in parts per million

LITHOLOGY KEY
Gravels/Gravel Sand Mixtures
Silty Gravels
Sands, Gravelly Sands
Silty Sands
Silts

0 100 200
Approximate Scale in Feet
Vertical Exaggeration 10X

Figure
L-7

Hydrogeologic Cross Section F - F'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
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434 NW SIXTH AVENUE, SUITE 203
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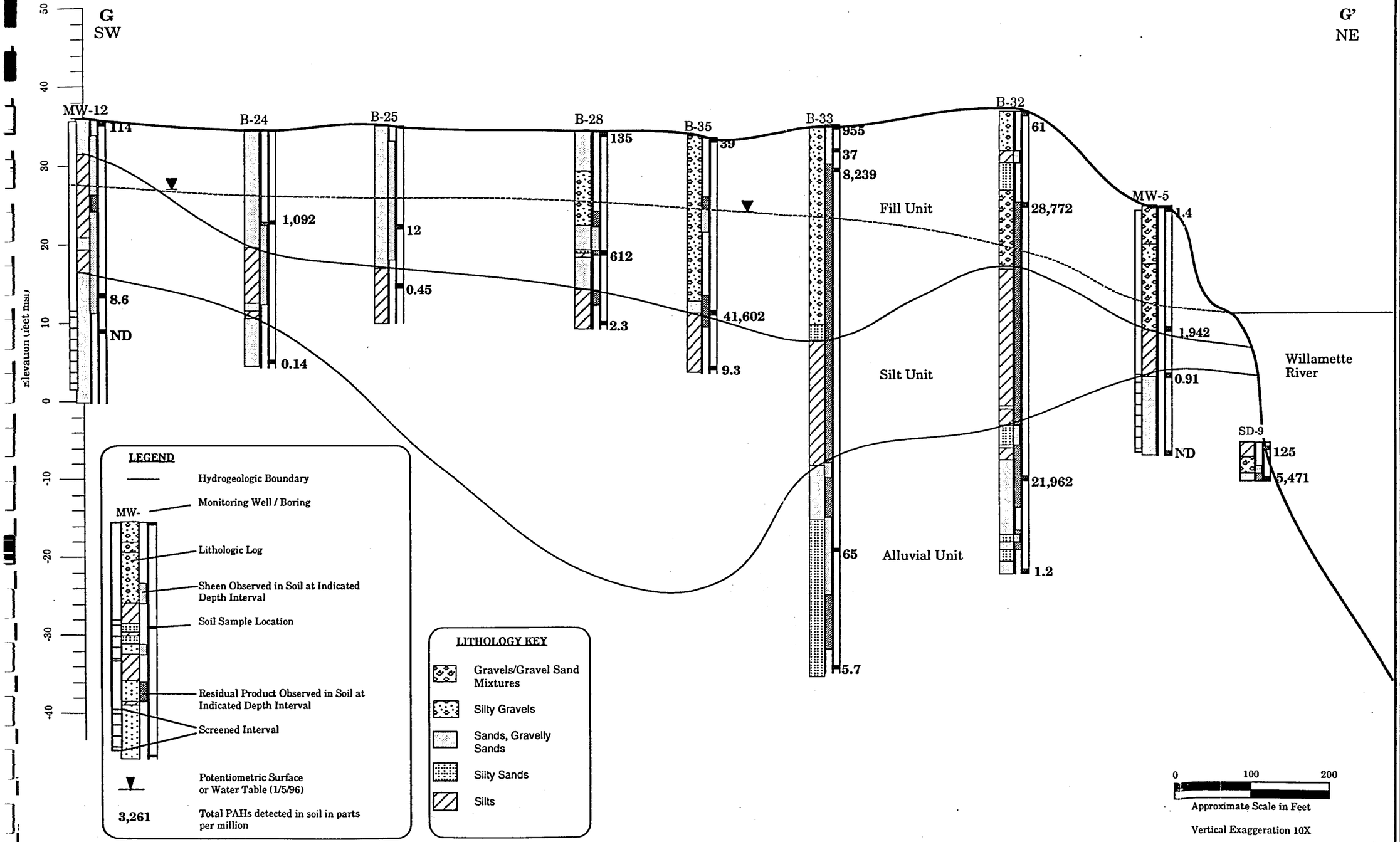
July 1996

Project #2708



Figure

L-8

Hydrogeologic Cross Section G - G'
Soil Quality - Total PAHs

Remedial Investigation
Northwest Natural Gas Company - Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

July 1996

Project #2708

MAR 07 2001

ANCHOR
ENVIRONMENTAL, L.L.C.

1411 4th Avenue, Suite 1210
Seattle, WA 98101
Phone 206.287.9130
Fax 206.287.9131

4-3-01
cc: Paul Anderson
Zabrow
Tracy Self

March 5, 2001

Ms. Shannon K. Craig
Environmental Manager
Beazer East, Inc.
Hanson Building Material America
One Oxford Centre, Suite 3000
Pittsburgh, PA 15219

SUBJECT: NW NATURAL "GASCO" SITE ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT – LEVEL II SCREENING REPORT

Dear Ms. Craig:

Enclosed please find one (1) copy of the subject report prepared by our firm on behalf of Mr. Bob Wyatt of NW Natural. This document was recently submitted to the Oregon Department of Environmental Quality to meet the requirements of a Voluntary Cleanup Order for the site.

The purpose of the report is to act as a screening-level risk assessment for the site. The goals of the report are to eliminate those chemicals not expected to pose an ecological or human health risk and to lay out the framework for continuing the risk evaluations at the site. While the calculations presented in the report may be used to assess overall estimates of risk, they are based on conservative assumptions and should not be considered conclusive.

If you have any questions about the information presented in the attached report, or regarding the risk assessment process, please feel free to contact me at 206-287-9130.

Sincerely,

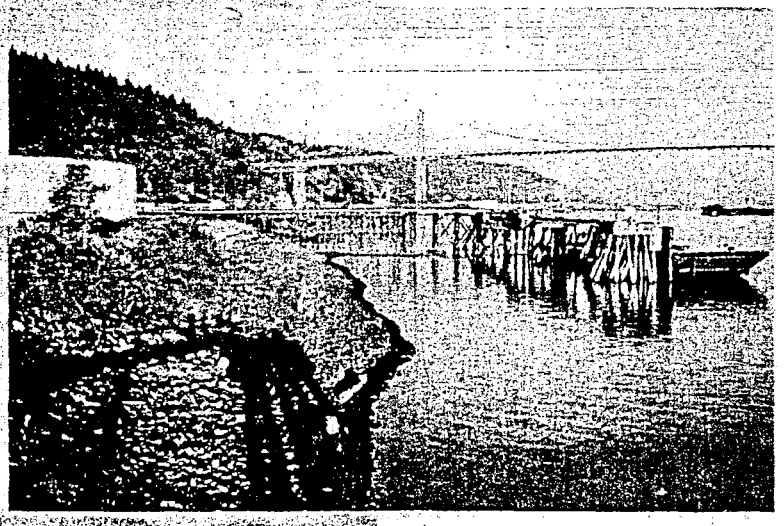
Anchor Environmental L.L.C.

Steve Cappellino

Attachments: one

cc: Bob Wyatt (NW Natural) w/out attachment
Robert Ede (Hahn and Associates) w/out attachment

Northwest Natural "Gasco" Site Ecological and Human Health Risk Assessment - Level II Screening Report



Prepared for Submittal to:

Oregon Department of Environmental Quality
2020 SW Fourth Avenue, Suite 400
Portland, OR 97201

Prepared by:

Anchor Environmental, L.L.C.
1411 Fouth Avenue Suite 1210
Seattle, WA 98101

On behalf of:

Northwest Natural
220 NW Second Avenue
Portland, OR 97209

February 2001

NW NATURAL "GASCO" SITE
ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT
LEVEL II SCREENING REPORT

Prepared for Submittal to:
Oregon Department of Environmental Quality
2020 SW Fourth Avenue, Suite 400
Portland, Oregon 97201

Prepared by:
Anchor Environmental, L.L.C.
1411 Fourth Avenue, Suite 1210
Seattle, Washington 98101

On Behalf of:
NW Natural
220 NW Second Avenue
Portland, Oregon 97209

February 2001

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Appendix E – Human Health Risk Screening Tables

NWT 002862

1.0 Introduction

The purpose of this report is to provide a framework for conducting the upland human health and ecological risk assessments. The objectives of the Level II screening assessment are to:

(a) construct a site description based on information from site visits and/or surveys, existing literature, any prior preliminary assessments, and the site history (including past and present uses);
(b) identify site-specific ecologically important receptors, relevant and complete exposure pathways between each source medium of concern and these receptors, determine contaminants of potential concern (COPC) from among the contaminants of interest (COI) associated with the site;
(c) discuss how the physiochemical and toxicological properties of each COPC may influence exposure pathways and adverse effects;
(d) define ecologically appropriate assessment endpoints;
(e) establish potential links between COPCs and responses in site-specific receptors by means of a preliminary conceptual site model;
(f) make an initial evaluation of the potential for site-related risk; and
(g) make recommendations about the need for and parameters to conduct a level III baseline risk assessment.

This report will seek to meet the above objectives by following the guidance provided by ODEQ for conducting human health (ODEQ 1998) and ecological (ODEQ 1999) risk assessments.

1.1 Site Description

The NW Natural "Gasco" site comprises approximately 47 acres in the North Doane Lake area of Portland and is bounded by St. Helens Road to the southwest, the Willamette River to the northeast, and industrial properties to the northwest and southeast (Figures 1-1 and 1-2). The ground surface at the site slopes gradually northeastward towards the Willamette River. Surface elevations range from approximately 38 feet above mean sea level (msl; City of Portland datum) at the southwestern portion of the property to approximately 23 to 30 feet msl at the top of the river bank. The river bank, composed primarily of rip rap, slopes steeply to an elevation of approximately 5 to 8 feet msl. Below this elevation the shoreline slopes more gradually. Average monthly river stages, as measured at the Portland Harbor from 1973 to 1990 and converted to the City of Portland datum, range from a low of approximately 6.3 feet msl during August and September, to a high of 10.9 feet msl during May and June (COE, 1991).

1.1.1 Site Geology

Site geology can be subdivided into three main geologic units: Columbia River Basalt Group, Alluvial Deposits, and Surficial Fill Deposits.

The Columbia River Basalt Group is the oldest and deepest geologic unit at the site. This Miocene-age basalt group forms the base of the Portland Basin and outcrops immediately to the southwest of the site in the Tualatin Mountains (Hahn and Associates 1998). The depth of the Columbia River Basalt Group inclines steeply at the site, ranging from -20 feet msl at the southern portion of the site to -230 feet msl near the eastern corner of the site in the vicinity of the Willamette River.

Overlying the basalt layer at the site is a Quaternary-age alluvial deposit layer composed of unconsolidated sands, silts, and gravels. This layer ranges in thickness from approximately 30 feet near the southern portion of the site to over 200 feet along the

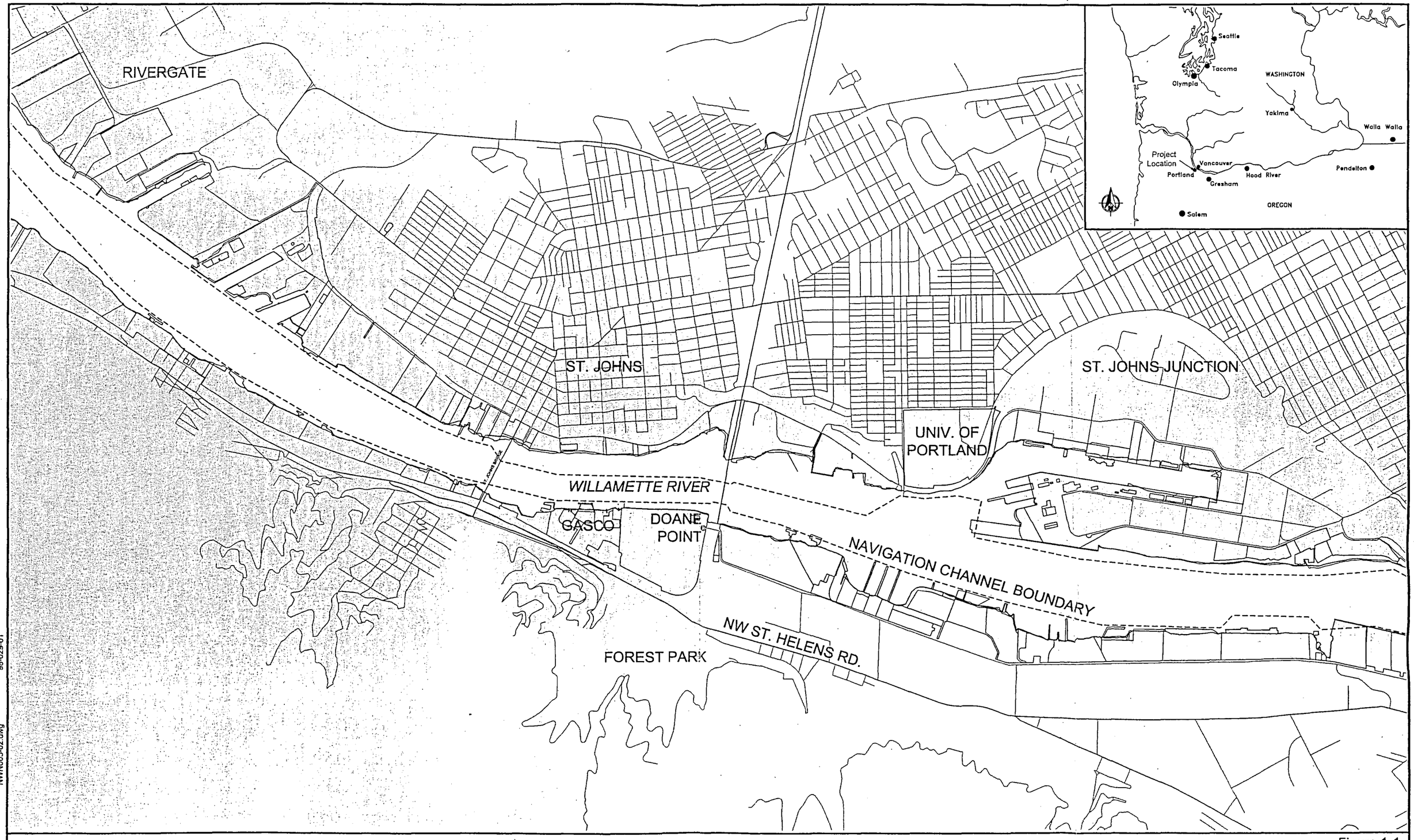

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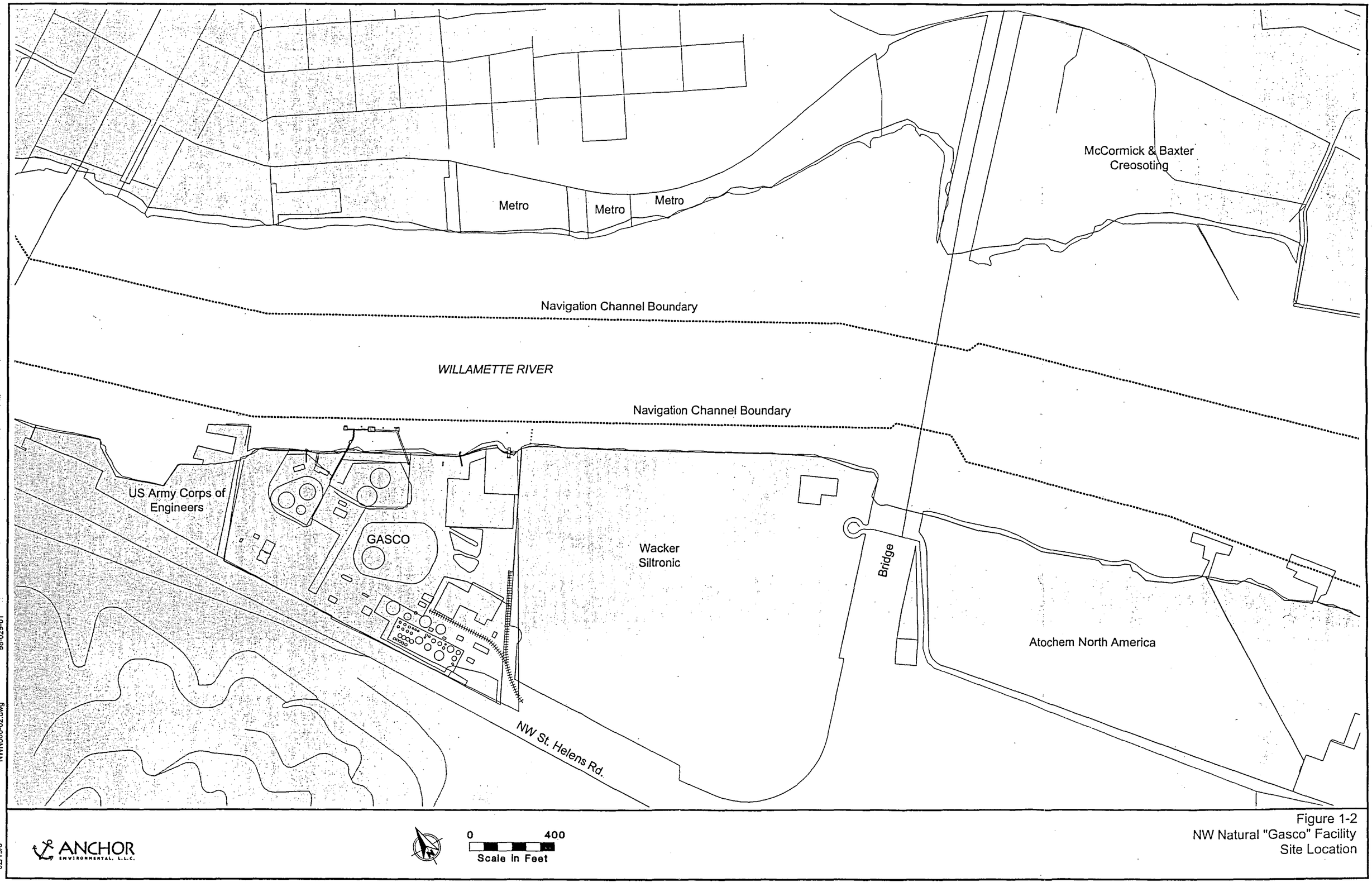
Figure 1-1
NW Natural "Gasco" Study Area
General Location

NWT 002864



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98-029-01
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02/19/0

Figure 1-2
NW Natural "Gasco" Facility
Site Location

northern portion of the site (adjacent to the Willamette River). The top of the silt layer delineates the historic surface of the site, prior to development.

A laterally extensive silt unit is present at the upper portion of the undifferentiated Alluvial Deposits. The top of this silt unit correlates with the historic ground surface of the site, prior to development. Above the alluvial deposit layer at the site is a surficial fill layer of mostly poorly graded sands and silty sands ranging in depth from approximately 2 feet (southwestern portion of the site) to over 30 feet (central portion of the site). This surficial fill layer consists primarily of hydraulically placed dredge materials, but also includes quarry reject rock, building debris, and miscellaneous plant byproducts (Hahn and Associates 1998).

1.1.2 Site Hydrogeology

Groundwater can be found in three hydrologic zones at the Gasco site: the unconfined surficial fill water-bearing zone, the semi-confined alluvial sand water-bearing zone, and the confined bedrock aquifers in the Columbia River Basalt. A low permeability silt unit separates the surficial fill and the alluvial sand water-bearing zones over most of the site.

Groundwater levels within the surficial fill water-bearing zone vary seasonally, and range from 3 to 12 feet bgs at the southwestern portion of the site, and from 9 to 27 feet bgs at the northeastern portion of the site. Groundwater flow within this unit is directed northeast, towards the Willamette River. A downward hydraulic potential also exists between the surficial fill and the underlying alluvial sand aquifer, though the low permeability silt unit that separates these units restricts vertical flow.

The overall groundwater flow direction within the semi-confined alluvial sand water-bearing zone is also directed northeast towards the Willamette River. Hydraulic gradients are greatest in the central portion of the site, but diminish near the riverbank, in part due to vertical (upward) discharge to the Willamette River (Hahn and Associates, 2000).

Groundwater in the underlying basalt unit exists primarily as isolated confined aquifers in the permeable fracture zones between the individual basalt flows (Camp, Dresser & McKee, Inc. 1987).

1.2 Site History

The Gasco site was the former location of the Portland Gas and Coke Company manufactured gas plant oil gasification facility from 1913 to 1956. Manufacturing processes at the site have involved the generation of town gas and pressed lampblack briquettes, aromatic generation and light oil recovery, tar recovery and refining, and the production of electrode grade coke and high Btu gas (Camp Dresser & McKee, Inc. 1987). NW Natural began construction of the liquefied natural gas (LNG) plant at the site in the late 1960's, at which time a majority of the old gasification plant facilities were demolished.

With regard to other uses of the property, Koppers operated a coal tar pitch manufacturing facility at the southern portion of the former gasification facility from 1966 to 1973. Koppers Industries, Inc. (KII) currently uses the facility as a terminal for the distribution of pencil pitch and coal tar pitch. Fuel and Marine Marketing (FAMM), and its predecessor Pacific Northern Oil (PNO), has operated a fuel storage and distribution facility at the northern portion of the site from the 1960's to the present.

The locations of the former structures and features associated with the former manufactured gas plant, as well as current structures associated with the NW Natural, KII, and FAMM facilities, are shown in Figure 1-3.

1.3 Regulatory Status

The overall Gasco site investigation is being performed under the Oregon Department of Environmental Quality's Voluntary Cleanup Program. A Phase I Remedial Investigation was completed for the site in October of 1998, which included the collection and analysis of upland groundwater and soil samples and limited nearshore sediment samples (Hahn and Associates 1998). Follow-up investigations are currently being performed at the site, including a near shore source control evaluation for River sediments. Source control evaluations will include aquatic life ecological and human health risk assessments as necessary to determine appropriate source controls to the river. Risks via aquatic pathways are not evaluated in this Level II Risk Assessment document.

1.4 Land and Water Use Determination

Land and surface water beneficial uses were defined by ODEQ in a memo dated 7/16/98 (ODEQ 1998b). This evaluation was later supplemented in a letter from Hahn and Associates dated 4/14/00 (Hahn and Associates 2000b). A summary of the defined beneficial uses follows.

1.4.1 Locality of Facility

"Locality of Facility", as defined within the Oregon Administrative Rules (OAR 340-122-115), means any point where a human or an ecological receptor contacts, or is reasonably likely to come into contact with, facility-related hazardous substances. An evaluation of Locality of Facility pertaining to contamination associated with the Gasco site, utilizing a site conceptual model, hydrogeological framework, and knowledge of the extent and magnitude of contaminant conditions, has previously been prepared by HAI. This evaluation was provided to ODEQ in correspondence dated August 1, 1997 (Hahn and Associates 1997).

Since preparation of the preceding Locality of Facility evaluation, significant additional investigatory activities have been completed. These include installation of additional monitoring wells to better define the lateral and vertical extent of groundwater contamination, and most recently, the characterization and sampling of water-bearing zones within bedrock as part of the abandonment of two deep cathodic protection wells.

With the exception of data acquired during the recent cathodic well abandonments, descriptions of the regional and site-specific hydrogeologic framework, as well as the nature and extent of site-related contamination, have been included within the 1998 Phase I Remedial Investigation Report, as well as within the Phase II Remedial Investigation Data Package for the Gasco facility.

As presented in the Phase I and II Remedial Investigation Reports, the lateral extent of soil and groundwater contamination associated with the Gasco site has been found to be primarily restricted to the site boundaries[1]. One exception is the presence of tar and contaminated sediments within the Willamette River adjacent to the site.

[1] The contamination may extend to the northern portion of the adjacent Wacker Siltronic Corp. property immediately south of the Gasco site. A study to determine the extent to which any such contamination may be migrating to the Willamette River is now being conducted in response to a DEQ order.

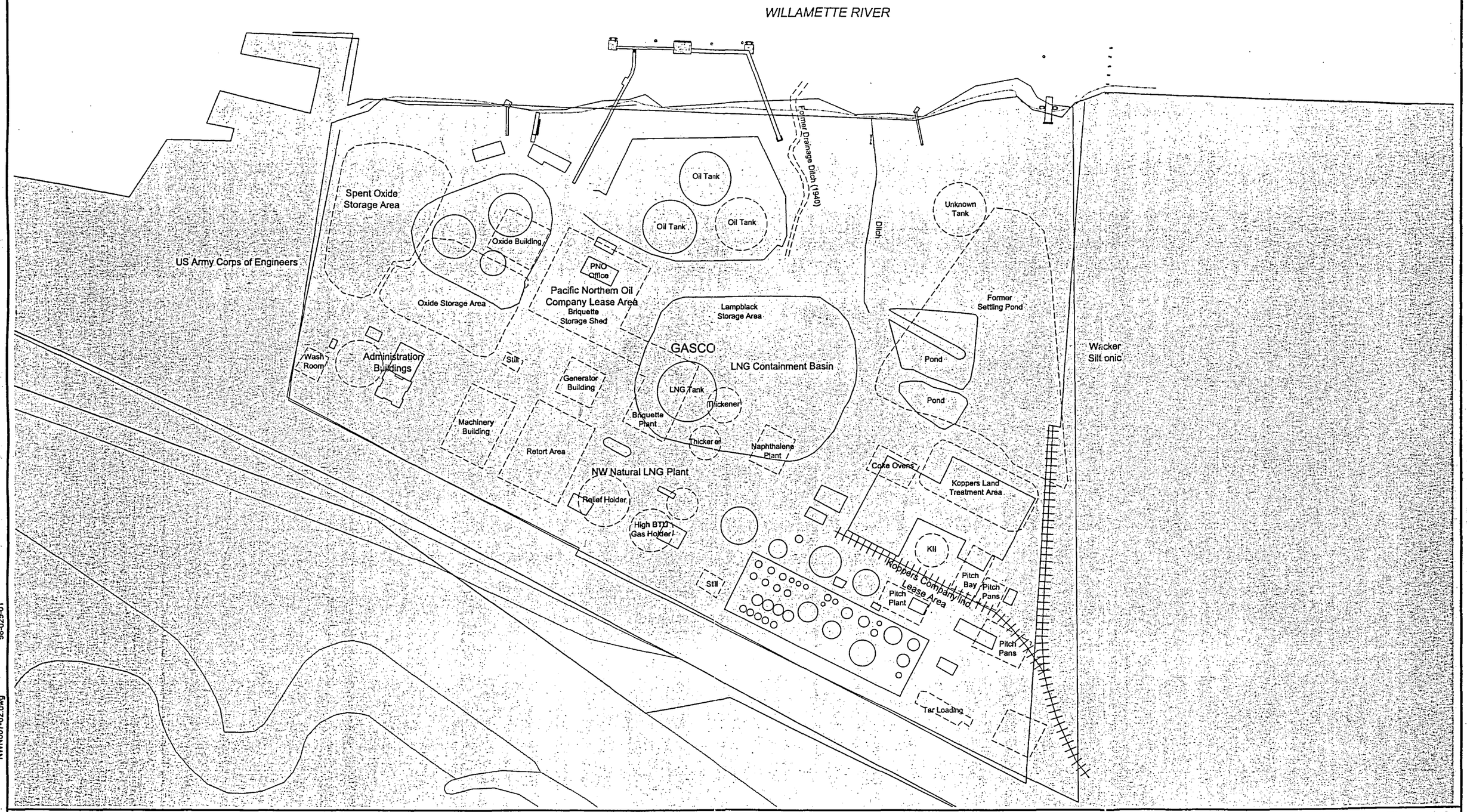


Figure 1-3
NW Natural "Gasco" Facility
Current & Former Structures

Vertically, soil and groundwater impacts have been identified within both the Surficial Fill water-bearing zone (WBZ), as well as within portions of the Alluvial Sand WBZ at the Gasco site. The most wide-spread contaminant impacts at Gasco have been found to occur within the Surficial Fill WBZ, while more limited impacts have been identified within the underlying Alluvial Sand WBZ. The silt unit, underlying the Surficial Fill WBZ and defining the top of the alluvial deposits, has acted as a semi-confining unit across the majority of the Gasco site and has prevented the vertical migration of contaminants to the underlying Alluvial Sand WBZ in most areas. There is limited impact to the upper portion of the Alluvial Sand WBZ down-gradient of the primary area of former waste placement (i.e., former effluent ponds). Specifically, contaminants have been detected in this region of the Alluvial Sand WBZ from the top of the unit (approximately 45 feet bgs) to maximum depths of between 100 to 150 feet bgs. Groundwater samples collected from the lower portion of the Alluvial Sand WBZ in this area are consistently free of chemical impact. Based on soil and groundwater quality data collected from the deeper Alluvial Sand WBZ across the site, as well as data recently collected from the upper WBZ within bedrock during the cathodic well abandonments, there appears to be little potential for the presence of significant site-related impact to the basalt WBZ.

Based on the current understanding of site-related contamination, and based on previous discussions with the ODEQ, the Locality of the Facility, as it pertains to soil and groundwater contamination, has been defined as the boundaries of the Gasco site itself. With regard to the hydrogeologic water-bearing zones, both the Surficial Fill and the Alluvial Sand WBZs beneath the Gasco site are included within the Locality of the Facility. With regard to water-bearing zones within the underlying bedrock, site data indicate little potential for the presence of impacts to these zones, and as such, groundwater within bedrock has not been considered to be within the LOF.

1.4.2 On-Site Land

The study site has remained industrial since it was first developed in the early 1900's. All subsequent development adjacent to the Gasco site has also been for industrial purposes. Consequently, ODEQ has determined that the current and reasonably likely future land use for the property is industrial (ODEQ 1998b).

1.4.3 Off-Site Land

Properties located between the Willamette River and U.S. Highway 30 (St. Helens Road) are currently zoned as industrial and are expected to remain that way. All properties along the Willamette River adjacent to the study area are also zoned industrial. As a result, ODEQ has determined that the current and reasonably likely future use of properties located between the River and U.S. Highway 30 is industrial (ODEQ 1998b).

Properties located immediately west of U.S. Highway 30 are currently undeveloped and are zoned as residential. Although commercial properties are also located along U.S. Highway 30, it appears that current zoning designations favor residential use. Therefore, ODEQ has determined that the reasonably likely future use of off-site properties located west of U.S. Highway 30 is residential (ODEQ 1998b).

1.4.4 On-Site Surface Water

On-site surface water is generally transitory and includes a few on-site ponds and ditches located in the former tar pond and spent oxide areas, and the liquefied natural gas (LNG) containment basin. The on-site ponds are seasonal, typically present during the winter and spring months. The on-site ditches contain minimal water most of the year. Because

these ponds are seasonal and located within a heavily industrialized area, they are not expected to provide significant habitat for resident aquatic and avian species. The LNG containment basin has historically contained standing water as a result of groundwater seepage; however, recent pumping by Plant personnel has resulted in much lower levels. Furthermore, the LNG containment basin does not contain suitable ecological habitat to support avian or aquatic receptors. Therefore, there are no current beneficial uses of on-site surface water, and its not reasonably likely that on-site surface water will be beneficially used in the future.

1.4.5 Off-Site Surface Water

Off-site surface water is not evaluated in this current risk assessment. Offsite surface water risks will be evaluated after completing the Willamette source control investigations.

1.4.6 On-Site Groundwater

For the Surficial Fill, Alluvial Sand and Basalt WBZs, with the exception of surface water recharge, there are no reasonably likely beneficial future uses. Groundwater from these two zones has not historically, nor is it currently, used for any beneficial uses within the study area. Additionally, the readily available nature of the municipal water supply to any new user, as well as the fact that all property within the Locality of Facility is currently connected to the municipal water supply, indicate that the future use of groundwater within the Locality of the Facility for any purpose other than surface water recharge is not reasonably likely.

A domestic use of groundwater from the Basalt WBZ was identified at a residential property located approximately 0.8 miles to the northwest of the site during the beneficial use evaluation (Hahn and Associates, 2000b). However, the domestic use of groundwater from within this zone is not reasonably likely to occur in the future. This is based on the fact that the property within the Locality of the Facility will continue to be zoned for industrial use, and because the property is currently supplied by municipal water. Similarly, due to the industrial land zoning, the use of groundwater (from any zone) from the site for the purpose of irrigation or livestock watering is also not deemed reasonably likely.

Groundwater within the Basalt WBZ in the study area has historically been used as an industrial water supply. However, because of existing municipal water hook-ups throughout the study area, all industrial uses of groundwater within the study area have been discontinued. Because the City of Portland plans to continue municipal water supply to all users within the study area, the use of groundwater from the Basalt WBZ for an industrial water source is not deemed reasonably likely.

1.4.7 Off-Site Groundwater

Off site groundwater is not included in the LOF and is not evaluated in the current risk assessment.

1.5 Summary of Historical Results

NW Natural and the ODEQ entered into an Agreement for the completion of a Remedial Investigation/Feasibility Study (ODEQ Agreement No. ECVC-WMCVC-NWR-94-13) for the Gasco site in 1994. RI activities were subsequently implemented by NW Natural in September 1995. The Preliminary Phase I Remedial Investigation (Hahn and Associates 1998) was completed in 1998. Additional investigations have been conducted since that time, and have been

included in quarterly progress reports to ODEQ. This section summarizes the results of the groundwater and soil investigations conducted at the Gasco facility thus far.

1.5.1 Phase 1 Remedial Investigation Results

Groundwater
Preliminary groundwater sampling occurred in 1995 during the Phase I Preliminary Remedial Investigation. Groundwater monitoring at the Gasco site has occurred on a quarterly basis since completion of the Phase I RI. A total of 17 monitoring wells (13 locations with multiple depths) are located around the site (Figure 1-4). Twelve of the wells are screened within the surficial fill water-bearing zone and 5 are screened within intermediate depths of the alluvial sand WBZ.

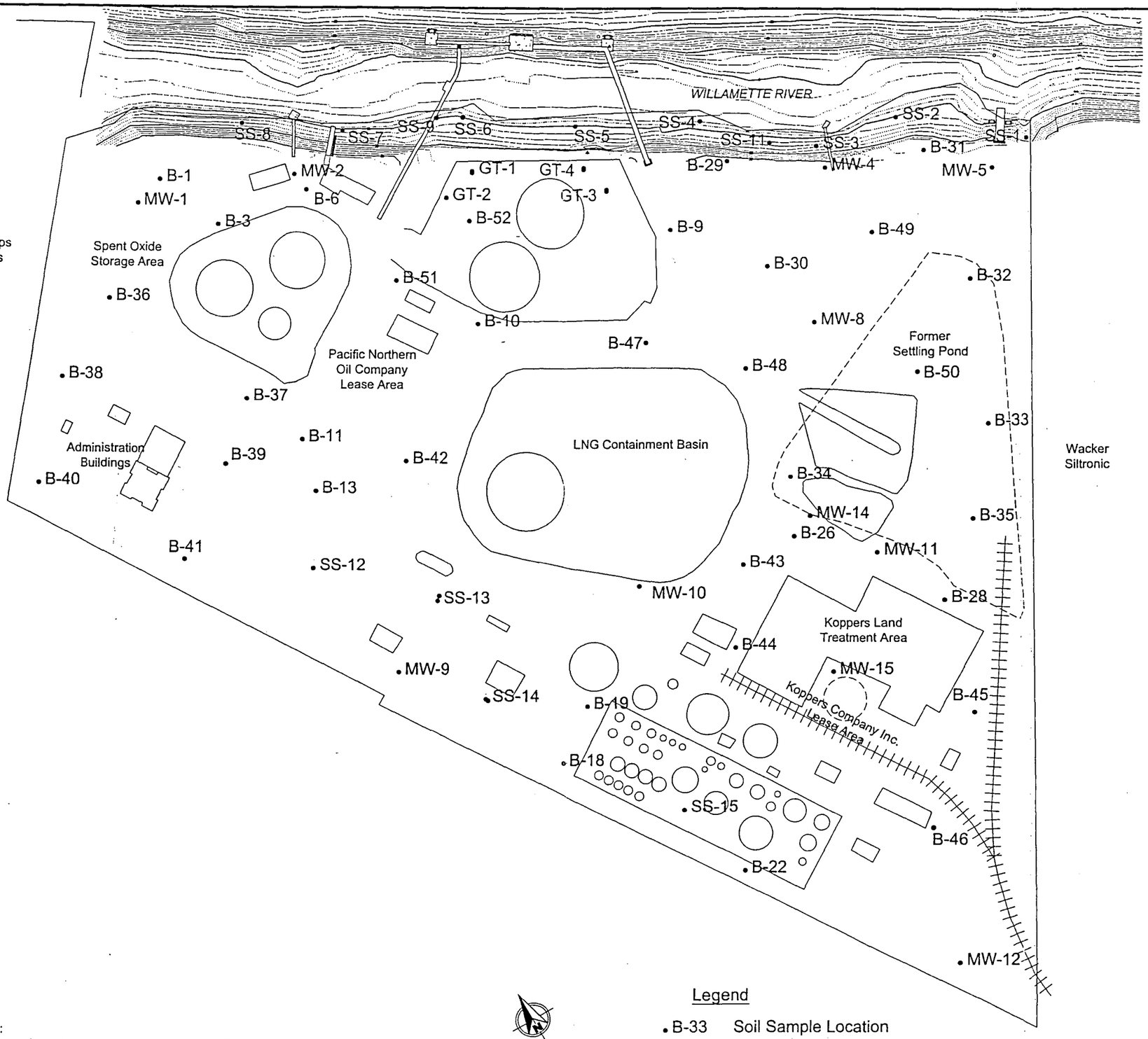
The Phase I RI (Hahn and Associates 1998) and associated quarterly reports (e.g., Hahn and Associates, 2000, 1999a, 1999b, 1999c) provide detailed descriptions of the available groundwater quality data for the site. These groundwater characterization data demonstrate that both the surficial fill and alluvial sand water bearing zones contain elevated concentrations (above area background) of polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylene (BTEX), and cyanide. In addition, several monitoring well locations contain elevated levels of metals, and some contain low concentrations of phenols and styrene. Elevated chemical concentrations have been detected within the alluvial sand WBZ down gradient from the former tar ponds to depths of up to 150 feet bgs, though groundwater samples collected from the lower portion of the Alluvial Sand WBZ in this area are consistently free of chemical impact.

Soil Data
The majority of the upland soil data for the Gasco site was collected during 1995 and 1996 as part of the Phase I Remedial Investigation (Hahn and Associates 1998). In total, 35 soil borings (B1 through B35), 17 monitoring wells (MW-1 through MW-13; completed at multiple depths), and 4 geotechnical soil borings (GT-1 through GT-4) were installed at the site. Figure 1-4 presents an overview of Phase 1 RI sample locations and Appendix A contains a summary of the soil data used in the risk assessment.

The results of the upland investigations indicate that residual tar, oil tar, and lampblack are present within the soils at several locations around the Gasco site. Tar and oil tar are differentiated primarily by their physical characteristics (color and viscosity). Tar refers to the black, viscous to semi-solid petroleum hydrocarbon found at the site, while oil tar refers to a brown to black, less viscous hydrocarbon material. The oil tar is potentially mobile in the subsurface soils. Lampblack refers to a hydrophobic black powder or sandy material, consisting primarily of carbon, which may contain minor concentrations of hydrocarbons (Hahn and Associates 1998).

Oil tars present as dense non-aqueous phase liquids (DNAPLs) are present in three monitoring wells at the site, all of which are located more than 300 feet inland from the top of bank, and within the surficial fill zone, overlying the silt unit (MW6-32, MW10-26 and MW11-32). Residual tar is present primarily in the vicinity of the former tar settling ponds. Site records indicate that approximately 4.6 million gallons of tar were discharged to these storage areas during the early operation of the plant. Beneath the tar pond area, tar has migrated in the soil to depths of up to 100 feet bgs.

Soil samples collected in the vicinity of the former tar settling ponds, along with associated fill areas at the site, contain elevated concentrations (above area background) of PAHs, BTEX, cyanide, and several metals (Hahn and Associates 1998). Total PAH



Legend

• B-33 Soil Sample Location

0 180

Scale in Feet

NOTES:
1. Bathymetric contour and dock survey by INCA Engineers Inc., August 1999.
2. Upland data from Hahn & Associates, Inc., September 1998.
3. Horizontal Datum: Oregon State Plane North NAD83 (feet).
4. Vertical Datum: City of Portland (feet).

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Figure 1-4
NW Natural "Gasco" Site
Historic Upland Sample Locations

concentrations at the Gasco site ranged from less than 0.5 milligrams per kilogram (mg/kg) to as high as 58,822 mg/kg. Carcinogenic PAH (cPAH) concentrations ranged from 0.03 to 5,214 mg/kg. The highest PAH and cPAH concentrations were detected in soil boring B-29, located close to the shoreline in historic shoreline fill materials within a former drainage feature. Total BTEX concentrations in site soils ranged from 1.0 to 0891 mg/kg (benzene ranged from 0.72 to 360 mg/kg), with the highest concentrations detected at inland locations (e.g., boring B-18). Total cyanide concentrations at the site ranged from 0.17 to 518 mg/kg (at inland boring MW-9). Cyanide detected at the Gasco site is associated with the spent oxide material, which was used as fill throughout the site. As such, detectable cyanide concentrations were present over much of the site.

1.5.2 Post Remedial Investigation Results

The primary source of post-remedial investigation soil data came from a supplemental sampling program documented in correspondence from Hahn and Associates to ODEQ dated 8/15/00. This program provided surface and subsurface soil samples from approximately 21 locations throughout the study area (Figure 1-4). Sample results were similar to those observed during the preliminary RI and essentially filled in data gaps between previous stations. One key data gap from the original RI that was filled during the supplemental sampling program was that of metals for surface soils. Previously, data existed for only one or two stations in the FAMM area. The most recent program collected surface soil metals data site-wide.

1.5.3 Contaminants of Interest

Based on the investigations described in sections 1.4.1 and 1.4.2, a contaminant-of-interest (COI) list was prepared for use in conducting the risk assessment. This COI list, which is summarized in Table 1-1, includes those chemicals that were evaluated during the original RI and subsequent site investigations. Raw data, sorted by study area (i.e., KII, former tar area, etc.) and depth, is located in Appendix A.

Table 1-1 - NW Natural "Gasco" Site Contaminants of Interest

Metals and Inorganics	Monocyclic Aromatic Compounds (Cont.)
Antimony	4-Methylphenol
Arsenic	4-Nitrophenol
Beryllium	Benzene
Cadmium	Ethylbenzene
Chromium	Pentachlorophenol
Copper	Phenol
Lead	Toluene
Mercury	Xylenes
Nickel	
Selenium	**Polycyclic Aromatic Compounds**
Silver	Acenaphthene
Thallium	Acenaphthylene
Zinc	Anthracene
Cyanide	Benzo(a)anthracene
	Benzo(a)pyrene
Monocyclic Aromatic Compounds	Benzo(b)fluoranthene
2,3,4,6-Tetrachlorophenol	Benzo(g,h,i)perylene
2,4,5-Trichlorophenol	Benzo(k)fluoranthene
2,4,6-Trichlorophenol	Chrysene
2,4-Dichlorophenol	Dibenzo(a,h)anthracene
2,4-Dinitrophenol	Fluoranthene
2-Chlorophenol	Fluorene
2-Methyl-4,6-Dinitrophenol	Indeno(1,2,3-cd)perylene
2-Methylphenol	Naphthalene
2-Nitrophenol	Phenanthrene
3-Methylphenol	Pyrene
4-Chloro-3-Methylphenol	

2.0 Site Survey

2.1 Objectives and Scope

The overall objective of the site survey is to gather the site-specific qualitative and semi-quantitative data necessary for identifying relevant and complete contaminant-pathway-receptor relationships. The scope of the Gasco site survey included a habitat/vegetation inventory and a terrestrial receptor observation.

2.2 Methodology

The Gasco site survey was conducted by walking the site and marking the perimeters of all habitat features using a hand-held Global Positioning System (GPS) meter. These features, and their corresponding coordinates, were then transferred to a Geographic Information System (GIS) so that the positions could be added to a site map.

The terrestrial receptor survey was conducted by relying on information collected at a nearby study location (McCormick and Baxter), searching the Oregon Natural Heritage Program database, and conducting a field survey to confirm the presence or absence of expected species. The field survey relied on visual and physical observations such as the presence of scat, animal trails and tracks, and/or night-time bedding areas. The results of the site survey were then used to assist in completing the conceptual site model and selecting target receptors for the Level III risk evaluation.

2.3 Results

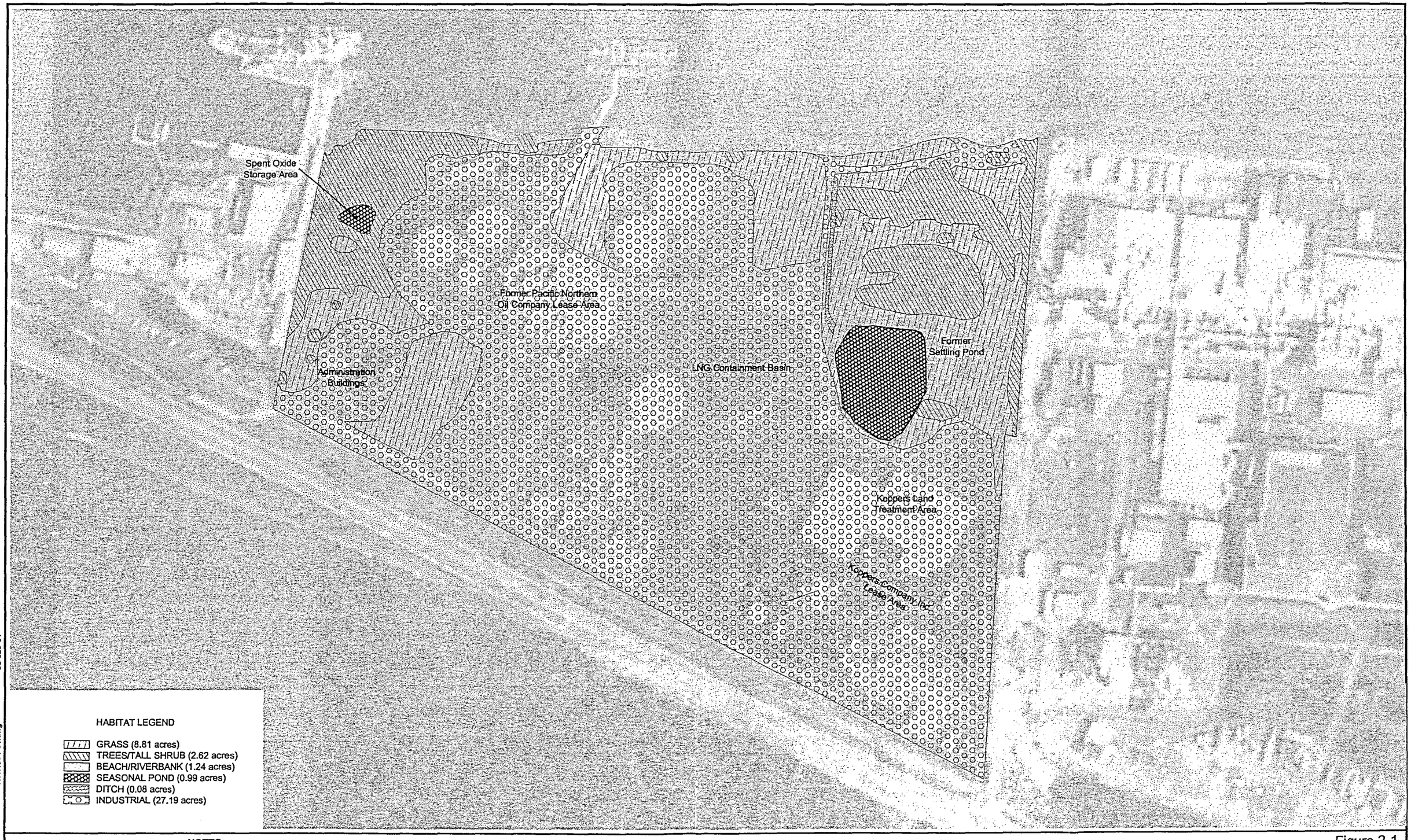
A total of five (5) habitat types was identified at the site and is presented in Figure 2-1. Examples of these habitat types are documented in the sites photos presented in Appendix B.

1. beach/riverbank (approximately 1.2 acres)
2. industrial/paved (approximately 27.2 acres)
3. grass, low shrub (approximately 8.8 acres)
4. high shrub/tree (approximately 2.6 acres)
5. pond and ditch (approximately 1.1 acres)

Type 1 (beach/riverbank) is sparsely vegetated, with algae on the sediments and some vegetation in the rip-rap on the bank slope (Photograph 1). Woody debris collects along the high water line. Presence of horsetail (*Equisetum arvense*) in several locations along the top of the bank indicates moist soils.

Type 2 (industrial/paved) encompasses much of the site, particularly the central and western portions. Occasional opportunistic vegetation is found in margins, gravel access roads, and on inactive structures. These isolated plants do not provide cover or habitat.

Type 3 (grass/low shrub) is found in several areas including interspersed with Type 4 (Photographs 3-5). The soils in Type 3 areas tend to be rockier and less developed than in Type 4. Plants commonly found here include various grass species, thistle (*Cirsium arvense*), cornflower (*Cichorium intybus*), sweet pea (*Lathyrus tingitanus*), Queen Anne's Lace (*Daucus carota*), mullein (*Verbascum thapsus*), teasel (*Dipsacus sylvestris*), tansy (*Tanacetum vulgare*), mugwort (*Artemisia douglasiana*), goldenrod (*Solidago canadensis*), and nettles (*Urtica dioca*). All of these species are common in disturbed areas such as along roads or disused areas. All are regarded as weeds, and most are not native to the Pacific Northwest. Two other invasive plants, scots broom (*Cytisus scoparius*) and himalayan blackberry (*Rubus discolor*) are found as both small



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NOTES:
1. Habitat intepretations based on 08/29/00 site visit by Anchor Environmental.

Figure 2-1
NW Natural "Gasco" Facility
Ecological Habitats

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shrubs and large shrubs. The large *Cytisus* resembles a small tree, and the large *Rubus* forms dense thickets up to 6 feet high.

Type 4 (high shrub/tree) is found in the north and southeast of the site (Photographs 4,5). The southeast has a number of mature cottonwoods (*Populus balsamifera*) and willows. There are at least 3 species of willow on site, possibly *Salix piperi*, *Salix fluviatilis*, and *Salix sitchensis*, but floral parts were not available for positive identification. The trees in the north are not as tall as those on the south, with the exception of 3 mature trees to the north of the former administration building which may have been intentionally planted. There are several big-leaf maple trees (*Acer macrophyllum*) along the river bank and in the disused northern part of the site. The maples appear to be around 15 years old.

Type 5 (pond/ditch) includes the former settling ponds and the drainage ditch (Photographs 5-8). Common rush (*Juncus effusus*) is found at edge of the ponds and ditch. There is an alder (*Alnus rubra*) tree by the ditch that is probably about 10 years old. The ponds were completely dry at the August site visit. The bare cracked soil indicates that they hold standing water late enough into the growing season to discourage extensive vegetative colonization.

Animals observed on site during numerous site visits between March and September 2000 include various species of songbirds, insects, deer, Canada geese, egrets, nutria, and dogs. Animal scat indicates use of the site by geese, dogs, and deer. One frog was observed at the ditch, but no aquatic invertebrates or fish were seen. Several animal trails and sleeping areas were noted (see photographs 9-13, Appendix B) indicating use by small mammals.

3.0 Screening Results

3.1 Site Designation

The Gasco site has been divided into five study areas (Figure 3-1) to allow a focused evaluation by current site use. The study areas, which were recommended previously by ODEQ staff, include the former spent oxide area, office area, the FAMM area, former tar pond area, and the KII area. For the purposes of the human health and ecological risk assessment, each study area will be evaluated separately.

3.2 Ecological Risk Assessment

An ecological risk assessment is being conducted on the upland areas of the Gasco facility according to U.S. EPA (1998) and ODEQ (1999) ecological risk assessment guidance documents. ODEQ's ecological risk assessment guidance document divides the risk assessment process into four levels: (I) scoping, (II) screening, (III) baseline, and (IV) field baseline. Within and between these levels are a number of technical management decision points. Based on information developed and presented within a given level, the decision points determine one of three possible recommendations: (1) no further ecological investigations are necessary, (2) the risk assessment should continue to the next level, or (3) a remedial action can be determined for the site. The current document is designed to provide information to support levels I and II, as described above.

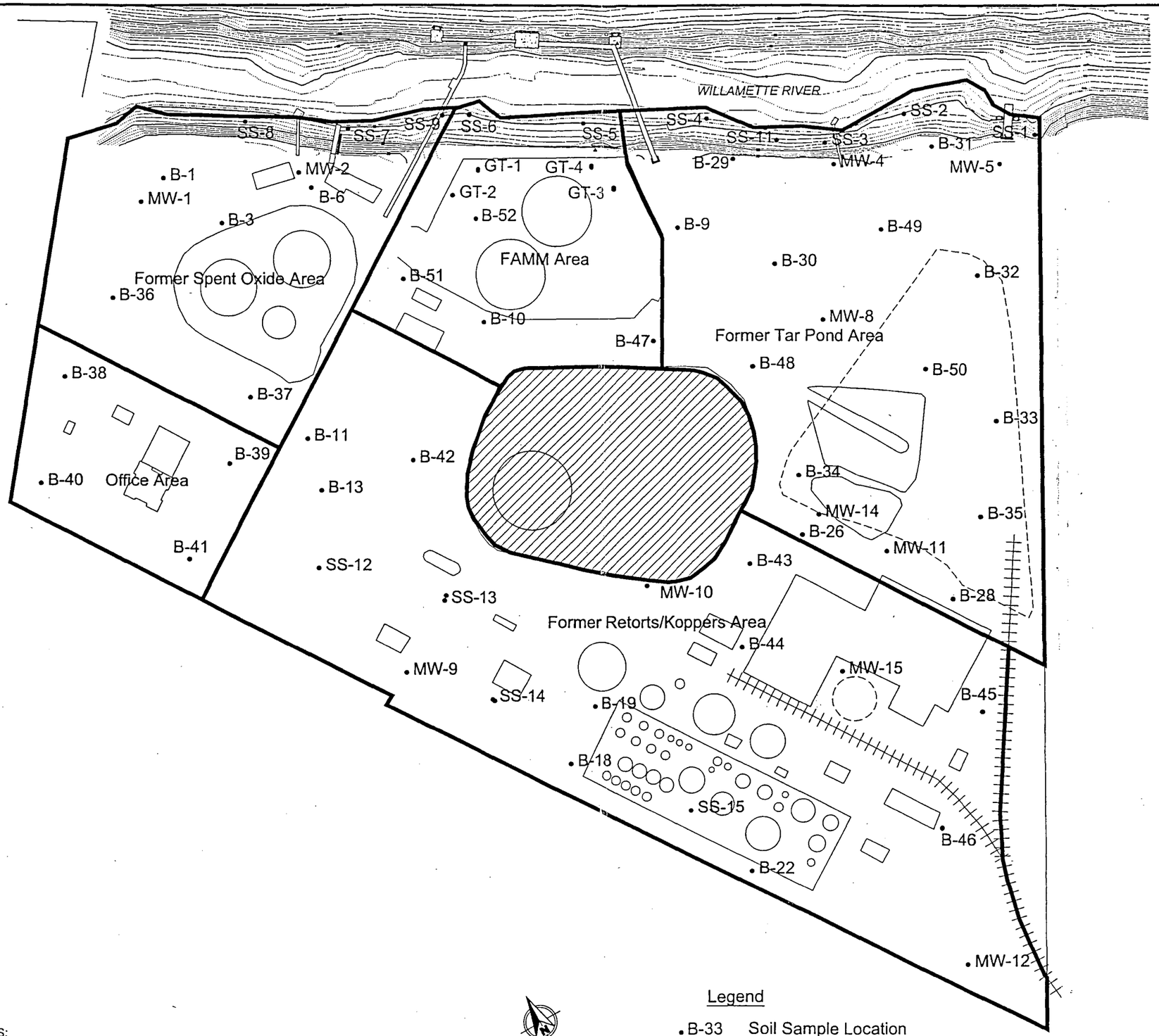
3.2.1 Potential Ecological Receptors

Potential ecological receptors at the Gasco site were identified using existing documentation from previous investigations conducted near the site (e.g., McCormick and Baxter Remedial Investigation (PTI, 1992)), information from the Oregon Natural Heritage Program (for rare, threatened and endangered species), and from observations made during recent site visits (see Section 2.3).

Terrestrial wildlife species known or expected to inhabit the site include raccoon (*Procyon lotor*), beaver (*Castor canadensis*), nutria (*Myocaster coypu*), black-tailed deer (*Odocoileus hemion*), dusky-footed wood rat (*Neotoma fuscipes*), opossum (*Didelphis marsupialis*), vagrant and Trowbridge's shrews (*Sorex vagrans* and *S. trowbridgii*), Townsend's and coast moles (*Scapanus townsendii* and *Neurotrichus gibbsii*), and striped skunk (*Mephitis mephitis*).

Avian species that may potentially utilize the study area while in transit to other, more optimal feeding areas, include great blue herons (*Ardea herodias*), double-crested cormorants (*Phalacrocorax autritus*), Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), gulls (*Larus* spp.), woodpeckers (various species), quail (*Callipepla* spp.), and various songbird species.

A search of the Oregon Natural Heritage Program database for rare, threatened, and endangered plant and animal species reported for the study sites did not locate any upland species (see Appendix C). Three records were noted within a two-mile radius of the study area, but were for proposed and listed salmonid fish species only and thus not pertinent to the upland risk assessment.



Legend

• B-33 Soil Sample Location

NOTES:
1. Bathymetric contour and dock survey by INCA Engineers Inc., August 1999.
2. Upland data from Hahn & Associates, Inc., September 1998.
3. Horizontal Datum: Oregon State Plane North NAD83 (feet).
4. Vertical Datum: City of Portland (feet).

0 180
Scale in Feet

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Figure 3-1
NW Natural "Gasco" Site
Study Area Designations

3.2.2 Candidate Assessment Endpoints

Based on the information presented in Sections 3.1 and 3.2.1 the following candidate assessment endpoints are proposed:

- Protection of mammalian and avian primary consumers (herbivores) from population level effects due to metals, monocyclic aromatic hydrocarbons, and polycyclic aromatic hydrocarbons (COIs).

- Protection of mammalian and/or avian secondary consumers (predators of soil invertebrates) from population level effects due to metals, monocyclic aromatic hydrocarbons, and polycyclic aromatic hydrocarbons.

These assessment endpoints represent key ecological receptors (rather than all) receptors potentially present at the site. These receptors are generalized in terms of species for use in the Level II (Screening) Risk Assessment. Selection of appropriate ecological receptor species for both of these endpoints is a critical step that must be completed prior to initiating the Level III (Baseline) Risk Assessment. It is recommended that the dusky-footed wood rat and quail would be the most appropriate species for primary consumers, while opossum would be the most appropriate species for secondary consumers. The wood rat and quail are widespread species that are likely present on the site, or species occupying similar niches are present on the site. In addition, these species forage and spend time on the ground in close contact with soils (Linsdale and Trevis 1951). Although woodrats are also arboreal, their nests are usually located on the ground (Linsdale and Tevis 1951). Thus, appropriate incidental soil ingestion rates for these species should be protective of many other mammals and passerine birds that are not in very frequent contact with soils. Opossum appears to be appropriate secondary consumer for similar reasons. It is widespread in the region including more developed areas and is likely present at or near the site. Opossum diet includes earthworms and snails and this receptor is generally in close contact with soils (Baker 1983).

Both of the general receptors (primary and secondary consumers) would likely include species that are relatively sensitive to the chemicals of interest. These general receptors also likely to include species considered societally important (at least for an industrialized habitat) because they represent some of the larger more visually apparent species likely in urbanized areas. Secondary consumers are included so that adverse impacts due to potential bioaccumulation in the food web can be evaluated.

The site is very likely too small to support a substantial population of tertiary consumers (e.g., hawks, foxes, etc.) or contribute substantially to the diet of any one individual tertiary consumer. Therefore, tertiary consumers are not included in the candidate endpoints.

Population level effects are selected because mortality or other effects to one or several individuals would not be expected to be ecologically significant at a small generally urbanized site. Effects to individuals might be appropriate for endangered or threatened species, but none are expected at or near the site (see Section 3.2.1). Population effects include any chemical toxicity that might contribute to a significant decrease in population abundance over time. Abundance decreases might be due to mortality, reproductive effects, effects leading to reduced capacity to forage or feed, or other chronic effects that might directly or indirectly lead to decreased long term reproduction and survival rates.

3.2.3 Contaminants of Potential Ecological Concern

Methods

Screening procedures to determine Contaminants of Potential Ecological Concern (CPECs) followed ODEQ guidance (ODEQ 1999). Chemical concentration data for soils from cores in each of the five areas described in Section 3.1 were statistically summarized (see details below). The appropriate statistic (per ODEQ 1999 guidance) was then compared to the lowest value from either the Screening Benchmark Values (SBVs) provided by ODEQ (1999) or the Washington State Model Toxics Control Act (WDOE 1998) values for industrial soils (together referred to as SBVs throughout the remainder of this document). Chemicals to be included in the screening (COIs) were selected as described in Section 1.5.3 using the data described in Section 1.5. Risk screening calculations were conducted for each of the five site areas described in Section 3.1.

Soils data from each site area were segregated into two categories: (1) data from samples obtained between 0 ft and 0.2 ft below ground surface (bgs) and (2) data from samples obtained between 0.2 ft and 5.5 ft bgs. This resulted in ten data sets (i.e., five areas multiplied by two soil strata). The maximum, and upper 90th percentile confidence levels (both arithmetic and logarithmic) were calculated for each data set. The statistic used to represent each area's Environmental Concentration (EC) in the risk screening was selected consistent with ODEQ (1999) methods. It should be noted that subsurface data would only be representative of potential risks to receptors that would be anticipated to burrow extensively. The proposed receptors (dusky footed wood rat, quail, and opossum do not burrow. Therefore, evaluation of subsurface soil data is a conservative approach (more likely to find risks).

In some cases SBVs were not available for a particular chemical and an SBV was extrapolated from other chemicals with similar structure. For non-carcinogenic PAHs with no SBV, the lowest SBV available for any non-carcinogenic PAH (fluorene) was used. For carcinogenic PAHs with no SBV, the lowest SBV available for any carcinogenic PAH (benzo(a)pyrene) was used. The SBVs for 2,3,4,5-tetrachlorophenol, 3,4-dichlorphenol, and 4-nitrophenol were used as surrogates for 2,3,4,6-tetrachlorophenol, 2,4-dichlorophenol, and 2-nitrophenol, respectively.

Consistent with ODEQ guidance (except where noted below) COIs were designated as Chemicals of Potential Environmental Concern (CPECs) based on the following five screening evaluations for each site area/strata:

1) COIs that were detected in less than 5% of the samples with detection limits less than 5 times the SBVs were excluded from the area/strata CPEC list.
2) COIs that had a maximum concentration below background concentrations were excluded from the area/strata CPEC list.
3) Detected chemicals with no SBVs were included in the area/strata CPEC list (to be evaluated qualitatively in the Level III Baseline Risk Assessment).
4) COIs with Hazard Quotients (HQs[2]) greater than 5 were included in the area/strata CPEC list.
5) COIs with HQs greater than the sum of HQs for all COIs in soils divided by the number of COIs were included in the area/strata CPEC list.

[2] Hazard quotients are the EC divided by the SBV.

For screening Evaluation 1, ODEQ guidance (1999) suggests excluding COIs with fewer than 5% detections from the CPEC list where the detection limit is sufficiently low for ecological purposes. A value of 5 times the SBV was selected to be representative of ecological purposes because the HQ used for screening chemicals is 5 (i.e., an EC of five times the SBV) consistent with ODEQ guidance on EC screening. This approach avoids including COIs based on undetected or very infrequently detected data.

For screening Evaluation 2, background concentrations from the Washington State Department of Ecology (WDOE 1994) were used as a reference. Specifically, values for Clark County Washington were used for the chemicals shown in Table 3-1.

Table 3-1 - Background Concentration (mg/kg) used in the Risk Screening (WDOE 1994)

Chemical	Conc.(mg/kg)
Arsenic	5.81
Beryllium	2.07
Cadmium	0.93
Chromium	26.57
Copper	34.34
Lead	24.02
Mercury	0.04
Nickel	21.04
Zinc	95.52

For screening Evaluation 5, ODEQ guidance suggests an additional evaluation of ECs in other site media (e.g., surface and groundwater). However, because groundwater and surface water are not expected to provide relevant and complete pathways for chemicals to the candidate ecological receptors, these media were not included in the evaluation. The evaluation of relevant and complete exposure pathways is discussed in more detail in Section 3.2.4.

Results

The results of the screening evaluations are summarized in Table 3-2 (surface soils) and Table 3-3 (subsurface soils). The raw data used for these evaluations and the results of each separate chemical screening are shown in Appendices A and D, respectively.

Metals

Metals were identified as CPECs in surface soils slightly more often than in subsurface soils. However, in both these soil strata most of the metal CPEC designations are based on undetected data for mercury and thallium where the detection limit was above the SBV. In some cases, mercury and thallium were detected but at concentrations very close to the analytical detection limits for these metals. Detections of chemicals very close to the detection limit are often inaccurate (U.S. EPA, 1995), and it appears that all mercury and thallium CPEC designations are an artifact of high detection limits. Zinc was designated as a CPEC in the surface soils of the spent oxide and KII areas. Zinc results do not appear to be due to analysis artifacts.

Monocyclic Aromatic Hydrocarbons

Of the monocyclic aromatic hydrocarbons, benzene, toluene, ethylbenzene, and xylenes (BTEX) were analyzed in all areas. Only ethylbenzene and xylenes were designated as CPECs in the subsurface soils of the tar pond area. Phenols were undetected in all cases.

Table 3-2. Ecological Screening Summary Results Table - Surface Soils (0 to 0.2 ft bgs).

	0 (mg/kg) Soil Screening Benchmark Value	Sreening Benchmark Value Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Metals and Inorganics																	
Antimony	5	MTCA	75%	6.60	1.3	100%	1.96	0.4	67%	2.26	0.5	67%	3.76	0.8	100%	1.84	0.4
Arsenic	7	MTCA	75%	21.00	3.0	100%	5.44	0.8	33%	3.14	0.4	33%	3.40	0.5	33%	1.11	0.2
Beryllium	8	ODEQ Mammals	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1
Cadmium	4	MTCA	25%	1.10	0.3	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1
Chromium	30	ODEQ Mammals	100%	30.00	1.0	100%	24.70	0.8	67%	70.90	2.4	89%	22.30	0.7	100%	11.90	0.4
Copper	50	MTCA	100%	60.00	1.2	100%	52.10	1.0	100%	34.70	0.7	100%	40.90	0.8	100%	16.70	0.3
Lead	50	MTCA	100%	60.00	1.2	100%	55.40	1.1	67%	30.40	0.6	89%	94.60	1.9	100%	10.80	0.2
Mercury	0.1	ODEQ Birds	0%	0.50	***5.0***	0%	0.50	***5.0***	0%	0.50	***5.0***	22%	3.23	***32.3***	0%	0.50	***5.0***
Nickel	30	MTCA	100%	26.00	0.9	100%	84.00	2.8	100%	146.00	4.9	78%	19.80	0.7	100%	5.95	0.2
Selenium	0.3	MTCA	0%	0.50	1.7	0%	0.50	1.7	0%	0.50	1.7	0%	0.50	1.7	0%	0.50	1.7
Silver	2	MTCA	0%	0.50	0.3	0%	0.50	0.3	0%	0.50	0.3	0%	0.50	0.3	0%	0.50	0.3
Thallium	1	MTCA	50%	7.60	***7.6***	0%	0.50	0.5	0%	5.00	***5.0***	0%	5.00	***5.0***	0%	5.00	***5.0***
Zinc	24	ODEQ Mammals	100%	160.00	***6.7***	100%	88.31	3.7	100%	114.00	4.8	100%	226.00	***9.4***	100%	68.39	2.8
Cyanide	780	ODEQ Mammals	100%	0.47	0.0	--	--	--	--	--	--	--	--	--	100%	0.78	0.0
Monocyclic Aromatic Compounds																	
2,3,4,6-Tetrachlorophenol	20	ODEQ Inverts.[2]	--	--	--	--	--	--	--	--	--	0%	1.70	0.1	0%	26.00	1.3
2,4,5-Trichlorophenol	9	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	0%	1.70	0.2	0%	26.00	***2.9***
2,4,6-Trichlorophenol	10	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	0%	1.70	0.2	0%	26.00	***2.6***
2,4-Dichlorophenol	20	ODEQ Inverts[3]	--	--	--	--	--	--	--	--	--	0%	1.70	0.1	0%	26.00	1.3
2,4-Dimethylphenol	20	ODEQ Plants	--	--	--	--	--	--	--	--	--	0%	1.70	0.1	0%	26.00	1.3
2,4-Dinitrophenol	20	ODEQ Plants	--	--	--	--	--	--	--	--	--	0%	3.30	0.2	0%	49.00	2.5
2-Chlorophenol	10	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	0%	1.70	0.2	0%	26.00	***2.6***
2-Methyl-4,6-dinitrophenol	--	--	--	--	--	--	--	--	--	--	--	0%	1.70	--	0%	26.00	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	7	ODEQ Inverts.[4]	--	--	--	--	--	--	--	--	--	0%	1.70	0.2	0%	26.00	***3.7***
3-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	--	--	--	--	--	--	--	--	--	--	0%	1.70	--	0%	26.00	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	0%	1.70	--	0%	26.00	--
4-Nitrophenol	7	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	0%	1.70	0.2	0%	26.00	***3.7***
Benzene	172	ODEQ Mammals	0%	0.15	0.0	--	--	--	--	--	--	0%	0.15	0.0	0%	0.15	0.0
Ethylbenzene	--	--	0%	0.15	--	--	--	--	--	--	--	0%	0.15	--	0%	0.15	--
Pentachlorophenol	0.879	ODEQ Birds	--	--	--	--	--	--	--	--	--	0%	1.70	1.9	0%	26.00	***29.6***
Phenol	30	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	0%	1.70	0.1	0%	26.00	0.9
Toluene	170	ODEQ Mammals	0%	0.15	0.0	--	--	--	--	--	--	0%	0.15	0.0	0%	0.15	0.0
Xylenes	14	ODEQ Mammals	0%	0.15	0.0	--	--	--	--	--	--	0%	0.15	0.0	0%	0.15	0.0

Table 3-2. Ecological Screening Summary Results Table - Surface Soils (0 to 0.2 ft bgs).

	0 (mg/kg) Soil Screening Benchmark Value	Sreening Benchmark Value Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Polyaromatic Compounds																	
Acenaphthene	20	MTCA	83%	0.51	0.03	100%	0.36	0.0	33%	0.06	0.00	79%	110	***5.5***	79%	9.2	0.46
Acenaphthylene	30	ODEQ Inverts.[5]	50%	0.41	0.01	75%	0.25	0.0	67%	0.18	0.01	36%	4.1	0.14	86%	29	1.0
Anthracene	30	ODEQ Inverts.[5]	67%	1.10	0.04	25%	0.56	0.0	33%	0.32	0.01	71%	212	***7.1***	93%	16	0.5
Benzo(a)anthracene	7	ODEQ Mammals[6]	100%	4.70	0.67	100%	4.86	0.7	100%	1.24	0.18	100%	53	***7.6***	100%	50	***7.1***
Benzo(a)pyrene	7	ODEQ Mammals	100%	7.35	1.05	100%	6.50	0.9	100%	1.74	0.25	100%	61	***8.7***	100%	129	***18.4***
Benzo(b)fluoranthene	7	ODEQ Mammals[6]	100%	6.50	0.93	100%	5.45	0.8	100%	1.60	0.23	100%	58	***8.2***	100%	124	***17.7***
Benzo(g,h,i)perylene	30	ODEQ Inverts.[5]	100%	6.30	0.21	100%	5.80	0.2	100%	1.82	0.06	100%	46	1.5	100%	202	***6.7***
Benzo(k)fluoranthene	7	ODEQ Mammals[6]	83%	4.92	0.70	100%	4.14	0.6	100%	1.02	0.15	100%	37	***5.2***	100%	45	***6.4***
Chrysene	7	ODEQ Mammals[6]	100%	5.85	0.84	100%	5.20	0.7	100%	1.60	0.23	100%	71	***10.2***	100%	75	***10.8***
Dibenzo(a,h)anthracene	7	ODEQ Mammals[6]	83%	1.67	0.24	100%	1.47	0.2	100%	0.39	0.06	93%	10	1.4	93%	33	4.7
Fluoranthene	30	ODEQ Inverts.[5]	100%	8.55	0.29	100%	7.05	0.2	100%	2.78	0.09	100%	135	4.5	100%	111	3.7
Fluorene	30	ODEQ Inverts.	50%	0.34	0.01	50%	0.25	0.0	33%	0.07	0.00	71%	55	1.8	71%	5.90	0.20
Indeno(1,2,3-cd)pyrene	7	ODEQ Mammals[6]	100%	5.05	0.72	100%	4.76	0.7	100%	1.53	0.22	100%	42	***5.9***	100%	141	***20.1***
Naphthalene	30	ODEQ Inverts.[5]	83%	0.46	0.02	50%	0.25	0.0	67%	0.43	0.01	50%	11	0.4	86%	9.40	0.31
Phenanthrene	30	ODEQ Inverts.[5]	83%	5.80	0.19	100%	3.00	0.1	100%	2.02	0.07	100%	92	3.1	100%	37	1.2
Pyrene	30	ODEQ Inverts.[5]	100%	10.40	0.35	100%	6.80	0.2	100%	2.59	0.09	100%	217	***7.2***	100%	134	4.5

EC - Environmental Concentrations determined per DEQ guidance. ECs are either maximum observed values or logarithmic 90th percentile upper confidence limits.

Box indicates Chemicals of Potential Environmental Concern (CPECs) following DEQ methodology.

-- indicates information not available.

1 In all cases the lowest value from ODEQ or the Washington State Model Control Toxics Act (MTCA) were used.

ODEQ references are for Guidance for Ecological Risk Assessment Level II Screening Benchmark Values (1998). Values are from the columns named as shown in the cited document table.

2 Screening Benchmark Value for 2,3,4,5-tetrachlorphenol

3 Screening Benchmark Value for 3,4-dichlorophenol

4 Screening Benchmark Value for 4-nitrophenol

5 Screening Benchmark Value for fluorene (lowest value available for a non-carcinogenic PAH).

6 Screening Benchmark Value for benzo(a)pyrene (lowest value available for a carcinogenic PAH).

Table 3-3. Ecological Screening Summary Results Table - Subsurface Soils (0.2 to 5.5 ft bgs).

	0 (mg/kg) Soil Screening Benchmark Value	Sreening Benchmark Value Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Metals and Inorganics																	
Antimony	5	MTCA	50%	1.59	0.3	75%	2.92	0.6	50%	1.02	0.2	60%	1.06	0.2	100%	1.54	0.3
Arsenic	7	MTCA	100%	4.50	0.6	100%	6.37	0.9	100%	5.25	0.8	100%	7.27	1.0	14%	1.10	0.2
Beryllium	8	ODEQ Mammals	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1
Cadmium	4	MTCA	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1	0%	0.50	0.1
Chromium	30	ODEQ Mammals	100%	15.79	0.5	100%	17.86	0.6	100%	16.10	0.5	100%	14.53	0.5	100%	10.78	0.4
Copper	50	MTCA	100%	18.90	0.4	100%	35.20	0.7	100%	19.60	0.4	100%	46.00	0.9	100%	10.64	0.2
Lead	50	MTCA	100%	47.00	0.9	100%	40.30	0.8	100%	12.10	0.2	100%	20.60	0.4	100%	18.30	0.4
Mercury	0.1	ODEQ Birds	0%	0.50	***5.0***	0%	0.50	***5.0***	0%	0.50	***5.0***	20%	0.50	5.0	0%	0.50	***5.0***
Nickel	30	MTCA	100%	17.56	0.6	100%	21.10	0.7	100%	14.57	0.5	100%	16.52	0.6	100%	11.10	0.4
Selenium	0.3	MTCA	0%	0.50	1.7	0%	0.50	1.7	0%	0.50	1.7	60%	0.50	1.7	0%	0.50	1.7
Silver	2	MTCA	0%	0.50	0.3	0%	0.50	0.3	0%	0.50	0.3	60%	0.50	0.3	0%	0.50	0.3
Thallium	1	MTCA	0%	0.50	0.5	0%	0.50	0.5	0%	5.00	***5.0***	60%	50.00	***50.0***	0%	5.00	***5.0***
Zinc	24	ODEQ Mammals	100%	73.18	3.0	100%	70.30	2.9	100%	55.20	2.3	100%	64.20	2.7	100%	62.12	2.6
Cyanide	780	ODEQ Mammals	50%	61.00	0.1	--	--	--	0%	0.01	0.0	100%	518.00	0.7	100%	3.90	0.0
Monocyclic Aromatic Compounds																	
2,3,4,6-Tetrachlorophenol	20	ODEQ Inverts.[2]	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	1.3
2,4,5-Trichlorophenol	9	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	***2.9***
2,4,6-Trichlorophenol	10	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	***2.6***
2,4-Dichlorophenol	20	ODEQ Inverts[3]	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	1.3
2,4-Dimethylphenol	20	ODEQ Plants	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	1.3
2,4-Dinitrophenol	20	ODEQ Plants	--	--	--	--	--	--	--	--	--	--	--	--	0%	46.00	2.3
2-Chlorophenol	10	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	***2.6***
2-Methyl-4,6-dinitrophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	7	ODEQ Inverts.[4]	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	***3.7***
3-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	--
4-Nitrophenol	7	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	***3.7***
Benzene	172	ODEQ Mammals	25%	0.03	0.0	0%	0.00	0.0	0%	0.01	0.0	0%	0.15	0.0	50%	107	0.6
Ethylbenzene	--	--	0%	0.01	--	0%	0.00	--	0%	0.01	--	0%	0.15	--	50%	103	--
Pentachlorophenol	0.879	ODEQ Birds	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	***29.6***
Phenol	30	ODEQ Inverts.	--	--	--	--	--	--	--	--	--	--	--	--	0%	26.00	0.9
Toluene	170	ODEQ Mammals	0%	0.01	0.0	0%	0.00	0.0	0%	0.01	0.0	0%	0.15	0.0	50%	78	0.5
Xylenes	14	ODEQ Mammals	25%	0.17	0.0	0%	0.00	0.0	0%	0.04	0.0	0%	0.15	0.0	50%	141	***10.1***

Table 3-3. Ecological Screening Summary Results Table - Subsurface Soils (0.2 to 5.5 ft bgs).

	0 (mg/kg) Soil Screening Benchmark Value	Sreening Benchmark Value Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Polycyclic Aromatic Hydrocarbons																	
Acenaphthene	20	MTCA	20%	1.30	0.07	25%	0.25	0.01	50%	1.65	0.08	44%	0.22	0.01	100%	369	***18.5***
Acenaphthylene	30	ODEQ Inverts.[5]	20%	30	1.0	25%	0.26	0.01	25%	0.29	0.01	56%	1.30	0.04	100%	138	4.6
Anthracene	30	ODEQ Inverts.[5]	40%	34	1.1	0%	0.25	0.01	50%	2.14	0.07	22%	2.00	0.07	100%	263	***8.8***
Benzo(a)anthracene	7	DEQ Mammals[6]	80%	315	***45.0***	50%	1.87	0.27	75%	8.70	1.24	67%	7.40	1.06	100%	357	***51.0***
Benzo(a)pyrene	7	ODEQ Mammals	20%	432	***61.7***	50%	2.86	0.41	75%	11.40	1.63	67%	14.40	2.06	100%	400	***57***
Benzo(b)fluoranthene	7	DEQ Mammals[6]	100%	563	***80.4***	50%	2.13	0.30	75%	8.45	1.21	78%	19.60	2.80	100%	411	***58.7***
Benzo(g,h,i)perylene	30	ODEQ Inverts.[5]	100%	490	***16.3***	50%	2.09	0.07	100%	8.05	0.27	67%	22.60	0.75	78%	152	***5.1***
Benzo(k)fluoranthene	7	DEQ Mammals[6]	80%	179	***25.6***	25%	1.58	0.23	75%	8.40	1.20	67%	5.00	0.71	100%	99	***14.2***
Chrysene	7	DEQ Mammals[6]	100%	334	***47.7***	50%	2.23	0.32	75%	9.45	1.35	67%	13.30	1.90	100%	343	***49.0***
Dibenzo(a,h)anthracene	7	DEQ Mammals[6]	100%	88	***12.5***	25%	0.42	0.06	25%	1.14	0.16	67%	2.70	0.39	89%	21	3.0
Fluoranthene	30	ODEQ Inverts.[5]	100%	591	***19.7***	50%	3.26	0.11	75%	15.60	0.52	78%	17.90	0.60	100%	1390	***46.3***
Fluorene	30	ODEQ Inverts.	100%	13	0.4	0%	0.25	0.01	25%	0.68	0.02	33%	0.40	0.01	89%	266	***8.9***
Indeno(1,2,3-cd)pyrene	7	DEQ Mammals[6]	100%	389	***55.6***	50%	1.49	0.21	75%	7.10	1.01	67%	16.10	2.30	89%	110	***15.7***
Naphthalene	30	ODEQ Inverts.[5]	60%	923	***30.8***	25%	0.25	0.01	50%	0.14	0.00	44%	1.20	0.04	100%	3460	***115.3***
Phenanthrene	30	ODEQ Inverts.[5]	80%	309	***10.3***	50%	2.26	0.08	75%	8.50	0.28	56%	8.60	0.29	100%	1190	***39.7***
Pyrene	30	ODEQ Inverts.[5]	100%	735	***24.5***	50%	5.20	0.17	75%	15.10	0.50	67%	30.40	1.01	100%	2190	***73.0***

EC - Determined per DEQ guidance. In most cases ECs are maximum observed values. Occasionally, they are arithmetic or logarithmic 90th percentile upper confidence limits.
Box indicates Chemicals of Potential Environmental Concern (CPECs) following DEQ methodology.
-- indicates information not available.
1 In all cases the lowest value from ODEQ or the Washington State Model Control Toxics Act (MTCA) were used.
ODEQ references are for Guidance for Ecological Risk Assessment Level II Screening Benchmark Values (1998). Values are from the columns named as shown in the cited document table.
2 Screening Benchmark Value for 2,3,4,5-tetrachlorphenol
3 Screening Benchmark Value for 3,4-dichlorophenol
4 Screening Benchmark Value for 4-nitrophenol
5 Screening Benchmark Value for fluorene (lowest value available for a non-carcinogenic PAH).
6 Screening Benchmark Value for benzo(a)pyrene (lowest value available for a carcinogenic PAH).

However, as with the metals, detection limits for a few phenolic compounds were above the SBVs and are designated as CPECs in the tar pond area on this basis alone.

Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) were detected at concentrations greater than 5 times their SBVs (i.e., HQs greater than 5 requiring CPEC designation) in only three site areas: spent oxide area subsurface soils, KII area subsurface soils, and tar pond area surface and subsurface soils. Fewer PAH CPECs were found in surface soils of the tar pond area as compared to other areas with PAH CPECs. However, the subsurface soils of the tar pond area had the greatest number of PAH CPECs.

For the site overall, two areas (office area and FAMM area) had no detections of any chemicals requiring a CPEC designation. This suggests that these areas should not be evaluated further for ecological risks.

ODEQ guidance (1999) recommends a discussion of any CPECs that have the potential to bioaccumulate in the food chain. Of the CPECs determined in this report, some of the PAHs have the potential for significant bioaccumulation. Most PAHs have log octanol/water (K_{ow}) partition coefficients (a general indicator of the propensity for a chemical to bioaccumulate; U.S. EPA 1991) in the 3 to 7 range (Table 3-4). Log K_{ow}'s above 3.5 indicate the potential for bioaccumulation, while values of 5 or greater have a relatively high propensity for bioaccumulation in food chains (U.S. EPA 1991 and Sample et al. 1997). Consequently, several of the PAHs found as CPECs are likely to bioaccumulate in the food chains and have some effect on higher trophic level organisms. For this reason a candidate assessment endpoint for secondary consumers was developed (see Section 3.2.2).

Table 3-4 - Log Octanol/Water (Kow) Coefficients for PAHs

Chemical	Mol. Wt.	log K_{ow}	Reference
Acenaphthene	154.21	3.92	Hansch and Leo 1987
Acenaphthylene	152.20	4.07	Callahan et al. 1979
Anthracene	178.23	4.45	Hansch et al. 1995
Benzo(a)anthracene	228.29	5.66	EPA 1992
Benzo(a)pyrene	252.32	6.10	EPA 1992
Benzo(b)fluoranthene	252.32	6.12	EPA 1992
Benzo(g,h,i)perylene	276.34	5.82	Hansch et al. 1995
Benzo(k)fluoranthene	252.32	6.84	Leo et al. 1971
Chrysene	228.29	5.66	EPA 1992
Dibenzo(a,h)anthracene	278.35	6.84	EPA 1992
Fluoranthene	202.26	4.95	EPA 1992
Fluorene	166.22	4.18	Hansch et al. 1995
Indeno(1,2,3-cd)pyrene	276.34	6.58	EPA 1992
Naphthalene	128.17	3.30	EPA 1992
Phenanthrene	178.23	4.57	EPA 1992
Pyrene	202.26	4.88	Hansch et al. 1995

3.2.4 Relevant and Complete Exposure Pathways

A key step in the ecological risk assessment process is identification of relevant and complete exposure pathways from chemical sources at the site to potential ecological receptors. The fate and transport steps that determine potential complete pathways are discussed below.

Chemical Sources

The source of the COIs discussed in this document are a result of historic operations at the NW Natural "Gasco" site. As discussed in Section 1.2, historic operations have led to direct and indirect transport of COIs to soils or transitory surface waters (i.e., stormwater) on the site. From these media, additional transport (desorption from soils or dissolved water transport) to site groundwater have occurred.

Transport Media

Due to historical operations, chemicals may now be present in soils or groundwaters. As rain falls and runs off the site, some of the chemicals in soils may be either dissolved into stormwater (most likely metals) or transported via movement or erosion of soil particulates (most likely organic compounds). The fate of these chemicals could be temporary on-site water bodies (e.g., puddles, ditches, etc.); redeposition, adsorption, or precipitation to soils; or transport to the Willamette River. Similarly, chemicals may be dissolved or desorbed from soils into groundwaters and transported by the groundwater to other soils on the site or discharged via groundwater flow to the Willamette River. Finally, volatilization from surface soils and waters could take place to the air. Transport to plants and animals can take place from any of these physical media, with the most likely transport being from soils and surface waters to plants and animals via ingestion, adsorption, and/or respiration. COIs may be further transported by ingestion by predators of plants or other animals.

While transport of chemicals by various means to the Willamette River is potentially possible, potential risks associated with Willamette River water and sediments will be addressed in the aquatic ecological and human health risk assessments. Consequently, aquatic fate and potential risks are not discussed further below.

Points of Environmental Contact

Terrestrial plants and animals may be in contact with soils, transitory surface waters, or airborne COIs. Theoretically, some larger plants (like trees) could also be in contact with site groundwaters. However, because there is no well-developed plant community on site with extensive root systems, groundwater is expected to be an unlikely point of contact. Similarly, no evidence of extensive burrow systems were observed on site. Therefore, burrowing to depths of groundwater (3 to 9 feet deep) by key receptors appears unlikely. However, if some burrowers are present, they would likely contact subsurface soils (deeper than 0.2 ft). Animals might have plants or other animals as the ultimate point of contact via consumption.

Exposure Routes at Point of Contact

For an exposure route to exist, an ecological receptor must be present at the point of contact. As discussed in Section 3.2.1, the potential ecological receptors at this site are limited due to its industrialized nature. All potential routes of exposure and their likely significance at this site are:

- Foliar and root (plants) or dermal and ingestion (animals) uptake of chemicals in soils (Relevant and Complete)

- Uptake by the same routes from surface water chemicals (Relevant But Usually Incomplete)
- Uptake by respiration of volatilized airborne chemicals (Likely Insignificant)
- Uptake by ingestion of plants and/or animals (Relevant and Complete).

Of these exposure routes, the most likely and relevant is uptake from soils to plants and animals. Similarly, animals could consume either plants or other animals present at the site and, thus receive indirect exposures to these soil chemicals.

There are no permanent surface waters on the site. Although a surface water uptake route may exist at certain times of the year, this would not be a constant source of exposure. Further, the levels of chemicals in transitory surface waters would be mainly determined by the concentrations in surface soils they contact. Consequently, the surface water uptake route of exposure is considered potentially complete but not relevant in terms of long-term exposures and potential site cleanup decisions as compared to soil concentrations.

Similarly, volatilization from soils to air is potentially possible and likely occurs at some rate on the site. However, this exposure route would likely be most significant when very high concentrations of highly volatile chemicals and/or physical locations that trap or limit air circulation (such as depressions) exist on the site. Although some volatile chemicals (like benzene) were found at the site, they are not the most widespread or most highly concentrated chemicals at the site. In contrast, PAHs, which are present at higher concentrations on the site, are relatively non-volatile (see Section 3.2.5). Consequently, the air uptake route is considered potentially complete but relatively insignificant in terms of overall exposure as compared to soils.

3.2.5 Known Ecological Effects

The known ecological and toxicological effects of the CPECs defined in Section 3.2.3 are discussed in this section. This section does not provide detailed toxicity profiles, which will occur in the Level III Baseline Risk Assessments, as necessary. Rather, potentially important (as far as further risk assessment and evaluation are concerned) physiochemical and toxicity information is discussed for each of the CPECs. CPECs that are a result of analytical detection limit issues are not discussed below. Physiochemical and toxicity information originated from the Hazardous Substances Data Base (HSDB 2000), unless otherwise noted.

Metals and Inorganics

As discussed in Section 3.2.3, only zinc was consistently detected at levels significantly above its respective SBV. The presence of mercury and thallium at concentrations that may be of concern can not be positively determined based on existing information. Consequently, this discussion is confined to zinc.

Zinc is an essential element for most life and is found in virtually all organisms. Zinc is generally not found in a free elemental state, but most often occurs in the +2 oxidation state in compounds such as zinc sulfide (sphalerite), zinc carbonate (smithsonite) and zinc oxide (zincite). Zinc is expected to have low mobility in soils, but is adsorbed by plants. Because zinc compounds are generally solids, volatilization from soil or water surfaces is not expected to be an important environmental fate process. Zinc is often measured as strongly adsorbed or associated with suspended solids and sediment in water.

A variety of toxic effects have been observed in terrestrial animals as a result of zinc exposure, depending on the dose. Effects in animals include depressed growth, arthritis, lesions in various internal and reproductive organs, gastrointestinal tract inflammation, defective bone mineralization, decreased egg hatching in birds (ORNL 1996), reduced fetal growth (ORNL 1996), and other effects. There is no evidence to clearly support that zinc is carcinogenic (USEPA classification D). Extremely high levels of zinc in soils have been linked to iron and copper deficiency in plants and inhibition of root growth.

Monocyclic Aromatic Hydrocarbons

The only detected monocyclic hydrocarbons identified as CPECs were benzene, toluene, ethylbenzene, and xylene in the subsurface soils of the former tar pond Area. These compounds have similar physical characteristics. Because of their high vapor pressures and Henry's Law constants, they volatilize readily to the air from soils or waters. Once in the air, they have been shown to rapidly degrade with half-lives on the order of a few hours to a few days. All four compounds have moderate to low organic carbon partition coefficients, with benzene having the lowest partition coefficient. This suggests they are relatively mobile (or very mobile in the case of benzene) in soils and could be leached from soils by surface and groundwaters. Benzene is also relatively water soluble, compounding this effect. All four chemicals have also been shown to degrade relatively rapidly in soils with half-lives in most studies on the order of several days to weeks (although outliers have been reported with half-lives as short as several hours and as long as two and half months). None of these compounds is expected to bioaccumulate in the food chain due to their relatively low log K_{ow} values of 2 to 3.

Benzene is a known carcinogen in humans and has been linked to tumor production in a variety of terrestrial animal organs. A wide variety of other toxic effects in terrestrial animals have been observed at various doses and exposure routes. Benzene has also been related to increased rat mortality and embryonic reabsorption during short (several day) exposures (ORNL 1996).

Toluene exposure in terrestrial animals has been linked to nervous system effects and depression, liver lesions, lung inflammation, and other effects. Toluene may cause reduced fetal weights and increased malformations in rats during short exposure durations (ORNL 1996). Unlike benzene, there is no clear evidence indicating that toluene is a human or animal carcinogen (EPA Classification D).

In terrestrial animals, ethylbenzene exposure has been linked to central nervous system depression, increased mortality, brain and lung edema, and other effects. There is no clear evidence indicating that ethylbenzene is a human or animal carcinogen (Classification D).

Exposure to xylenes has been linked in terrestrial animals to decreased red and white blood cell counts, central nervous system depression, skeletal abnormalities, fetal mortality and growth reduction, and other effects. Xylenes may also cause reduced fetal weights and increased malformations in rats during short exposure durations (ORNL 1996). There is no clear evidence indicating that xylenes are a human or animal carcinogen (Classification D).

Polycyclic Aromatic Hydrocarbons

The PAHs identified as CPECs for this project are all moderately sized organic compounds composed of two to six aromatic rings. As the number of aromatic rings increases (and thus, the molecular weight) the physiochemical properties of the compounds also change (Table 3-5).

Table 3-5 - Summary of Physiochemical Characteristics of PAHs

Chemical	Molecular Weight	No. of Rings	Vapor Pressure (Pa)	Henry's Law K (Atm-m3/mol)	Mid-Range K_{oc}	K_{ow}	Degradation Half-life (days)
Acenaphthene	154	2	5.96E-01	2.40E-04	2.65E+03	8.32E+03	3.50E+01
Acenaphthylene	152	2	1.20E-01	1.30E-05	2.13E+03	1.17E+04	6.65E+01
Anthracene	178	3	7.50E-04	1.80E-06	5.60E+03	2.82E+04	9.20E+01
Benzo(a)anthracene	228	4	7.30E-06	1.20E-06	1.22E+06	4.57E+05	2.12E+02
Benzo(a)pyrene	252	5	8.40E-07	2.70E-07	3.62E+03	1.26E+06	2.15E+02
Benzo(b)fluoranthene	252	4	6.70E-05	5.00E-07	3.40E+06	1.32E+06	7.60E+02
Benzo(g,h,i)perylene	276	6	6.00E-08	2.70E-07	9.60E+04	6.61E+05	5.18E+02
Benzo(k)fluoranthene	252	4	1.30E-07	5.84E-07	7.90E+05	6.92E+06	N/AV
Chrysene	228	4	5.70E-07	6.70E-06	2.90E+05	4.57E+05	N/AV
Dibenzo(a,h)anthracene	278	5	3.70E-10	2.90E-09	1.79E+06	6.92E+06	4.95E+02
Fluoranthene	202	3	2.54E-01	1.95E-03	1.46E+06	8.91E+04	3.33E+02
Fluorene	166	2	8.86E-02	7.40E-05	1.00E+04	1.51E+04	5.00E+00
Indeno(1,2,3-cd)pyrene	276	5	1.70E-07	3.50E-06	1.10E+05	3.80E+06	1.18E+03
Naphthalene	128	2	1.09E-01	4.50E-03	1.41E+03	2.00E+03	4.45E+01
Phenanthrene	178	3	1.80E-02	2.70E-04	2.30E+04	3.72E+04	1.33E+03
Pyrene	202	4	8.86E-04	1.30E-05	6.53E+04	7.59E+04	7.37E+02

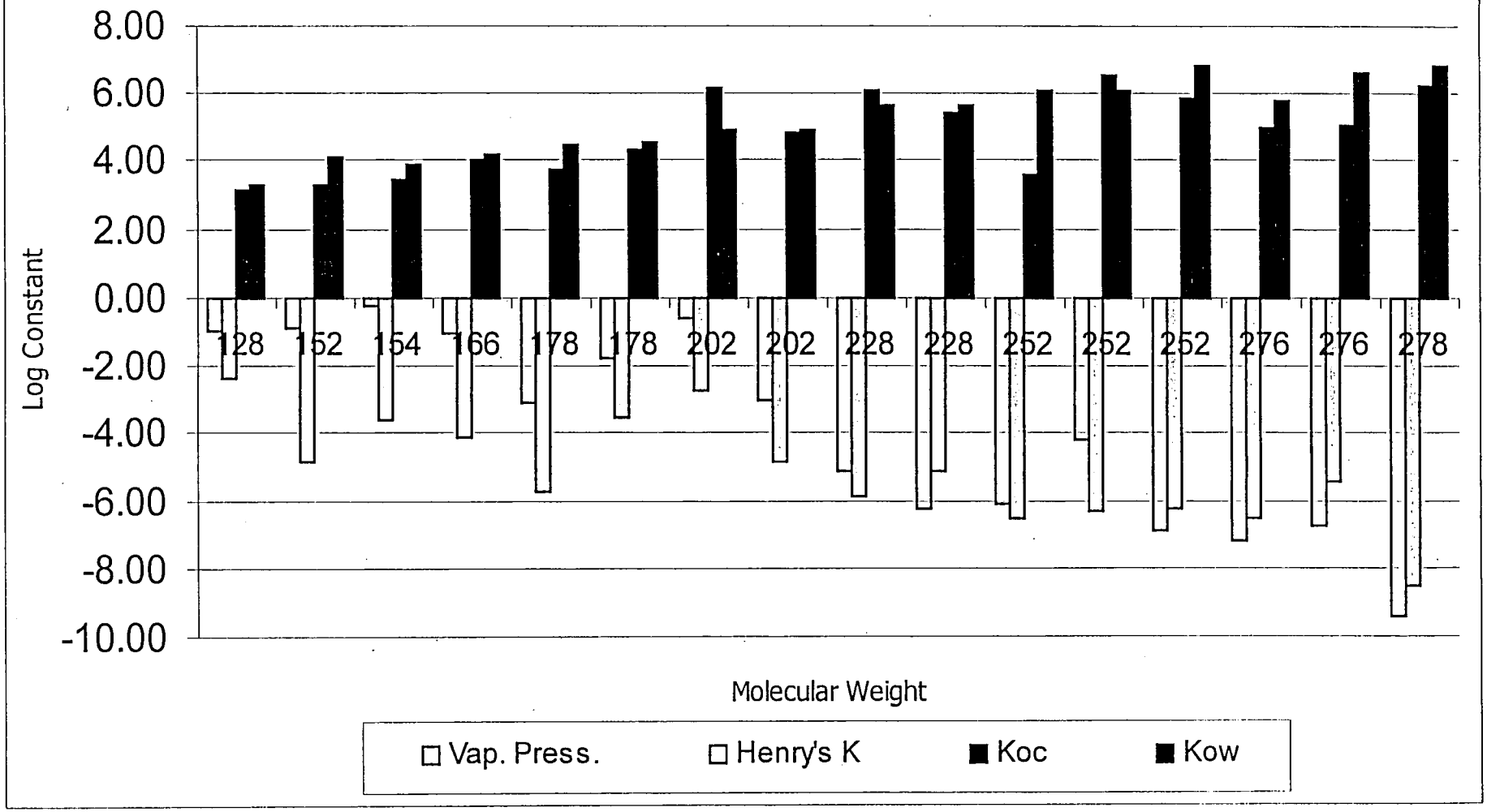
Reference: HSDB 2000.

Figure 3-2 illustrates how four properties (vapor pressure, Henry's law constant, K_{oc}, and K_{ow}) vary as the molecular weight of the PAHs increases. Generally, K_{oc} and K_{ow} increase with increasing molecular weight while vapor pressure and Henry's law constant decrease with increasing molecular weight. Thus, higher molecular weight PAHs partition more to soils (as indicated by higher K_{oc}'s) and are less mobile in surface and groundwaters. They are also more likely to bioaccumulate in the food chain (as indicated by higher K_{ow}; U.S. EPA 1991). However, they are less likely to volatilize to the air (indicated by lower vapor pressures and Henry's law constants).

Generally, PAHs with vapor pressures less than 10^{-2} Pa and Henry's law constants less than 10^{-4} are not expected to readily volatilize to air from soils or water. PAHs with K_{oc} less than 10^{+3} are expected to be somewhat mobile in soils, while higher values indicate strong to very strong partitioning to soils. K_{ow} values greater than $3x10^{+3}$ indicate PAHs that have the potential to bioaccumulate. K_{ow} values in the 10^{+5} or greater range indicate a high potential to bioaccumulate in food chains (U.S. EPA 1991). The degradation half-lives of PAHs in aerobic soils varies widely among the PAHs and various site-specific conditions. Some typical half-lives are shown in Table 3-5. Half-lives greater than a year (365 days) indicate that rapid degradation cannot be expected.

A variety of toxic effects have been observed for the various PAHs. Most notably a number are suspected or probable human carcinogens. Most of the evidence of cancer causing effects is based on laboratory studies of terrestrial animals (e.g., rats and chickens). Consequently, these carcinogenic classifications are relevant to many terrestrial ecological receptors. Table 3-6 summarizes the carcinogenic classifications of

Figure 3-2. Log of PAH Physical Constants by Molecular Weight



the various PAHs and some other notable[3] toxic effects observed in laboratory studies of terrestrial animals.

Table 3-6 - Summary of Notable Toxicity Characteristics of PAHs

Chemical	Molecular Weight	Carcinogen Classification[1]	Notable Other Effects
Acenaphthene	154	D	Hepatoxicity
Acenaphthylene	152	N/AV	N/AV
Anthracene	178	D	hematologic toxicity
Benzo(a)anthracene	228	B2	proliferating cell effects
Benzo(a)pyrene	252	B2	bone marrow effects
Benzo(b)fluoranthene	252	B2	N/AV
Benzo(g,h,i)perylene	276	D	N/AV
Benzo(k)fluoranthene	252	B2	N/AV
Chrysene	228	B2	immune suppression
Dibenzo(a,h)anthracene	278	B2	immune suppression
Fluoranthene	202	D	liver effects
Fluorene	166	N/AV	N/AV
Indeno(1,2,3-cd)pyrene	276	B2	N/AV
Naphthalene	128	D	hematologic anemia
Phenanthrene	178	D	Hepatoxicity
Pyrene	202	D	Nephropathy

1 USEPA carcinogen classifications are for humans. Most of the evidence used in these determinations is from testing on terrestrial animals, and therefore, provides insight on potential modes of toxicity in ecological receptors.

B2 - probable human carcinogen based on animal evidence (no human evidence).

D - Not classifiable as to carcinogenic effects. Generally indicates the chemical is not considered a carcinogen.

Reference: Oak Ridge National Laboratory Risk Assessment Information System (2000).

3.2.6 Preliminary Conceptual Site Model

Based on the information discussed in the previous sections (particularly Section 3.2.4), a preliminary conceptual site model was developed and is shown in Figure 3-3. As noted in Section 3.2.4, the likely complete and significant pathways at the Gasco site are from soils to plants and animals (either primary or secondary consumers). It is conceivable that higher level (tertiary) consumers might also receive chemical doses, but as noted in Section 3.2.1, this site is not expected to support appreciable populations of higher level predators.

Because the vast majority of CPECs found in the various site areas are not volatile chemicals, air transport to ecological receptors is not considered a complete or significant pathway. Similarly, although groundwater is shown in the site conceptual model, it is not expected to contribute appreciably to the doses of chemicals received by either plants or

[3] Effects noted are one of many non-carcinogenic effects observed for each chemical in various bioassays. Generally, non-carcinogenic effects shown in the table were those that were reported in more than one study and/or were pronounced at relatively low doses.

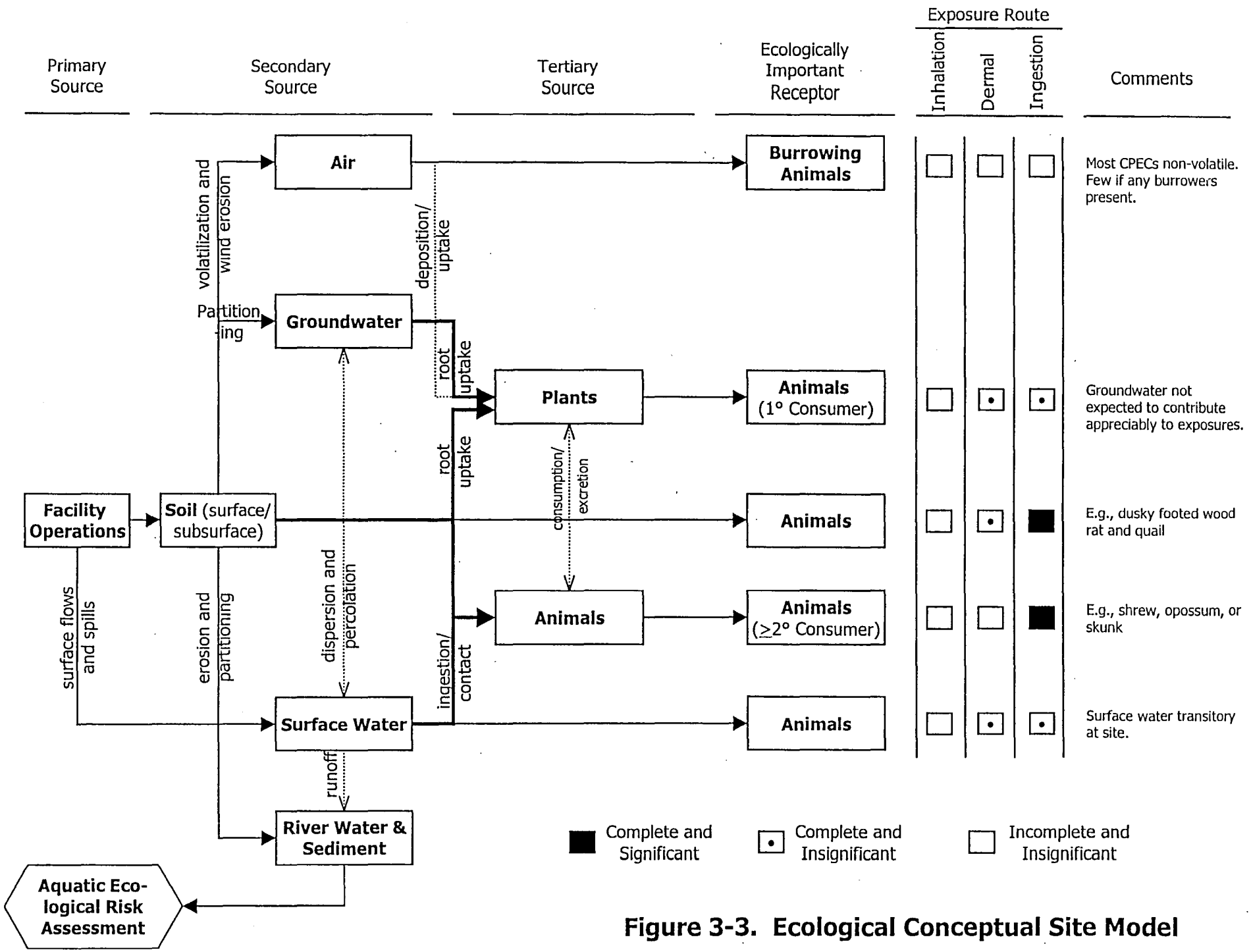


Figure 3-3. Ecological Conceptual Site Model

animals. This is because groundwater levels are too deep (minimum 3 to 9 feet bgs) for appreciable contact with the types of plant roots (grasses and shrubs) and animals (small mammals or birds) predominant at the site. The other complete pathways shown, primarily soil and to a lesser extent surface water, are expected to comprise the majority of exposure for plants and animals. Therefore, the focus of the Level III baseline risk assessment should be on chemical transport from soils directly to plants, and either directly or indirectly to animals. These potentially complete pathways are discussed in more detail in Section 3.2.4.

Based on the conceptual site model a reasonable set of preliminary risk hypotheses for further assessment would be:

- The doses of PAHs to mammalian and avian primary consumers (e.g., wood rat and quail) from incidental soil and food consumption do not cause significant adverse population level effects.

- The doses of PAHs to mammalian and avian secondary consumers (e.g., opossum) from incidental soil and food consumption do not cause significant adverse population level effects.

Although other chemicals of potential concern have been identified in this Level II screening assessment, PAHs appear to be the most widespread and likely to have the potential to cause risks. Consequently, the risk hypotheses focus on these chemicals.

3.3 Human Health Risk Assessment

The general information used to screen human health risks is detailed in Sections 1 and 2, which include a description of the nature and extent of chemicals in soils at the site, site history, and site description. Based on this information, a risk screen following ODEQ (1998) guidance was conducted. The following subsections present the methods and results of this risk screening.

3.3.1 Potentially Exposed Populations

The Gasco site is an industrial facility. As such, there are three potential general types of populations that could have current or reasonably likely future exposures to site chemicals:

- On-site workers expected to be present on a regular basis
- General public that might periodically visit the site for business purposes or gain unauthorized access to the site on a one-time or irregular basis
- Residents living nearby the site (not a current use).

As noted in Section 1.4, the on-site reasonably likely future exposures are essentially identical to existing potential exposures. In addition, above ground (non-invasive) storage of chemical products, and potentially, sand and gravel are proposed. No commercial, residential, or other types of industrial uses are planned for the site. The reasonably likely future site uses for nearby properties are industrial and possibly residential, even though no residential areas currently exist near the site. Consequently, the discussion of on-site exposures (workers and visitors) considers existing and reasonable likely future exposures as one topic, while nearby residential exposures are discussed for the future only.

On-site Workers

On-site workers have a potential to be exposed on a regular basis. A previous human exposure pathways analysis conducted for the site (DMA 1997) identified three site worker populations (or occupations) based on detailed surveys and interviews of site

activities and the exposures likely from each of these observed activities. The three site worker occupations were:

- NW Natural Gas workers
- KII workers
- Pacific Northern Oil workers.

Detailed exposure assumptions were developed for each of these occupations. While this approach has merit, it appears reasonable to assume that all of these occupations have moderate levels of exposures to site media (e.g., soils, air and transitory surface waters). Thus, these occupations can be evaluated as one population, provided that exposure scenarios, routes, and assumptions are sufficiently conservative to be protective of all three occupations.

In addition, temporary short-term high-level exposures could occur to excavation workers associated with occasional activities like utilities repair and replacement. These types of exposures would be assessed in a second population group. The exposed worker population for both groups would be adults.

Public Visitors

General members of the public that periodically visit the site could also potentially receive short-term low-level exposures. These types of exposures are expected to be similar to on-site worker exposures but of a shorter duration and lesser frequency. In addition, people present for business purposes would also be adults. Consequently, this population could be conservatively included in evaluations of on-site workers.

General public exposures could also include people who gain illegal entry to the site. Again, the exposures that trespassers might receive would generally be expected to be similar to on-site workers, but of a shorter duration and lesser frequency. One potential exposure to trespassers that would not normally be expected to on-site workers might be consumption of plants or animals (hunting, gathering, fishing, etc.) at the site. However, the site does not support any plant or animal population that would reasonably be consumed in any appreciable quantity. (Note that fishing in the Willamette River will be evaluated in the off-site aquatic risk assessment.) Therefore, trespassers could also be conservatively assessed in the same group as on-site workers.

This approach does not explicitly account for the potential that trespassers could be children. However, this non-conservative assumption is outweighed by the conservative assumption that trespassers would be exposed at a duration and frequency similar to on-site workers. That is, the smaller averaging time and bodyweight for children would be outweighed by the greater assumed exposure duration and frequency (e.g., five days a week for 8 hours a day). The overall conservativeness of this approach could be confirmed through sensitivity analysis in the Level III baseline risk assessment, and the exposure evaluations refined as appropriate.

Nearby Residential

Some residentially zoned areas exist across Highway 30, although no residences are currently present. Future nearby residents could conceivably be exposed to chemicals either from air or water transport. In this case, both exposures appear to be unlikely.

Any air transport of chemicals (either volatiles or dust) would be rapidly diluted before contact at residential areas. Assuming that air transport will be evaluated for on-site worker exposures (see below), the potential risks to off-site residents from airborne exposures could also be conservatively evaluated by the on-site worker assessment. If

potential risks were found for workers, air dilution and transport modeling appropriate for off-site residential areas could be pursued.

Site surface water runoff enters the Willamette River and is expected to continue in the future. Potential risks associated with this exposure will be evaluated in the off-site aquatic risk assessment.

Current groundwater conditions at the site are described in Section 1.4.6. In summary, groundwater contamination is limited to within the site boundaries and the groundwater gradient is towards the river. Further, the entire region is supplied with municipal water. Future residential uses adjacent to the site would not require wells as a source of water, but would likely rely on the municipal water supply. Consequently, exposure to groundwater in future residential areas is extremely unlikely by all reasonable expectations.

3.3.2 Exposure Scenarios

The discussion of likely exposed populations indicates the most representative exposure scenarios for this site are:

- Industrial (on-site workers and visitors)
- Excavation (or "trench workers" involved in temporary excavation activities).

As discussed above, potential future off-site residential exposures via air, surface water, or groundwater are extremely unlikely to occur. Therefore, a residential scenario is not proposed. The proposed scenarios would be consistent with USEPA default scenario descriptions (ODEQ 1998). Exposure assumptions in the Level III baseline risk assessment would the same as those defined in ODEQ (1998) guidance for "Occupational Adult" and "Excavation Worker".

3.3.3 Exposure Routes

Based on the discussion of likely exposed populations (Section 3.3.1), the following exposure routes are proposed:

1. Industrial (Worker/Visitor/Trespasser)
   a. Incidental ingestion of soil
   b. Dermal contact with soil
   c. Inhalation of air borne chemicals (volatiles and dust from soils)

2. Excavation Worker
   a. Incidental ingestion of soil
   b. Dermal contact with soil
   c. Inhalation of air borne chemicals (volatile organic chemicals and dust from soils)

The exposure routes to be evaluated are from soils or airborne chemicals from soils. Groundwater and surface water routes are expected to be either incomplete or insignificant in comparison to soils exposure routes. Groundwater is and will not be used on-site for any purpose. Thus, the groundwater route to industrial workers is incomplete. Excavation workers are not expected to dig to groundwater elevations[4], making the exposure route to this group also incomplete. Surface waters are transitory on site, so any exposures to either type of worker would be of very short duration and frequency and are

[4] OSHA regulations prohibit workers from entering an excavated pit that contains groundwater. Therefore, dermal and airborne exposure to groundwater are not considered complete pathways at the site.

expected to be insignificant in comparison to soils exposures. Further, the concentrations of chemicals in transitory surface waters would be primarily determined by the soils they contact.

3.3.4 Chemicals of Potential Concern

Methods

Screening procedures to determine Chemicals of Potential Concern (COPCs) followed ODEQ guidance (ODEQ 1998). Chemical concentration soils data from cores in each of the five areas described in Section 3.1 were statistically summarized in a manner similar to the ecological risk screening including differentiation of surface and subsurface soils. However, for human health screening, all core results from 0.2 ft bgs to 12 ft bgs were included in subsurface soils data. This approach was used because workers could be potentially exposed to relatively deep soils during temporary excavation activities. As with the ecological risk screening, this approach resulted in 10 data sets for human health screening (five site areas multiplied by two soil strata). The maximum values for each chemical in each data set were used as the EC. The COIs used were the same as for the ecological risk screening.

The ECs were compared to Preliminary Remedial Goals (PRGs) following ODEQ guidance. USEPA Region 9 PRGs were used in all cases. In some cases, PRGs were not available for a particular chemical, and a PRG was extrapolated from other chemicals with similar structures. For non-carcinogenic PAHs with no PRG, the lowest available PRG for any non-carcinogenic PAH (naphthalene) was used. For carcinogenic PAHs with no PRG, the lowest PRG available for any carcinogenic PAH (benzo(a)pyrene) was used.

COIs were designated as chemicals of potential concern (COPCs) using the same methods as for the ecological risk screening and consistent with ODEQ (1998) guidance. However, COIs with HQ values greater than one were included in COPC list (rather than the value of 5 used for the ecological risk screening).

Results

The results of the risk screening are summarized in Table 3-7 (surface soils) and Table 3-8 (subsurface soils). The data used and the results of each of the separate screening evaluations are shown in Appendices A and E, respectively.

As indicated in the summary tables, only one metal (chromium in the FAMM area) and one phenol (pentachlorophenol in the tar pond area) were designated as COPCs in the surface soils. Pentachlorophenol was actually not detected in any surface soil sample. This phenol was designated as a COPC because its analytical detection limit in the tar pond area was greater than the PRG.

In subsurface soils, no metals in any area and three monocyclic aromatic hydrocarbons (benzene, pentachlorophenol, and xylenes) were designated as COPCs (in the KII and tar pond areas only). Again, pentachlorphenol was not detected in the tar pond area, but is included in the COPC list because of its relatively high detection limit. The only detections of benzene and xylenes substantially over detection limits occurred in the KII and tar pond areas.

At least a few PAHs were designated as COPCs in every area in both surface and subsurface soils. The fewest PAH COPCs (with generally lower HQs) were found in the

Table 3-7. Human Health Screening Summary Results Table - Surface Soils (0 to 0.2 ft bgs).

	(mg/kg) Soil Preliminary Remedial Goal	Preliminary Remedial Goal Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Metals and Inorganics																	
Antimony	820	USEPA Rg. 9	75%	6.60	0.01	100%	1.96	0.0	67%	2.26	0.00	67%	3.76	0.00	100%	1.87	0.00
Arsenic	27	USEPA Rg. 9[2]	75%	21.00	0.78	100%	5.26	0.2	33%	3.14	0.12	33%	3.40	0.13	33%	1.11	0.04
Beryllium	2200	USEPA Rg. 9	0%	0.50	0.00	0%	0.50	0.0	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00
Cadmium	810	USEPA Rg. 9	25%	1.10	0.00	0%	0.50	0.0	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00
Chromium	64	USEPA Rg. 9[2]	100%	30.00	0.47	100%	24.70	0.4	67%	70.90	*1.11*	89%	22.30	0.35	100%	11.90	0.19
Copper	76000	USEPA Rg. 9	100%	60.00	0.00	100%	52.10	0.0	100%	34.70	0.00	100%	40.90	0.00	100%	16.70	0.00
Lead	1000	USEPA Rg. 9	100%	60.00	0.06	100%	55.40	0.1	67%	30.40	0.03	89%	94.60	0.09	100%	10.80	0.01
Mercury	88	USEPA Rg. 9[3]	0%	0.50	0.01	0%	0.50	0.0	0%	0.50	0.01	22%	3.23	0.04	0%	0.50	0.01
Nickel	41000	USEPA Rg. 9	100%	26.00	0.00	100%	84.00	0.0	100%	146.00	0.00	78%	19.80	0.00	100%	5.92	0.00
Selenium	10000	USEPA Rg. 9	0%	0.50	0.00	0%	0.50	0.0	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00
Silver	10000	USEPA Rg. 9	0%	0.50	0.00	0%	0.50	0.0	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00
Thallium	160	USEPA Rg. 9[4]	50%	7.60	0.05	0%	0.50	0.0	0%	5.00	0.03	0%	5.00	0.03	0%	5.00	0.03
Zinc	100000	USEPA Rg. 9	100%	160.00	0.00	100%	92.90	0.0	100%	114.00	0.00	100%	226.00	0.00	100%	67.20	0.00
Cyanide	4400	USEPA Rg. 9	100%	0.47	0.00	--	--	--	--	--	--	--	--	--	100%	0.80	0.00
Monocyclic Aromatic Compounds																	
2,3,4,6-Tetrachlorophenol	26000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.00	0%	26.00	0.00
2,4,5-Trichlorophenol	88000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.00	0%	26.00	0.00
2,4,6-Trichlorophenol	220	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.01	0%	26.00	0.12
2,4-Dichlorophenol	2600	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.00	0%	26.00	0.01
2,4-Dimethylphenol	18000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.00	0%	26.00	0.00
2,4-Dinitrophenol	1800	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	3.30	0.00	0%	49.00	0.03
2-Chlorophenol	240	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.01	0%	26.00	0.11
2-Methyl-4,6-dinitrophenol	--	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	--	0%	26.00	--
2-Methylphenol	44000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	--	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	--	0%	26.00	--
3-Methylphenol	44000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	--	0%	26.00	--
4-Methylphenol	4400	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.00	0%	26.00	0.01
4-Nitrophenol	7000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.00	0%	26.00	0.00
Benzene	1.5	USEPA Rg. 9	0%	0.15	0.10	--	--	--	--	--	--	0%	0.15	0.10	0%	0.15	0.10
Ethylbenzene	230	USEPA Rg. 9	0%	0.15	0.00	--	--	--	--	--	--	0%	0.15	0.00	0%	0.15	0.00
Pentachlorophenol	11	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.15	0%	26.00	**2.36**
Phenol	100000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	0%	1.70	0.00	0%	26.00	0.00
Toluene	520	USEPA Rg. 9	0%	0.15	0.00	--	--	--	--	--	--	0%	0.15	0.00	0%	0.15	0.00
Xylenes	210	USEPA Rg. 9	0%	0.15	0.00	--	--	--	--	--	--	0%	0.15	0.00	0%	0.15	0.00

Table 3-7. Human Health Screening Summary Results Table - Surface Soils (0 to 0.2 ft bgs).

	(mg/kg) Soil Preliminary Remedial Goal	Preliminary Remedial Goal Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Polycyclic Aromatic Compounds																	
Acenaphthene	38000	USEPA Rg. 9	83%	0.51	0.00	100%	0.36	0.0	33%	0.06	0.00	79%	110	0.00	79%	9.20	0.00
Acenaphthylene	190	USEPA Rg. 9[5]	50%	0.41	0.00	75%	0.25	0.0	67%	0.18	0.00	36%	4	0.02	86%	29.10	0.15
Anthracene	100000	USEPA Rg. 9	67%	1.10	0.00	25%	0.56	0.0	33%	0.32	0.00	71%	212	0.00	93%	16.00	0.00
Benzo(a)anthracene	2.9	USEPA Rg. 9	100%	4.70	***1.62***	100%	4.86	***1.7***	100%	1.24	0.43	100%	53	***18.31***	100%	49.80	***17.17***
Benzo(a)pyrene	0.29	USEPA Rg. 9	100%	7.35	***25.34***	100%	6.50	***22.4***	100%	1.74	***6.00***	100%	61	***210.34***	100%	129.00	***444.83***
Benzo(b)fluoranthene	2.9	USEPA Rg. 9	100%	6.50	***2.24***	100%	5.45	***1.9***	100%	1.60	0.55	100%	58	***19.86***	100%	124.00	***42.76***
Benzo(g,h,i)perylene	0.29	USEPA Rg. 9[6]	100%	6.30	***21.72***	100%	5.80	***20.0***	100%	1.82	***6.28***	100%	46	***158.62***	100%	202.00	***696.55***
Benzo(k)fluoranthene	29	USEPA Rg. 9	83%	4.92	0.17	100%	4.14	0.1	100%	1.02	0.04	100%	37	***1.26***	100%	45.00	***1.55***
Chrysene	290	USEPA Rg. 9	100%	5.85	0.02	100%	5.20	0.0	100%	1.60	0.01	100%	71	0.25	100%	75.40	0.26
Dibenzo(a,h)anthracene	0.29	USEPA Rg. 9	83%	1.67	***5.76***	100%	1.47	***5.1***	100%	0.39	***1.34***	93%	10	***34.48***	93%	32.70	***112.76***
Fluoranthene	30000	USEPA Rg. 9	100%	8.55	0.00	100%	7.05	0.0	100%	2.78	0.00	100%	135	0.00	100%	110.50	0.00
Fluorene	33000	USEPA Rg. 9	50%	0.34	0.00	50%	0.25	0.0	33%	0.07	0.00	71%	55	0.00	71%	5.90	0.00
Indeno(1,2,3-cd)pyrene	2.9	USEPA Rg. 9	100%	5.05	***1.74***	100%	4.76	***1.6***	100%	1.53	0.53	100%	42	***14.31***	100%	141.00	***48.62***
Naphthalene	190	USEPA Rg. 9	83%	0.46	0.00	50%	0.25	0.0	67%	0.43	0.00	50%	11	0.06	86%	9.40	0.05
Phenanthrene	0.29	USEPA Rg. 9[6]	83%	5.80	***20.00***	100%	3.00	***10.3***	100%	2.02	***6.97***	100%	92	***316.21***	100%	37.30	***128.62***
Pyrene	54000	USEPA Rg. 9	100%	10.40	0.00	100%	6.80	0.0	100%	2.59	0.00	100%	217	0.00	100%	133.80	0.00

EC - Determined per DEQ guidance. All ECs are maximum observed values.
Box indicates Chemicals of Potential Concern (COPCs) following DEQ methodology.
-- indicates information not available.
1 In all cases, USEPA Region 9 Preliminary Remedial Goals were used.
2 Cancer endpoint used for As III or Cr VI.
3 Based on soluble salt value.
4 Value for thallium chloride.
5 Preliminary Remedial Goal for Napthalene used (lowest value available for a non-carcinogenic PAH).
6 Preliminary Remedial Goal for benzo(a)pyrene used (lowest value available for a carcinogenic PAH).

Table 3-8. Human Health Screening Summary Results Table - Subsurface Soils (0.2 to 12 ft bgs).

	(mg/kg) Soil Preliminary Remedial Goal	Preliminary Remedial Goal Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Metals and Inorganics																	
Antimony	820	USEPA Rg. 9	40%	1.59	0.00	60%	2.92	0.00	67%	1.02	0.00	67%	1.06	0.00	100%	1.59	0.00
Arsenic	27	USEPA Rg. 9[2]	100%	14.00	0.52	100%	6.37	0.24	100%	5.25	0.19	100%	7.27	0.27	17%	1.80	0.07
Beryllium	2200	USEPA Rg. 9	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00
Cadmium	810	USEPA Rg. 9	0%	3.40	0.00	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00
Chromium	64	USEPA Rg. 9[2]	100%	30.00	0.47	100%	19.70	0.31	100%	16.10	0.25	100%	16.20	0.25	100%	10.60	0.17
Copper	76000	USEPA Rg. 9	100%	80.00	0.00	100%	35.20	0.00	100%	19.60	0.00	100%	46.00	0.00	100%	10.70	0.00
Lead	1000	USEPA Rg. 9	100%	130.00	0.13	100%	40.30	0.04	33%	13.20	0.01	100%	20.60	0.02	100%	18.30	0.02
Mercury	88	USEPA Rg. 9[3]	0%	0.50	0.01	0%	0.50	0.01	33%	3.50	0.04	17%	2.60	0.03	0%	0.50	0.01
Nickel	41000	USEPA Rg. 9	100%	41.00	0.00	100%	21.10	0.00	0%	14.30	0.00	100%	16.60	0.00	100%	11.10	0.00
Selenium	10000	USEPA Rg. 9	0%	0.50	0.00	0%	0.50	0.00	0%	0.50	0.00	67%	0.50	0.00	0%	0.50	0.00
Silver	10000	USEPA Rg. 9	0%	0.50	0.00	0%	0.50	0.00	33%	0.50	0.00	67%	0.50	0.00	0%	0.50	0.00
Thallium	160	USEPA Rg. 9[4]	40%	5.00	0.03	0%	0.50	0.00	33%	27.50	0.17	67%	50.00	0.31	0%	5.00	0.03
Zinc	100000	USEPA Rg. 9	100%	670.00	0.01	100%	70.30	0.00	100%	55.20	0.00	100%	64.20	0.00	100%	62.60	0.00
Cyanide	4400	USEPA Rg. 9	75%	61.00	0.01	--	--	--	0%	0.02	0.00	50%	518.00	0.12	71%	6.48	0.00
Monocyclic Aromatic Compounds																	
2,3,4,6-Tetrachlorophenol	26000	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.00	0%	26.00	0.00
2,4,5-Trichlorophenol	88000	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.00	0%	26.00	0.00
2,4,6-Trichlorophenol	220	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.12	0%	26.00	0.12
2,4-Dichlorophenol	2600	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.01	0%	26.00	0.01
2,4-Dimethylphenol	18000	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.00	0%	26.00	0.00
2,4-Dinitrophenol	1800	USEPA Rg. 9	0%	1.65	0.00	--	--	--	--	--	--	0%	46.00	0.03	0%	46.00	0.03
2-Chlorophenol	240	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.11	0%	26.00	0.11
2-Methyl-4,6-dinitrophenol	--	USEPA Rg. 9	0%	0.85	--	--	--	--	--	--	--	0%	26.00	--	0%	26.00	--
2-Methylphenol	44000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	--	USEPA Rg. 9	0%	0.85	--	--	--	--	--	--	--	0%	26.00	--	0%	26.00	--
3-Methylphenol	44000	USEPA Rg. 9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	USEPA Rg. 9	0%	0.85	--	--	--	--	--	--	--	0%	26.00	--	0%	26.00	--
4-Methylphenol	4400	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.01	0%	26.00	0.01
4-Nitrophenol	7000	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.00	0%	26.00	0.00
Benzene	1.5	USEPA Rg. 9	14%	0.15	0.10	0%	0.00	0.00	0%	0.01	0.01	35%	360.00	240.00	61%	107.00	71.33
Ethylbenzene	230	USEPA Rg. 9	0%	0.15	0.00	0%	0.00	0.00	13%	0.03	0.00	35%	111.00	0.48	61%	103.00	0.45
Pentachlorophenol	11	USEPA Rg. 9	0%	0.85	0.08	--	--	--	--	--	--	25%	26.00	2.36	0%	26.00	2.36
Phenol	100000	USEPA Rg. 9	0%	0.85	0.00	--	--	--	--	--	--	0%	26.00	0.00	0%	26.00	0.00
Toluene	520	USEPA Rg. 9	0%	0.15	0.00	0%	0.00	0.00	0%	0.01	0.00	29%	280.00	0.54	56%	78.10	0.15
Xylenes	210	USEPA Rg. 9	14%	0.17	0.00	0%	0.00	0.00	13%	0.13	0.00	35%	289.00	1.38	61%	141.00	0.67

Table 3-8. Human Health Screening Summary Results Table - Subsurface Soils (0.2 to 12 ft bgs).

	(mg/kg) Soil Preliminary Remedial Goal	Preliminary Remedial Goal Reference[1]	Spend Oxide Area			Office Area			FAMM Area			Koppers Area			Tar Pond Area		
			% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)	% Detect	(mg/kg) EC	Hazard Quotient (R)
Polycyclic Aromatic Compounds																	
Acenaphthene	38000	USEPA Rg. 9	40%	21	0.00	13%	0.25	0.00	56%	1.65	0.00	65%	1630	0.04	82%	990	0.03
Acenaphthylene	190	USEPA Rg. 9[5]	40%	124	0.65	13%	0.26	0.00	22%	4.00	0.02	70%	155	0.82	82%	807	4.25
Anthracene	100000	USEPA Rg. 9	50%	191	0.00	0%	0.25	0.00	56%	2.80	0.00	50%	578	0.01	86%	1289	0.01
Benzo(a)anthracene	2.9	USEPA Rg. 9	90%	574	198	25%	1.87	0.64	56%	18.00	6.21	80%	564	194	91%	495	171
Benzo(a)pyrene	0.29	USEPA Rg. 9	90%	767	2645	25%	2.86	9.86	56%	47.00	162	75%	942	3248	95%	585	2017
Benzo(b)fluoranthene	2.9	USEPA Rg. 9	90%	972	335	25%	2.13	0.73	56%	40.00	13.79	90%	752	259	95%	500	172
Benzo(g,h,i)perylene	0.29	USEPA Rg. 9[6]	80%	1080	3724	25%	2.09	7.21	67%	58.00	200	80%	747	2576	73%	529	1824
Benzo(k)fluoranthene	29	USEPA Rg. 9	70%	370	12.76	13%	1.58	0.05	56%	12.00	0.41	80%	238	8.21	82%	292	10.07
Chrysene	290	USEPA Rg. 9	90%	833	2.87	25%	2.23	0.01	56%	24.00	0.08	80%	811	2.80	95%	824	2.84
Dibenzo(a,h)anthracene	0.29	USEPA Rg. 9	70%	159	548	13%	0.42	1.45	33%	6.00	20.69	70%	4707	16231	64%	87	301
Fluoranthene	30000	USEPA Rg. 9	90%	1680	0.06	25%	3.26	0.00	56%	26.00	0.00	85%	2350	0.08	91%	2050	0.07
Fluorene	33000	USEPA Rg. 9	40%	7308	0.22	0%	0.25	0.00	33%	2.10	0.00	65%	481	0.01	77%	810	0.02
Indeno(1,2,3-cd)pyrene	2.9	USEPA Rg. 9	80%	738	254	25%	1.49	0.51	56%	38.00	13.10	80%	519	179	73%	373	129
Naphthalene	190	USEPA Rg. 9	60%	923	4.86	13%	0.25	0.00	44%	2.30	0.01	65%	13000	68.42	82%	11100	58.42
Phenanthrene	0.29	USEPA Rg. 9[6]	80%	1180	4069	25%	2.26	7.79	56%	8.50	29.31	75%	2950	10172	86%	4560	15724
Pyrene	54000	USEPA Rg. 9	90%	2840	0.05	25%	5.20	0.00	56%	52.00	0.00	80%	3580	0.07	95%	3580	0.07

EC - Determined per DEQ guidance. All ECs are maximum observed values.

Box indicates Chemicals of Potential Concern (COPCs) following DEQ methodology.

-- indicates information not available.

1 In all cases, USEPA Region 9 Preliminary Remedial Goals were used.

2 Cancer endpoint used for As III or Cr VI.

3 Based on soluble salt value.

4 Value for thallium chloride.

5 Preliminary Remedial Goal for Napthalene used (lowest value available for a non-carcinogenic PAH).

6 Preliminary Remedial Goal for benzo(a)pyrene used (lowest value available for a carcinogenic PAH).

office area subsurface soils and the FAMM area surface soils. The greatest numbers of PAH COPCs (with generally higher HQs) were found in the spent oxide, KII, and tar pond areas subsurface soils. In most cases, surface soils HQs were lower than subsurface soils HQs in the same area.

3.3.5 Preliminary Conceptual Site Model

The preliminary conceptual site model is shown in Figure 3-4. The model is based on the exposure populations, scenarios, and routes discussed in the previous sections. The chemicals requiring evaluation in this model are the COPCs listed in Tables 3-7 and 3-8. Because of their widespread presence on the site, PAHs will be the primary chemicals driving risk determinations for the site. The fate/transport properties and toxicity characteristics of PAHs are described in detail in Section 3.2.5 including USEPA human carcinogen designations and other effects commonly noted in mammals (Table 3-6).

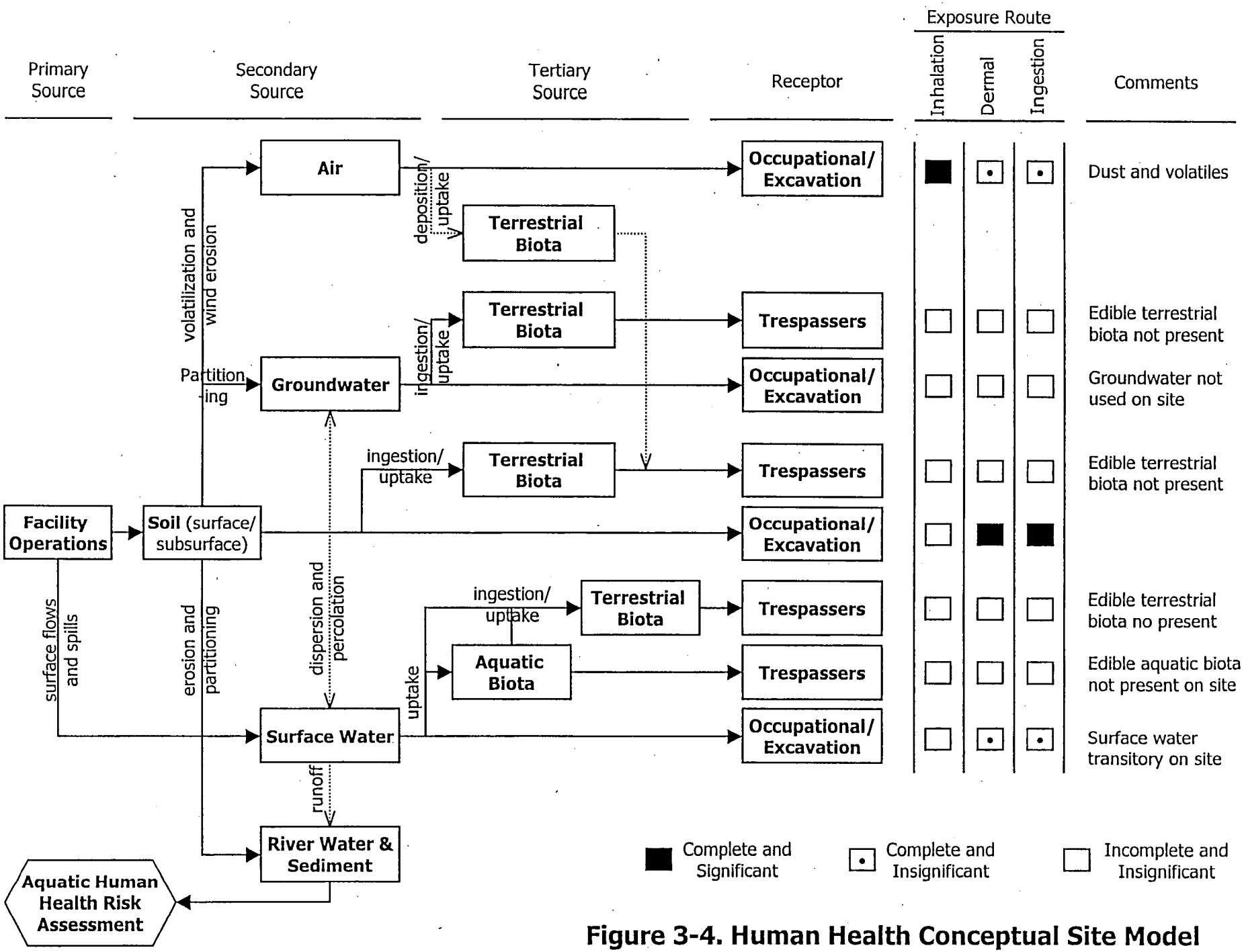


Figure 3-4. Human Health Conceptual Site Model

4.0 Recommendations

The purpose of this screening-level risk assessment is to select the appropriate receptors, pathways and chemicals of concern for inclusion in the detailed risk assessment. This section summarizes the results of the ecological and human health risk screens and provides recommendations for proceeding forward.

4.1 Ecological Risk Assessment

The results of the screening-level ecological risk assessment indicate that three metals and several phenolic compounds and PAHs exceeded the screening benchmark values (see Table 4-1). Several of these compounds, however, were identified not because they were detected at concentrations that exceeded the SBV, but because the analytical detection limits were not sufficiently low for use in the risk assessment. The standard DEQ risk assessment guidance requires that these compounds be included in the detailed risk assessment, however, special circumstances apply in several of the current evaluations, as discussed below.

Two of the metals, mercury and thallium, exceeded the SBVs due to insufficient analytical detection limits during the most recent sampling event only. Prior sampling events, conducted using detection limits below the ecological SBV also resulted in no detected values. Therefore, it appears that these metals are not of concern for the site and it is recommended that they not be included in the Level III detailed risk assessment.

Similarly, several phenolic compounds also exceeded the SBVs based on poor detection limits (e.g., Tar Pond surface and subsurface). As with mercury and thallium, other sampling events were conducted that included detection limits well below the SBV and only one detected value was observed. That concentration (0.36 ppm for pentachlorophenol) is below the SBV of 0.87 ppm. Therefore, it is recommended that no phenolic compounds be carried forward to the Level III detailed risk assessment for ecological receptors.

Evaluating the ecological screening results by study area indicates that no SBVs were exceeded in two of the five areas (Office and FAMM). In the remaining three study areas (Spent Oxide, KII and Tar Pond), PAH SBVs were exceeded in either the surface soil exposures only (KII), surbsurface soil exposures only (Spent Oxide), or both (Tar Pond).

Thus, the recommended chemicals of concern, by study area and depth, for the Level III ecological risk assessment include:

Office Area
(Surface) none
(Subsurface) none

FAMM Area
(Surface) none
(Subsurface) none

Spent Oxide Area
(Surface) Zinc
(Subsurface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene, Pyrene

Table 4-1. Summary of Risk Screening Results by Area - Chemicals of Potential Concern.

	Spent Oxide Area				Office Area				FAMM Area				Koppers Area				Tar Pond Area			
	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.
Metals and Inorganics																				
Antimony																				
Arsenic																				
Beryllium																				
Cadmium																				
Chromium											X									
Copper																				
Lead																				
Mercury	X	X			X	X			X	X			X				X	X		
Nickel																				
Selenium																				
Silver																				
Thallium	X								X	X			X	X			X	X		
Zinc	X												X							
Cyanide																				
Monocyclic Aromatic Compounds																				
2,3,4,6-Tetrachlorophenol																				
2,4,5-Trichlorophenol																	X	X		
2,4,6-Trichlorophenol																	X	X		
2,4-Dichlorophenol																				
2,4-Dimethylphenol																				
2,4-Dinitrophenol																				
2-Chlorophenol																	X	X		
2-Methyl-4,6-dinitrophenol																				
2-Methylphenol																				
2-Nitrophenol																	X	X		
3-Methylphenol																				
4-Chloro-3-methylphenol																				
4-Methylphenol																				
4-Nitrophenol																	X	X		
Benzene																X				X
Ethylbenzene																		--		
Pentachlorophenol																X	X	X	X	X
Phenol																				
Toluene																				
Xylenes																X		X		

Table 4-1. Summary of Risk Screening Results by Area - Chemicals of Potential Concern.

	Spent Oxide Area				Office Area				FAMM Area				Koppers Area				Tar Pond Area			
	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.	Eco. Surf.	Eco. Sub Surf.	Human Health Surf.	Human H. Sub Surf.
Polycyclic Aromatic Compounds																				
Acenaphthene													X					X		
Acenaphthylene																				X
Anthracene													X					X		
Benzo(a)anthracene		X	X	X			X					X	X		X	X	X	X	X	X
Benzo(a)pyrene		X	X	X			X	X			X	X	X		X	X	X	X	X	X
Benzo(b)fluoranthene		X	X	X			X					X	X		X	X	X	X	X	X
Benzo(g,h,i)perylene		X	X	X			X	X			X	X			X	X	X	X	X	X
Benzo(k)fluoranthene		X		X									X		X	X	X	X	X	X
Chrysene		X		X									X			X	X	X		X
Dibenzo(a,h)anthracene		X	X	X			X	X			X	X			X	X			X	X
Fluoranthene		X																X		
Fluorene																		X		
Indeno(1,2,3-cd)pyrene		X	X	X			X					X	X		X	X	X	X	X	X
Naphthalene		X		X												X		X		X
Phenanthrene		X	X	X			X	X			X	X			X	X		X	X	X
Pyrene		X											X					X		

X = Undetected or detected at detection limit with detection limit greater than the SBV or PRG.
-- = Detected but no SBV or PRG available.

KII Area
(Surface) Zinc, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Indeno(1,2,3-cd)pyrene, Pyrene
(Subsurface) none

Tar Pond Area
(Surface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Indeno(1,2,3-cd)pyrene
(Subsurface) Xylenes, Ethylbenzene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene, Pyrene

4.2 Human Health Risk Assessment

The results of the screening-level human health risk assessment (Table 4-1) show one metal exceedance of the PRGs (chromium for the surface soils in the FAMM area) and several monocyclic and polycyclic aromatic hydrocarbon exceedances. One chemical, pentachlorophenol, was identified due to its high analytical detection limit. The detection limit for some sampling events, however, was below the human health PRG and no exceedances were observed. Thus, it is recommended that pentachlorophenol not be included in the Level III detailed risk assessment.

A review of the screening data by study area indicates that no areas can be completely eliminated for the human health assessment. A summary of the recommended chemicals of concern, by study area and depth, for the Level III human health risk assessment include:

Office Area
(Surface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Phenanthrene
(Subsurface) Benzo(a)pyrene, Benzo(g,h,i)perylene, Dibenzo(a,h)anthracene, Phenanthrene

FAMM Area
(Surface) Chromium, Benzo(a)pyrene, Benzo(g,h,i)perylene, Dibenzo(a,h)anthracene, Phenanthrene
(Subsurface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Phenanthrene

Spent Oxide Area
(Surface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Phenanthrene
(Subsurface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene

KII Area
(Surface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Phenanthrene
(Subsurface) Benzene, Xylenes, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Phenanthrene

Tar Pond Area

(Surface) Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Phenanthrene

(Subsurface) Benzene, Acenaphthylene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene

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Appendix A – Summary of Analytical Results for Surface and Subsurface Soils

Summary of Analytical Results for Soil Samples
Phenols by EPA Method 8270

	Phenols by EPA Method 8270				Analytical Results mg/kg (ppm)														
Study Area	Soil Boring	Sample Number[1]	Sample Date	Sample Depth (feet bgs)	4-Chloro-3-methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methyl-4,6-dinitrophenol	Cresols, Total	4-Methylphenol	2-Nitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Pentachlorophenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	Total Phenols
Koppers	B-19	950919-B19-01	19-Sep-95	0.2	0.085	0.085	0.085	0.085	0.16	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	ND
	MW-10-60	951108-M10-01	8-Nov-95	0.2	1.7	1.7	1.7	1.7	3.3	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	ND
				Mean (0-0.2)	0.9	0.9	0.9	0.9	1.7	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	ND
				Maximum (0-0.2)	1.7	1.7	1.7	1.7	3.3	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	ND
	B-13	951006-B13-03	6-Oct-95	10.5	26	26	26	26	46	26	26	26	26	26	26	26	26	26	26	ND
	B-18	950919-B18-05	19-Sep-95	12.0	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.36	0.085	0.085	0.085	0.36
	B-19	950919-B19-03	19-Sep-95	6.5	13	13	13	25	13	13	13	13	13	13	13	13	13	13	13	ND
	B-20	950929-B20-03	29-Sep-95	10.5	13	13	13	25	13	13	13	13	13	13	13	13	13	13	13	ND
				Mean (0.2-12)	13.0	13.0	13.0	19.0	18.0	13.0	13.0	13.0	13.0	13.0	13.0	13.1	13.0	13.0	13.0	ND
				Maximum (0.2-12)	26.0	26.0	26.0	26.0	46.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	ND
Tar Pond	B-28	951002-B28-01	2-Oct-95	0.2	2.6	2.6	2.6	2.6	4.9	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	ND
	B-35	951005-B35-01	5-Oct-95	0.2	0.085	0.085	0.085	0.085	0.16	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	ND
	MW-04-57	951030-M4-01	30-Oct-95	0.2	26	26	26	26	49	26	26	26	26	26	26	26	26	26	26	ND
				Mean (0-0.2)	9.56	9.56	9.56	9.56	18.02	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	
				Maximum (0-0.2)	26.0	26.0	26.0	26.0	49.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	
	B-33	951005-B33-03	5-Oct-95	5.5	26	26	26	26	46	26	26	26	26	26	26	26	26	26	26	ND
	B-30	950922-B30-06	22-Sep-95	11.5	26	26	26	26	46	26	26	26	26	26	26	26	26	26	26	ND
				Mean (0.2-12)	26	26	26	26	46	26	26	26	26	26	26	26	26	26	26	ND
				Maximum (0.2-12)	26	26	26	26	46	26	26	26	26	26	26	26	26	26	26	ND

Note: ODEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram

ND = Not detected above detection limit indicated
ppm = parts per million
PRGs = EPA Region 9 Preliminary Remediation G

[1] = Sample number prefix: 2708-
[2] = Reference Levels are Soil Cleanup Levels in the Soil Cleanup Table (OAR 340-122-045)
[3] = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial
# = Reference level not established

Updated: 2/14/01
File Name: soil EC data.xls

Summary of Analytical Results for Soil Samples (Priority Pollutant Metals)

	Total Metals by EPA Method 6010 and 7470				Analytical Results mg/kg (ppm)												
Study Area	Soil Boring	Sample Number[1]	Sample Date	Sample Depth (feet bg	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Spent Oxide	B-1	950921-B1-01	21-Sep-95	0.2	**0.5**	6.6	**0.5**	**0.5**	26.	41.	60.	**0.05**	21.	**0.5**	**0.5**	4.1	140.
	B-1	950921-B1-02	21-Sep-95	0.2	6.6	21.	**0.5**	1.1	30.	60.	58.	**0.05**	26.	**0.5**	**0.5**	7.6	160.
	B-36	000828-017	28-Aug-00	0.2	1.27	4.16	**0.5**	**0.5**	18.	29.7	40.2	**0.5**	14.4	**0.5**	**0.5**	**5.**	82.8
	B-37	000828-001	28-Aug-00	0.2	1.73	**0.5**	**0.5**	**0.5**	5.43	10.2	7.69	**0.5**	3.98	**0.5**	**0.5**	**0.5**	49.8
				Mean (0-0.2)	2.5	8.1	0.5	0.7	19.9	35.2	41.5	0.3	16.3	0.5	0.5	4.3	108.2
				Maximum (0-0.2)	6.6	21.0	0.5	1.1	30.0	60.0	60.0	0.5	26.0	0.5	0.5	7.6	160.0
	MW-02-61	981007-M2-01	7-Oct-98	2.0		3.44											
	B-1	950921-B1-05	21-Sep-95	10.5	**0.5**	14.	**0.5**	3.4	11.	80.	130.	**0.5**	36.	**0.5**	**0.5**	3.	670.
	B-3	950921-B3-05	21-Sep-95	10.5	**0.5**	7.	**0.5**	**0.5**	30.	36.	22.	**0.5**	41.	**0.5**	**0.5**	5.	120.
	MW-02-61	981007-M2-02	7-Oct-98	5.5		4.											
	B-36	000828-018	28-Aug-00	3.5	1.59	4.89	**0.5**	**0.5**	15.2	18.9	47.	**0.5**	12.3	**0.5**	**0.5**	**0.5**	67.3
	B-36	000828-019	28-Aug-00	10.0	1.26	2.07	**0.5**	**0.5**	6.58	13.1	8.56	**0.5**	6.91	**0.5**	**0.5**	**0.5**	45.2
	B-37	000828-002	28-Aug-00	4.5	**0.5**	3.2	**0.5**	**0.5**	13.5	10.3	2.61	**0.5**	16.1	**0.5**	**0.5**	**0.5**	51.9
				Mean (0.2-5.5)	1.05	3.88	0.5	0.5	14.35	14.6	24.81	0.5	14.2	0.5	0.5	0.5	59.6
				Maximum (0.2-5.5)	1.59	4.89	0.5	0.5	15.2	18.9	47.	0.5	16.1	0.5	0.5	0.5	67.3
				Mean (0.2-12)	0.87	5.51	0.5	1.08	15.26	31.66	42.03	0.5	22.46	0.5	0.5	1.9	190.88
				Maximum (0.2-12)	1.59	14.	0.5	3.4	30.	80.	130.	0.5	41.	0.5	0.5	5.	670.
Office	B-38	000828-014	28-Aug-00	0.2	1.71	5.26	**0.5**	**0.5**	24.7	52.1	33.5	**0.5**	25.6	**0.5**	**0.5**	**0.5**	69.3
	B-39	000828-004	28-Aug-00	0.2	1.43	5.05	**0.5**	**0.5**	18.9	22.	36.6	**0.5**	84.	**0.5**	**0.5**	**0.5**	82.7
	B-40	000828-010	28-Aug-00	0.2	1.01	3.39	**0.5**	**0.5**	16.2	23.2	55.4	**0.5**	39.8	**0.5**	**0.5**	**0.5**	92.9
	B-41	000828-007	28-Aug-00	0.2	1.96	4.97	**0.5**	**0.5**	14.7	19.7	21.4	**0.5**	20.9	**0.5**	**0.5**	**0.5**	74.4
				Mean (0-0.2)	1.53	4.67	0.5	0.5	18.63	29.25	36.73	0.5	42.58	0.5	0.5	0.5	79.83
				Maximum (0-0.2)	1.96	5.26	0.5	0.5	24.7	52.1	55.4	0.5	84.	0.5	0.5	0.5	92.9
	B-38	000828-015	28-Aug-00	2.0	2.92	6.37	**0.5**	**0.5**	19.7	35.2	40.3	**0.5**	17.9	**0.5**	**0.5**	**0.5**	70.3
	B-39	000828-005	28-Aug-00	3.0	1.42	4.86	**0.5**	**0.5**	15.1	14.9	15.7	**0.5**	12.5	**0.5**	**0.5**	**0.5**	55.6
	B-40	000828-011	28-Aug-00	2.5	**0.5**	2.69	**0.5**	**0.5**	13.1	12.2	2.27	**0.5**	15.6	**0.5**	**0.5**	**0.5**	36.9
	B-41	000828-008	28-Aug-00	2.5	1.24	4.1	**0.5**	**0.5**	13.7	19.	24.6	**0.5**	21.1	**0.5**	**0.5**	**0.5**	57.9
	B-41	000828-009	28-Aug-00	9.5	**0.5**	2.55	**0.5**	**0.5**	12.9	12.5	1.94	**0.5**	15.3	**0.5**	**0.5**	**0.5**	36.2
				Mean (0.2-5.5)	1.52	4.51	0.5	0.5	15.4	20.33	20.72	0.5	16.78	0.5	0.5	0.5	55.18
				Maximum (0.2-5.5)	2.92	6.37	0.5	0.5	19.7	35.2	40.3	0.5	21.1	0.5	0.5	0.5	70.3
				Mean (0.2-12)	1.32	4.11	0.5	0.5	14.9	18.76	16.96	0.5	16.48	0.5	0.5	0.5	51.38
				Maximum (0.2-12)	2.92	6.37	0.5	0.5	19.7	35.2	40.3	0.5	21.1	0.5	0.5	0.5	70.3
Koppers	B-42	000828-020	28-Aug-00	0.2	1.16	**0.5**	**0.5**	**0.5**	**0.5**	4.3	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	27.5
	B-43	000829-050	29-Aug-00	0.2	3.76	3.04	**0.5**	**0.5**	22.3	40.9	94.6	3.23	19.8	**0.5**	**0.5**	**0.5**	226.
	B-44	000829-052	29-Aug-00	0.2	**0.5**	3.4	**0.5**	**0.5**	12.6	12.5	1.76	**0.5**	14.6	**0.5**	**0.5**	**5.**	37.9
	B-45	000829-054	29-Aug-00	0.2	1.44	**0.5**	**0.5**	**0.5**	4.96	10.1	2.77	**0.5**	3.16	**0.5**	**0.5**	**5.**	42.3
	B-46	000829-058	29-Aug-00	0.2	1.16	**0.5**	**0.5**	**0.5**	11.1	11.5	8.2	**0.5**	6.57	**0.5**	**0.5**	**5.**	71.4
	SS-12	000829-061	29-Aug-00	0.2	**0.5**	**0.5**	**0.5**	**0.5**	5.55	21.7	3.74	**0.5**	4.89	**0.5**	**0.5**	**5.**	45.9
	SS-13	000829-062	29-Aug-00	0.2	**0.5**	**0.5**	**0.5**	**0.5**	1.07	6.24	1.23	**0.5**	**0.5**	**0.5**	**0.5**	**5.**	32.7
	SS-14	000829-063	29-Aug-00	0.2	1.34	**0.5**	**0.5**	**0.5**	3.21	5.41	4.17	**0.5**	2.08	**0.5**	**0.5**	**5.**	55.1
	SS-15	000829-064	29-Aug-00	0.2	0.82	1.92	**0.5**	**0.5**	5.2	8.9	68.2	2.8	4.4	**0.5**	**0.5**	**5.**	48.2
				Mean (0-0.2)	1.24	1.26	0.5	0.5	7.39	13.51	20.57	1.06	6.28	0.5	0.5	4.	65.22
				Maximum (0-0.2)	3.76	3.4	0.5	0.5	22.3	40.9	94.6	3.23	19.8	0.5	0.5	5.	226.

Summary of Analytical Results for Soil Samples (Priority Pollutant Metals)

	Total Metals by EPA Method 6010 and 7470				Analytical Results mg/kg (ppm)												
Study Area	Soil Boring	Sample Number[1]	Sample Date	Sample Depth (feet bg	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
	B-42	000828-021	28-Aug-00	1.0	**0.5**	2.74	**0.5**	**0.5**	13.7	12.4	3.19	**0.5**	16.5	**0.5**	**0.5**	**0.5**	64.2
	B-43	000828-046	28-Aug-00	2.0	**0.5**	2.91	**0.5**	**0.5**	11.8	11.8	2.2	0.3	16.4	**0.5**	**0.5**	**5.**	36.4
	B-44	000829-051	29-Aug-00	3.5	0.5	2.46	**0.5**	**0.5**	10.8	11.9	1.7	**0.5**	13.8	0.5	0.5	50.	36.1
	B-45	000829-055	29-Aug-00	2.0	1.06	7.27	**0.5**	**0.5**	16.2	46.	20.6	**0.5**	16.6	0.5	0.5	50.	59.6
	B-46	000829-059	29-Aug-00	5.0	0.5	2.75	**0.5**	**0.5**	12.5	11.5	1.65	**0.5**	13.3	0.5	0.5	50.	35.7
	B-46	000829-060	29-Aug-00	10.5	0.5	1.46	**0.5**	**0.5**	9.21	10.1	1.36	**0.5**	12.3	0.5	0.5	0.5	28.5
				Mean (0.2-5.5)	0.61	3.63	0.5	0.5	13.	18.72	5.87	0.46	15.32	0.5	0.5	31.1	46.4
				Maximum (0.2-5.5)	1.06	7.27	0.5	0.5	16.2	46.	20.6	0.5	16.6	0.5	0.5	50.	64.2
				Mean (0.2-12)	0.59	3.27	0.5	0.5	12.37	17.28	5.12	0.47	14.82	0.5	0.5	26.	43.42
				Maximum (0.2-12)	1.06	7.27	0.5	0.5	16.2	46.	20.6	0.5	16.6	0.5	0.5	50.	64.2
FAMM	B-47	000829-039	29-Aug-00	0.2	1.5	**0.5**	**0.5**	**0.5**	2.13	5.89	**0.5**	**0.5**	1.52	**0.5**	**0.5**	**5.**	34.4
	B-51	000828-023	28-Aug-00	0.2	2.26	3.14	**0.5**	**0.5**	70.9	34.7	30.4	**0.5**	146.	**0.5**	**0.5**	**5.**	114.
	B-52	000828-026	28-Aug-00	0.2	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	3.83	4.01	**0.5**	3.78	**0.5**	**0.5**	**0.5**	28.4
				Mean (0-0.2)	1.42	1.38	0.5	0.5	24.51	14.81	11.64	0.5	50.43	0.5	0.5	3.5	58.93
				Maximum (0-0.2)	2.26	3.14	0.5	0.5	70.9	34.7	30.4	0.5	146.	0.5	0.5	5.	114.
	GT-1	971117-001	17-Nov-97	3.0		1.8											
	GT-2	971117-012	17-Nov-97	3.5		1.1											
	GT-3	971118-023	18-Nov-97	3.0		2.7											
	GT-1	971117-004	17-Nov-97	10.5		1.8											
	MW-13	971218-M13-02	18-Dec-97	6.0		2.7											
	MW-13	971218-M13-03	18-Dec-97	10.0		2.8											
	B-47	000829-041	29-Aug-00	5.0	1.02	5.25	**0.5**	**0.5**	16.1	19.6	12.1	**0.5**	13.5	**0.5**	**0.5**	**5.**	55.2
	B-47	000829-042	29-Aug-00	11.5	0.78	3.	**0.5**	**0.5**	14.5	18.5	13.2	3.5	13.4	**0.5**	**0.5**	27.5	52.7
	B-52	000828-027	28-Aug-00	3.5	**0.5**	2.54	**0.5**	**0.5**	11.8	11.8	1.78	**0.5**	14.3	**0.5**	**0.5**	**0.5**	35.9
				Mean (0.2-5.5)	0.76	2.68	0.5	0.5	13.95	15.7	6.94	0.5	13.9	0.5	0.5	2.75	45.55
				Maximum (0.2-5.5)	1.02	5.25	0.5	0.5	16.1	19.6	12.1	0.5	14.3	0.5	0.5	5.	55.2
				Mean (0.2-12)	0.77	2.63	0.5	0.5	14.13	16.63	9.03	1.5	13.73	0.5	0.5	11.	47.93
				Maximum (0.2-12)	1.02	5.25	0.5	0.5	16.1	19.6	13.2	3.5	14.3	0.5	0.5	27.5	55.2
Tar Pond	B-48	000828-030	28-Aug-00	0.2	1.57	**0.5**	**0.5**	**0.5**	5.01	12.9	3.78	**0.5**	5.44	**0.5**	**0.5**	**0.5**	54.4
	B-49	000828-036	28-Aug-00	0.2	1.62	**0.5**	**0.5**	**0.5**	9.26	9.62	6.93	**0.5**	4.7	**0.5**	**0.5**	**5.**	63.9
	B-50	000828-033	28-Aug-00	0.2	1.87	1.11	**0.5**	**0.5**	11.9	16.7	10.8	**0.5**	5.92	**0.5**	**0.5**	**5.**	67.2
				Mean (0-0.2)	1.69	0.7	0.5	0.5	8.72	13.07	7.17	0.5	5.35	0.5	0.5	3.5	61.83
				Maximum (0-0.2)	1.87	1.11	0.5	0.5	11.9	16.7	10.8	0.5	5.92	0.5	0.5	5.	67.2
	MW-04-101	981014-M4-01	14-Oct-98	2.0		**0.5**											
	MW-05-175	981019-M5-01	19-Oct-98	5.0		1.1											
	MW-05-175	981019-M5-02	19-Oct-98	5.0		**0.5**											
	MW-14-110	981014-M14-01	14-Oct-98	3.5		**0.5**											
	MW-04-101	981014-M4-02	14-Oct-98	6.0		**0.5**											
	MW-05-175	981019-M5-03	19-Oct-98	9.5		**0.5**											
	MW-14-110	981014-M14-02	14-Oct-98	6.0		**0.5**											
	MW-14-110	981014-M14-03	14-Oct-98	10.0		1.8											
	B-48	000828-031	28-Aug-00	5.0	1.03	**0.5**	**0.5**	**0.5**	8.86	9.23	18.3	**0.5**	11.1	**0.5**	**0.5**	**0.5**	43.4
	B-49	000828-037	28-Aug-00	1.5	1.54	**0.5**	**0.5**	**0.5**	10.6	9.9	6.68	**0.5**	6.9	**0.5**	**0.5**	**5.**	53.

Summary of Analytical Results for Soil Samples (Priority Pollutant Metals)

	Total Metals by EPA Method 6010 and 7470				Analytical Results mg/kg (ppm)												
Study Area	Soil Boring	Sample Number[1]	Sample Date	Sample Depth (feet bg	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
	B-50	000828-034	28-Aug-00	1.0	1.52	**0.5**	**0.5**	**0.5**	10.2	10.7	11.1	**0.5**	8.65	**0.5**	**0.5**	**5.**	62.6
	B-50	000828-035	28-Aug-00	6.0	1.59	**0.5**	**0.5**	**0.5**	10.	10.4	12.6	**0.5**	10.1	**0.5**	**0.5**	**5.**	61.4
				Mean (0.2-5.5)	1.36	0.59	0.5	0.5	9.89	9.94	12.03	0.5	8.88	0.5	0.5	3.5	53.
				Maximum (0.2-5.5)	1.54	1.1	0.5	0.5	10.6	10.7	18.3	0.5	11.1	0.5	0.5	5.	62.6
				Mean (0.2-12)	1.42	0.66	0.5	0.5	9.92	10.06	12.17	0.5	9.19	0.5	0.5	3.88	55.1
				Maximum (0.2-12)	1.59	1.8	0.5	0.5	10.6	10.7	18.3	0.5	11.1	0.5	0.5	5.	62.6

Notes: **Bold = Non Detected; value set at 1/2 detection limit.**
Sample number prefix: 2708-
mg/kg = milligrams/kilogram

Summary of Analytical Results for Soil Samples, PAHs by EPA Method 8270 (SIM)

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
					Carcinogenic PAHs							*Non-carcinogenic PAHs*										
Study Area	Soil Boring	Sample Number[1]	Sample Date	Sample Depth (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total Non-Carcinogenic PAH
Spent Oxide	B-01	950921-B1-01	21-Sep-95	0.2	1.	1.6	0.52	1.5	1.4	0.22	0.93	0.14	0.025	0.14	1.3	1.3	0.055	0.073	0.88	2.3	7.17	6.213
	B-01	950921-B1-02	21-Sep-95	0.2	3.7	5.6	1.7	5.2	5.6	0.84	3.5	0.51	0.41	1.1	5.1	5.7	0.34	0.46	5.8	10.4	26.14	29.82
	MW-01-22	951024-M1-01	24-Oct-95	0.2	0.41	0.66	0.025	0.61	0.64	0.025	0.75	0.025	0.025	0.025	1.	0.71	0.025	0.025	0.025	1.	3.12	2.86
	MW-02-32	951106-M2-01	6-Nov-95	0.2	0.73	1.2	0.49	1.1	0.83	0.16	0.69	0.047	0.083	0.14	1.	1.4	0.025	0.053	0.57	1.8	5.2	5.118
	B-36	000828-017	28-Aug-00	0.2	0.98	1.23	1.05	1.38	1.16	0.215	0.575	0.105	0.025	0.025	0.6	1.52	0.025	0.105	0.7	1.47	6.59	4.5
	B-37	000828-001	28-Aug-00	0.2	4.7	6.5	4.92	7.35	5.85	1.67	5.05	0.455	0.06	0.735	6.3	8.55	0.2	0.055	3.96	7.5	36.04	27.815
			Mean (0-0.2)		1.92	2.8	1.45	2.86	2.58	0.52	1.92	0.21	0.1	0.36	2.55	3.2	0.11	0.13	1.99	4.08	14.04	12.72
			Maximum (0-0.2)		4.7	6.5	4.92	7.35	5.85	1.67	5.05	0.51	0.41	1.1	6.3	8.55	0.34	0.46	5.8	10.4	36.04	29.82
	MW-02-61	981007-M2-01	7-Oct-98	2.0	9.7	13.1	0.25	12.8	8.8	1.9	8.	1.3	0.25	2.3	11.3	14.3	0.25	0.6	9.	16.9	54.55	56.2
	MW-01-22	951024-M1-02	24-Oct-95	3.5	0.91	1.5	0.74	1.7	1.3	0.4	1.8	0.1	0.1	0.1	2.3	0.79	0.1	0.1	0.1	1.4	8.35	5.09
	B-36	000828-018	28-Aug-00	3.5	0.07	0.11	0.065	0.1	0.08	0.025	0.09	0.025	0.025	0.025	0.13	0.155	0.025	0.12	0.07	0.17	0.515	0.645
	B-37	000828-002	28-Aug-00	4.5	0.25	0.33	0.25	0.365	0.3	0.095	0.375	0.025	0.025	0.025	0.475	0.54	0.025	0.025	0.21	0.515	1.965	1.740
	MW-02-61	981007-M2-02	7-Oct-98	5.5	315.	563.	179.	432.	334.	87.8	389.	0.025	30.4	34.2	490.	591.	12.9	923.	309.	735.	2,299.8	3,125.5
	B-06	950927-B6-02	27-Sep-95	8.0	574.	972.	370.	767.	833.	159.	738.	21.	124.	191.	1,080.	1,680.	7,308.	884.	1,180.	2,840.	4,413.	8,073.8
	B-36	000828-019	28-Aug-00	10.0	0.09	0.12	0.025	0.05	0.055	0.025	0.025	0.025	0.025	0.025	0.025	0.08	0.025	0.025	0.135	0.105	0.315	0.320
	B-01	950921-B1-05	21-Sep-95	10.5	45.3	72.3	26.7	55.7	82.8	7.7	46.2	6.1	5.8	21.7	65.8	140.	9.6	313.	142.	239.	336.7	943.0
	B-03	950921-B3-05	21-Sep-95	10.5	3.2	5.2	1.9	4.8	4.1	0.64	3.2	0.3	0.14	3.1	4.2	5.9	0.2	0.16	3.1	8.9	23.04	26.0
	B-37	000828-003	28-Aug-00	11.0	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
			Mean (0.2-5.5)		2.79	4.01	0.6	3.89	2.87	0.6	2.62	0.35	0.11	1.11	3.59	4.25	0.12	0.2	2.48	5.5	17.35	17.65
			Maximum (0.2-5.5)		9.7	13.1	1.9	12.8	8.8	1.9	8.	1.3	0.25	3.1	11.3	14.3	0.25	0.6	9.	16.9	54.55	56.2
			Mean (0.2-12)		94.85	162.77	57.9	127.45	126.45	25.76	118.67	2.89	16.08	25.25	165.43	243.28	733.12	212.11	164.36	384.2	713.83	1,223.23
			Maximum (0.2-12)		574.	972.	370.	767.	833.	159.	738.	21.	124.	191.	1,080.	1,680.	7,308.	923.	1,180.	2,840.	4,413.	8,073.8
Office	B-38	000828-014	28-Aug-00	0.2	1.58	1.8	1.12	2.08	1.76	0.43	1.62	0.13	0.25	0.25	1.93	2.94	0.25	0.25	1.11	2.68	10.39	8.79
	B-39	000828-004	28-Aug-00	0.2	1.	1.16	0.71	1.36	1.13	0.26	0.88	0.09	0.06	0.03	1.02	1.62	0.03	0.06	0.52	1.72	6.49	5.08
	B-40	000828-010	28-Aug-00	0.2	4.86	5.45	4.14	6.5	5.2	1.47	4.76	0.36	0.07	0.56	5.8	7.05	0.14	0.03	3.	6.8	32.38	23.78
	B-41	000828-007	28-Aug-00	0.2	2.16	2.64	1.74	3.1	2.43	0.6	2.22	0.17	0.17	0.03	2.56	3.86	0.07	0.08	1.68	3.82	14.89	12.4
			Mean (0-0.2)		2.4	2.76	1.93	3.26	2.63	0.69	2.37	0.19	0.14	0.22	2.83	3.87	0.12	0.1	1.58	3.76	16.04	12.51
			Maximum (0-0.2)		4.86	5.45	4.14	6.5	5.2	1.47	4.76	0.36	0.25	0.56	5.8	7.05	0.25	0.25	3.	6.8	32.38	23.78
	B-38	000828-015	28-Aug-00	2.0	1.15	1.55	0.25	0.85	0.8	0.25	0.55	0.25	0.25	0.25	0.65	1.15	0.25	0.25	1.85	1.85	4.9	5.5
	B-40	000828-011	28-Aug-00	2.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	12.58	0.03
	B-41	000828-008	28-Aug-00	2.5	1.87	2.13	1.58	2.86	2.23	0.42	1.49	0.13	0.26	0.03	2.09	3.26	0.05	0.24	2.26	5.2	15.54	13.85
	B-39	000828-005	28-Aug-00	3.0	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	B-38	000828-016	28-Aug-00	8.5	0.1	0.14	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.4	0.33
	B-39	000828-006	28-Aug-00	9.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	B-40	000828-012	28-Aug-00	9.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	B-41	000828-009	28-Aug-00	9.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.	0.03
			Mean (0.2-5.5)		0.79	0.96	0.53	1.	0.83	0.24	0.58	0.16	0.2	0.14	0.75	1.17	0.14	0.19	1.1	1.83	5.21	4.93
			Maximum (0.2-5.5)		1.87	2.13	1.58	2.86	2.23	0.42	1.49	0.25	0.26	0.25	2.09	3.26	0.25	0.25	2.26	5.2	15.54	13.85
			Mean (0.2-12)		0.41	0.49	0.28	0.51	0.43	0.13	0.3	0.09	0.11	0.08	0.39	0.6	0.08	0.11	0.56	0.93	4.44	2.48
			Maximum (0.2-12)		1.87	2.13	1.58	2.86	2.23	0.42	1.49	0.25	0.26	0.25	2.09	3.26	0.25	0.25	2.26	5.2	15.54	13.85
Koppers	B-19	950919-B19-01	19-Sep-95	0.2	53.1	57.6	29.6	61.	71.4	10.	41.5	6.8	0.52	212.	46.	115.	20.1	2.9	91.7	114.	324.2	609.02
	MW-09-29	951023-M9-01	23-Oct-95	0.2	1.4	2.7	0.88	2.5	1.9	0.42	1.9	0.12	0.17	0.31	2.6	2.2	0.055	0.087	0.96	3.3	11.7	9.802
	MW-10-61	951108-M10-01	8-Nov-95	0.2	6.7	11.	5.1	9.5	6.3	1.4	5.	0.83	0.025	1.7	6.7	11.	0.23	0.081	3.3	9.9	45.	33.766
	MW-10-61	951108-M10-02	8-Nov-95	0.2	10.	17.	6.2	14.	7.5	2.2	7.2	1.1	0.025	1.1	9.	14.	0.36	0.13	5.2	12.	64.1	42.915
	MW-12-36	951023-M12-01	23-Oct-95	0.2	8.5	15.3	5.2	13.3	12.3	2.2	8.7	1.5	0.23	2.	10.8	12.4	0.54	0.34	5.8	17.1	65.5	50.71
	B-42	000828-020	28-Aug-00	0.2	0.12	0.135	0.17	0.185	0.16	0.025	0.055	0.025	0.025	0.025	0.18	0.205	0.025	0.025	0.115	0.195	0.825	0.695
	B-43	000829-050	29-Aug-00	0.2	1.49	1.76	1.46	2.02	1.65	0.5	1.46	110.	2.5	139.	1.6	1.98	55.	11.	0.825	1.86	13.34	321.265
	B-44	000829-052	29-Aug-00	0.2	5.05	4.58	3.55	6.85	6.25	1.08	4.92	0.17	4.1	3.17	6.1	14.5	2.92	1.21	18.3	17.2	32.28	67.67
	B-45	000829-054	29-Aug-00	0.2	33.6	47.1	36.6	47.	38.5	7.75	23.7	2.15	0.25	4.3	23.3	52.5	1.4	0.25	24.8	45.5	234.25	153.95

Summary of Analytical Results for Soil Samples, PAHs by EPA Method 8270 (SIM)

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
					Carcinogenic PAHs							*Non-carcinogenic PAHs*										
Study Area	Soil Boring	Sample Number[1]	Sample Date	Sample Depth (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total Non-Carcinogenic PAH
	B-46	000829-058	29-Aug-00	0.2	19.5	29.7	21.9	30.8	22.8	4.95	14.6	1.3	**0.25**	2.45	15.1	29.6	0.75	**0.25**	14.3	32.4	144.25	95.9
	SS-12	000829-061	29-Aug-00	0.2	0.255	0.35	0.29	0.35	0.265	0.09	0.165	**0.025**	**0.025**	**0.025**	0.215	0.375	**0.025**	**0.025**	0.215	0.325	1.795	1.13
	SS-13	000829-062	29-Aug-00	0.2	0.205	0.275	0.22	0.275	0.235	0.085	0.165	**0.025**	**0.025**	**0.025**	0.195	1.04	**0.025**	**0.025**	0.75	0.275	1.46	2.26
	SS-14	000829-063	29-Aug-00	0.2	1.34	1.74	1.52	2.01	1.6	0.385	1.2	0.125	**0.025**	**0.025**	1.34	2.22	**0.05**	**0.025**	0.93	2.04	9.975	6.705
	SS-15	000829-064	29-Aug-00	0.2	41.65	47.45	36.5	45.8	53.95	7.425	23.1	2.725	1.375	21.375	22.9	134.75	2.475	**0.5**	44.95	217.	255.875	338.925
			Mean (0-0.2)		13.1	16.9	10.7	16.8	16.1	2.8	9.5	9.1	0.7	27.7	10.4	28.	6.	1.2	15.2	33.8	86.	123.9
			Maximum (0-0.2)		53.1	57.6	36.6	61.	71.4	10.	41.5	110.	4.1	212.	46.	134.8	55.	11.	91.7	217.	324.2	609.
	B-42	000828-021	28-Aug-00	1.0	2.47	2.47	1.83	3.26	2.68	0.605	2.22	0.22	**0.025**	**0.025**	2.77	4.86	0.08	0.18	1.98	4.12	15.535	14.21
	B-43	000829-046	29-Aug-00	2.0	0.258	0.748	0.44	0.928	0.435	0.252	1.42	0.025	0.138	**0.025**	2.155	0.308	**0.025**	0.075	0.065	0.352	4.48	3.055
	B-45	000829-055	29-Aug-00	2.0	**0.025**	0.072	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	0.05	**0.025**	**0.025**	**0.025**	**0.025**	0.072	0.038
	MW-06-61	951107-M6-01	7-Nov-95	2.5	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**
	B-17	950929-B17-01	29-Sep-95	3.0	3.5	5.6	1.3	5.7	3.6	0.67	3.7	0.026	0.22	0.92	5.3	10.5	0.15	0.093	4.	13.8	24.07	35.009
	B-44	000829-051	29-Aug-00	3.5	0.5	1.	0.595	1.32	0.755	0.245	1.11	**0.025**	0.14	**0.025**	1.55	0.53	**0.025**	**0.025**	**0.025**	0.715	5.525	2.935
	B-14	950928-B14-03	28-Sep-95	5.0	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**
	MW-09-29	951023-M9-04	23-Oct-95	5.0	7.4	19.6	5.	14.4	13.3	2.7	16.1	0.12	1.3	2.	22.6	17.9	0.4	1.2	8.6	30.4	78.5	84.52
	B-46	000829-059	29-Aug-00	5.0	0.135	0.385	0.29	0.48	0.19	0.15	0.435	**0.025**	0.075	**0.025**	0.625	0.095	**0.025**	**0.025**	0.135	0.14	2.065	1.07
	B-19	950919-B19-03	19-Sep-95	6.5	7.6	5.4	2.4	5.8	9.7	0.96	3.9	13.4	4.6	14.4	5.1	25.4	13.	180.	83.3	33.3	35.76	372.5
	B-42	000828-022	28-Aug-00	7.5	0.255	0.275	0.21	0.405	0.37	0.09	0.395	0.025	0.26	**0.025**	0.675	0.64	0.85	0.58	1.36	0.715	2.	4.315
	B-43	000829-048	29-Aug-00	8.5	13.762	17.673	14.059	20.286	14.569	15.575	9.36	6.35	**0.25**	9.1	9.966	19.686	3.15	0.725	9.438	23.279	105.284	81.568
	B-45	000829-057	29-Aug-00	8.5	0.355	0.98	0.635	1.05	0.665	0.23	1.4	**0.025**	0.21	**0.025**	1.98	0.36	**0.025**	**0.025**	**0.025**	0.49	5.315	3.04
	B-44	000829-053	29-Aug-00	10.0	2.45	1.72	1.7	2.78	2.88	0.44	1.8	0.125	3.48	2.58	2.	8.	1.9	8.3	14.	8.25	13.77	48.635
	B-24	95-1002-B24-03	2-Oct-95	10.5	41.9	53.2	21.3	59.5	64.1	5.5	31.	52.4	7.5	34.9	42.	132.	28.5	115.	186.	217.	276.5	815.3
	B-13	951006-B13-03	6-Oct-95	10.5	564.	752.	238.	942.	811.	89.9	519.	1,630.	155.	578.	747.	2,350.	481.	13,000.	2,950.	3,580.	3,915.	25,471.
	B-20	950929-B20-03	29-Sep-95	10.5	40.4	44.5	19.	45.	67.1	4,707.	23.8	35.8	9.4	122.	29.3	113.	57.8	27.8	239.	214.	244,507.	848.1
	B-46	000829-060	29-Aug-00	10.5	**0.025**	0.09	**0.025**	**0.025**	**0.025**	**0.025**	0.05	**0.025**	**0.025**	**0.025**	0.085	**0.025**	**0.025**	**0.025**	0.135	**0.025**	0.14	0.22
	B-21	951003-B21-04	3-Oct-95	11.5	0.12	0.079	0.079	**0.025**	0.14	**0.025**	**0.025**	1.3	0.44	0.2	**0.025**	0.59	0.089	0.71	2.5	0.86	0.418	6.689
	B-18	950919-B18-05	19-Sep-95	12.0	0.17	0.09	0.032	0.074	0.26	**0.025**	0.033	1.9	0.16	0.44	0.047	1.1	1.8	44.8	6.7	1.7	0.659	58.647
			Mean (0.2-5.5)		9.53	11.37	4.84	12.25	15.06	523.75	6.7	9.98	2.	17.47	8.77	27.98	9.71	16.05	47.89	48.62	27,201.26	188.31
			Maximum (0.2-5.5)		41.9	53.2	21.3	59.5	67.1	4,707.	31.	52.4	9.4	122.	42.	132.	57.8	115.	239.	217.	244,507.	848.1
			Mean (0.2-12)		34.27	45.30	15.35	55.16	49.59	241.22	30.79	87.09	9.16	38.24	43.66	134.25	29.45	668.98	175.37	206.46	12,449.61	1,392.55
			Maximum (0.2-12)		564.00	752.00	238.00	942.00	811.00	4,707.00	519.00	1,630.00	155.00	578.00	747.00	2,350.00	481.00	13,000.00	2,950.00	3,580.00	244,507.00	25,471.00
Tar Pond	B-26	951003-B26-01	4-Oct-95	0.2	0.73	1.2	0.49	0.99	0.77	0.16	0.79	0.092	**0.025**	0.097	0.84	1.5	**0.025**	**0.025**	0.46	1.2	5.13	4.264
	B-28	951002-B28-01	2-Oct-95	0.2	6.1	10.1	4.3	8.6	8.2	1.6	6.6	0.73	0.26	4.6	8.2	9.7	0.246	0.3	4.6	12.7	45.5	41.336
	B-28	951002-B28-02	2-Oct-95	0.2	9.5	14.9	6.3	14.1	9.5	2.4	8.8	1.1	0.86	1.8	12.3	17.3	0.55	0.88	9.2	25.7	65.5	69.69
	B-29	950922-B29-01	22-Sep-95	0.2	10.5	31.7	11.6	32.5	19.3	4.8	28.4	0.4	7.3	3.3	41.8	9.4	0.47	2.4	3.4	22.8	138.8	91.27
	B-30A	950922-B30-01	22-Sep-95	0.2	49.8	110.	45.	99.6	75.4	20.2	100.	9.2	13.4	16.	129.	110.5	5.9	9.4	37.3	133.8	500.	464.5
	B-31	950925-B31-01	25-Sep-95	0.2	2.1	5.4	1.8	4.8	3.	0.98	4.9	0.11	1.3	0.59	6.8	1.6	0.058	0.3	0.71	3.7	22.98	15.168
	B-32	951004-B32-01	4-Oct-95	0.2	2.9	6.9	2.5	7.4	5.6	1.8	7.7	0.09	1.7	0.53	12.4	2.7	0.11	0.82	0.66	7.4	34.8	26.41
	B-33	951005-B33-01	5-Oct-95	0.2	34.6	124.	44.	129.	70.	32.7	141.	1.3	29.1	9.9	202.	29.5	1.6	9.1	10.5	87.1	575.3	380.1
	B-34	950926-B34-01	26-Sep-95	0.2	6.	10.	4.5	9.9	9.6	1.6	7.6	0.99	0.46	1.5	9.5	11.7	0.44	1.1	5.6	13.6	49.2	44.89
	B-35	951005-B35-01	5-Oct-95	0.2	2.2	4.	1.5	4.1	4.1	0.59	3.	0.14	0.54	0.88	4.5	4.	0.15	0.34	2.2	6.7	19.49	19.45
	MW-04-57	951030-M4-01	30-Oct-95	0.2	10.	26.	10.	28.	15.	4.	21.	**2.5**	4.4	2.6	35.	12.	**2.5**	1.7	3.4	22.	114.	86.1
	MW-05-32	951027-M5-01	27-Oct-95	0.2	0.13	0.22	0.077	0.15	0.13	**0.025**	0.11	**0.025**	**0.025**	**0.025**	0.15	0.2	**0.025**	**0.025**	0.073	0.19	0.842	0.738
	MW-08-56	951025-M8-01	25-Oct-95	0.2	12.	39.6	13.8	41.7	20.5	9.1	46.2	**0.25**	3.2	1.8	56.5	6.7	**0.025**	2.2	1.4	26.1	203.4	98.175
	M-11	951102-M11-01	2-Nov-95	0.2	8.1	18.	6.	10.	6.9	2.3	9.2	0.73	0.91	0.82	12.	12.	0.3	0.37	4.2	14.	67.4	45.33
			Mean (0-0.2)		11.05	28.72	10.85	27.92	17.71	5.88	27.52	1.26	4.53	3.17	37.93	16.34	0.89	2.07	5.98	26.93	131.6	99.1
			Maximum (0-0.2)		49.8	124.	45.	129.	75.4	32.7	141.	9.2	29.1	16.	202.	110.5	5.9	9.4	37.3	133.8	575.3	464.5
	B-50	000828-034	28-Aug-00	1.0	0.069	0.042	0.044	0.077	0.086	0.009	0.044	0.145	0.016	0.086	0.058	0.22	0.082	0.76	0.434	0.254	0.37	2.055
	B-49	000828-037	28-Aug-00	1.5	28.5	66.	40.	114.	39.4	9.4	46.1	0.65	12.5	2.1	105.	22.8	**0.25**	6.2	8.95	60.5	343.4	218.7
	MW-04-101	981014-M4-01	14-Oct-98	2.0	67.8	209.	49.9	183.	82.1	21.1	110.	1.1	25.1	7.9	**0.5**	53.2	1.5	6.1	13.6	145.	722.9	254.

Summary of Analytical Results for Soil Samples, PAHs by EPA Method 8270 (SIM)

PAHs by EPA Method 8270 (SIM)					Analytical Results mg/kg (ppm)																	
					Carcinogenic PAHs							*Non-carcinogenic PAHs*										
Study Area	Soil Boring	Sample Number[1]	Sample Date	Sample Depth (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (ah) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (ghi) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total Carcinogenic PAHs	Total Non-Carcinogenic PAH
	B-33	951005-B33-02	5-Oct-95	2.5	1.9	2.4	0.88	2.8	2.5	0.29	1.5	1.7	0.23	0.96	2.1	6.4	0.85	1.5	4.1	7.4	12.27	25.24
	MW-14-110	981014-M14-01	14-Oct-98	3.5	357.	411.	99.2	400.	343.	**0.5**	**0.5**	42.3	138.	1.4	**0.5**	1,390.	57.	36.8	411.	2,190.	1,611.2	4,267.
	MW-05-175	981019-M5-01	19-Oct-98	5.0	7.1	14.4	3.5	16.3	9.3	2.1	10.5	0.47	1.6	0.95	15.1	10.5	0.39	0.54	2.6	17.	63.2	49.15
	MW-05-175	981019-M5-02	19-Oct-98	5.0	3.2	3.9	1.4	4.3	3.6	0.53	2.6	1.7	0.64	2.	3.6	11.	1.2	0.24	13.	14.3	19.53	47.68
	B-48	000828-031	28-Aug-00	5.0	0.043	0.026	0.029	0.048	0.054	0.006	0.027	0.073	0.048	0.059	0.037	0.146	0.055	0.835	0.302	0.164	0.23	1.717
	B-33	951005-B33-03	5-Oct-95	5.5	181.	185.	72.1	225.	262.	21.3	108.	369.	133.	263.	152.	527.	266.	3,460.	1,190.	824.	1,054.4	7,184.
	MW-14-110	981014-M14-02	14-Oct-98	6.0	116.	133.	37.3	136.	152.	**0.5**	58.1	10.6	21.9	23.	90.2	292.	14.2	12.9	118.	482.	632.4	1,064.8
	MW-04-101	981014-M4-02	14-Oct-98	6.0	**0.025**	0.1	**0.025**	0.1	0.057	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	0.11	0.257	0.11
	B-50	000828-035	28-Aug-00	6.0	0.244	0.15	0.142	0.259	0.284	0.034	0.16	0.344	0.33	0.342	0.207	0.875	0.31	4.1	1.81	0.995	1.272	9.313
	B-49	000828-038	28-Aug-00	8.0	0.116	0.077	0.072	0.132	0.14	0.017	0.081	0.199	0.043	0.121	0.106	0.334	0.121	1.3	0.75	0.384	0.634	3.358
	MW-05-175	981019-M5-03	19-Oct-98	9.5	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**
	B-48	000828-032	28-Aug-00	9.5	0.077	0.055	0.051	0.088	0.092	0.011	0.051	0.114	0.03	0.078	0.065	0.212	0.065	0.755	0.386	0.258	0.425	1.962
	MW-14-110	981014-M14-03	14-Oct-98	10.0	71.3	74.6	24.	82.5	94.8	**0.025**	42.6	39.3	6.6	37.1	57.	194.	33.	93.3	250.	310.	389.8	1,020.3
	B-09	950918-B9-02	18-Sep-95	10.0	472.	420.	139.	487.	601.	56.5	246.	558.	457.	603.	344.	1,350.	464.	7,560.	3,410.	2,270.	2,421.5	17,016.
	MW-04-101	981014-M4-03	14-Oct-98	10.5	0.13	0.25	**0.025**	0.23	0.16	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	0.21	**0.025**	**0.025**	**0.025**	0.46	0.77	0.67
	MW-09-29	951023-M9-05	23-Oct-95	11.5	0.028	0.035	**0.025**	0.032	0.041	**0.025**	0.027	**0.025**	**0.025**	0.03	0.036	0.076	**0.025**	**0.025**	0.096	0.12	0.163	0.036
	B-34	950926-B34-05	26-Sep-95	11.5	227.	256.	153.	356.	383.	**41.**	**223.**	253.	452.	1,289.	**318.**	849.	409.	5,420.	1,580.	1,290.	1,639.	11,860.
	B-30	950922-B30-06	22-Sep-95	11.5	167.	167.	71.9	182.	245.	16.5	89.3	220.	228.	417.	125.	739.	310.	1,730.	1,260.	808.	938.7	5,837.
	B-32	951004-B32-03	4-Oct-95	11.5	495.	500.	292.	585.	824.	87.3	373.	990.	807.	1,190.	529.	2,050.	810.	11,100.	4,560.	3,580.	3,156.3	25,616.
			Mean (0.2-5.5)		122.38	143.32	44.94	153.91	146.94	11.82	56.	91.6	95.83	114.83	65.81	396.91	92.68	1,037.99	567.86	610.92	679.3	3,074.35
			Maximum (0.2-5.5)		472.	420.	139.	487.	601.	56.5	246.	558.	457.	603.	344.	1,390.	464.	7,560.	3,410.	2,270.	2,421.5	17,016.
			Mean (0.2-12)		99.8	111.05	44.76	126.13	138.3	11.69	59.62	113.13	103.82	174.46	79.21	340.77	107.64	1,337.97	582.96	545.5	591.31	3,385.41
			Maximum (0.2-12)		495.00	500.00	292.00	585.00	824.00	87.30	373.00	990.00	807.00	1,289.00	529.00	2,050.00	810.00	11,100.00	4,560.00	3,580.00	3,156.30	25,616.00
FAMM	B-47	000829-039	29-Aug-00	0.2	0.16	0.24	0.19	0.24	0.2	0.08	0.21	**0.03**	**0.03**	**0.03**	0.25	0.25	**0.03**	**0.03**	0.1	0.23	1.22	0.78
	B-51	000828-023	28-Aug-00	0.2	1.24	1.6	1.02	1.74	1.6	0.39	1.53	0.06	0.18	**0.03**	1.82	2.78	0.07	0.43	2.02	2.59	9.12	9.94
	B-52	000828-026	28-Aug-00	0.2	0.85	1.35	0.97	1.52	1.5	0.25	0.92	**0.03**	0.13	0.32	1.14	1.61	**0.03**	0.23	0.83	1.94	7.36	6.2
			Mean (0-0.2)		0.75	1.06	0.73	1.17	1.1	0.24	0.69	0.04	0.11	0.12	1.07	1.55	0.04	0.23	0.98	1.59	5.9	5.64
			Maximum (0-0.2)		1.24	1.6	1.02	1.74	1.6	0.39	1.53	0.06	0.18	0.32	1.82	2.78	0.07	0.43	2.02	2.59	9.12	9.94
	GT-1	971117-001	17-Nov-97	3.0	0.27	0.5	0.16	0.58	0.25	**0.025**	0.48	**0.025**	**0.025**	**0.025**	1.	0.38	**0.025**	**0.025**	0.06	0.66	2.27	2.23
	GT-3	971118-023	18-Nov-97	3.0	2.2	3.3	8.4	3.8	1.8	**0.025**	2.4	0.33	0.29	0.11	4.1	7.5	**0.025**	0.14	0.12	8.6	21.9	21.2
	GT-2	971117-012	17-Nov-97	3.5	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	0.084	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	0.284
	B-47	000829-041	29-Aug-00	5.0	8.7	8.45	7.85	11.4	9.45	1.14	7.1	1.65	**0.025**	2.14	8.05	15.6	0.675	0.085	8.5	15.1	54.1	51.8
	MW-13	971218-M13-02	18-Dec-97	6.0	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**
	MW-13	971218-M13-03	18-Dec-97	10.0	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**	**0.025**
	B-08	950918-B8-04	18-Sep-95	10.0	18.	40.	12.	47.	24.	6.	38.	0.48	4.	2.8	58.	26.	0.71	2.3	7.2	52.	185.	153.5
	GT-1	971117-004	17-Nov-97	10.5	**0.35**	**0.35**	**0.35**	**0.35**	**0.35**	**0.35**	**0.35**	1.4	**0.35**	0.97	**0.35**	**0.35**	**2.1**	**0.35**	**0.35**	1.7	**0.35**	6.17
	B-47	000829-042	29-Aug-00	11.5	0.094	0.08	0.078	0.108	0.1	0.019	0.064	0.08	**0.025**	0.092	0.072	0.221	0.056	0.05	0.249	0.196	0.5	1.
			Mean (0.2-5.5)		0.71	1.04	2.23	1.19	0.61	0.11	0.81	0.45	0.17	0.28	1.38	2.06	0.54	0.14	0.14	2.75	6.14	7.47
			Maximum (0.2-5.5)		2.2	3.3	8.4	3.8	1.8	0.35	2.4	1.4	0.35	0.97	4.1	7.5	2.1	0.35	0.35	8.6	21.93	21.22
			Mean (0.2-12)		3.3	5.86	3.21	7.03	4.	0.85	5.39	0.45	0.53	0.69	7.97	5.57	0.41	0.34	1.84	8.7	29.36	26.25
			Maximum (0.2-12)		18.	40.	12.	47.	24.	6.	38.	1.65	4.	2.8	58.	26.	2.1	2.3	8.5	52.	185.	153.49

Notes: mg/kg = milligrams/kilogram
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
Bold = Not detected; value is 1/2 detection limit.

Summary of Analytical Results for Soil Samples (TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead)

	Soil Boring Number	Sample Number	Sample Date	Depth Feet (bgs)	Analytical Results mg/kg (ppm)											
					ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
					TPH-G	TPH-418.1M										
					Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
Spent Oxide	B-01	950921-B1-01	21-Sep-95	0.2	**5.**	130.	7.17	13.358	**0.15**	**0.15**	**0.15**	**0.15**	ND		0.427	60.
	B-01	950921-B1-02	21-Sep-95	0.2		220.	26.14	55.96							0.382	58.
	MW-01-22	951024-M1-01	24-Oct-95	0.2			3.07	5.78							0.25	
	MW-02-32	951106-M2-01	6-Nov-95	0.2			5.2	10.293							0.47	4.9
	B-36	000828-017	28-Aug-00	0.2			6.59	11.09								
	B-37	000828-001	28-Aug-00	0.2			36.04	63.855								
			Mean (0-0.2)		5.	175.	14.035	26.723	0.15	0.15	0.15	0.15			0.382	40.967
			Maximum (0-0.2)		5.	220.	36.04	63.855	0.15	0.15	0.15	0.15			0.47	60.
	MW-02-61	981007-M2-01	7-Oct-98	2.0			54.3	110.	**0.013**	**0.013**	**0.013**	**0.038**	ND			
	MW-01-22	951024-M1-02	24-Oct-95	3.5		460.	8.35	12.84							**0.25**	
	B-36	000828-018	28-Aug-00	3.5			0.515	1.16	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-37	000828-002	28-Aug-00	4.5			1.965	3.705	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	MW-02-61	981007-M2-02	7-Oct-98	5.5			2,299.8	5,425.3	0.03	**0.013**	**0.013**	0.17	0.2		61.	
	B-06	950927-B6-02	27-Sep-95	8.0		810.	4,413.	12,486.8								
	B-36	000828-019	28-Aug-00	10.0			0.315	0.635	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-01	950921-B1-05	21-Sep-95	10.5		640.	336.7	1,279.7							50.7	130.
	B-03	950921-B3-05	21-Sep-95	10.5		120.	23.04	49.04	**0.15**	**0.15**	**0.15**	**0.15**	ND	ND	7.44	22.
	B-37	000828-003	28-Aug-00	11.0			ND	ND	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-01	950921-B1-06	21-Sep-95	12.0		560.										
			Mean (0.2-5.5)			460.	99.966	350.925	0.005	0.005	0.005	0.015	#DIV/0!		25.475	
			Maximum (0.2-5.5)			460.	336.7	1,279.7	0.013	0.013	0.013	0.038	0.		50.7	
			Mean (0.2-12)			635.	793.109	2,152.131	0.028	0.026	0.026	0.053	0.2		29.848	76.
			Maximum (0.2-12)			810.	4,413.	12,486.8	0.15	0.15	0.15	0.17	0.2		61.	130.
Office	B-38	000828-014	28-Aug-00	0.2			10.39	19.18								
	B-39	000828-004	28-Aug-00	0.2			6.49	11.57								
	B-40	000828-010	28-Aug-00	0.2			32.38	56.155								
	B-41	000828-007	28-Aug-00	0.2			14.885	27.285								
			Mean (0-0.2)				16.036	28.548								
			Maximum (0-0.2)				32.38	56.155								
	B-38	000828-015	28-Aug-00	2.0			4.9	10.4	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-40	000828-011	28-Aug-00	2.5			ND	ND	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-41	000828-008	28-Aug-00	2.5			12.58	26.43	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-39	000828-005	28-Aug-00	3.0			ND	ND	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-38	000828-016	28-Aug-00	8.5			0.395	0.72	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-39	000828-006	28-Aug-00	9.5			ND	ND	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-40	000828-012	28-Aug-00	9.5			ND	ND	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-41	000828-009	28-Aug-00	9.5			ND	ND	**0.001**	**0.001**	**0.001**	**0.004**	ND			
			Mean (0.2-5.5)				5.958	12.517	0.001	0.001	0.001	0.004				
			Maximum (0.2-5.5)				12.58	26.43	0.001	0.001	0.001	0.004				
			Mean (0.2-12)				5.958	12.517	0.001	0.001	0.001	0.004				
			Maximum (0.2-12)				12.58	26.43	0.001	0.001	0.001	0.004				
Koppers	B-11	950928-B11-01	28-Sep-95	0.2		1,600.										
	B-14	950928-B14-01	28-Sep-95	0.2												
	B-19	950919-B19-01	19-Sep-95	0.2		68.	324.2	933.22	**0.15**	**0.15**	**0.15**	**0.15**	ND	ND		57.
	MW-09-29	951023-M9-01	23-Oct-95	0.2			11.7	21.502								
	MW-10-61	951108-M10-01	8-Nov-95	0.2			45.	78.741						ND		6.4
	MW-10-61	951108-M10-02	8-Nov-95	0.2			64.1	106.99								
	MW-12-36	951023-M12-01	23-Oct-95	0.2		29.	65.5	116.21								
	B-42	000828-020	28-Aug-00	0.2			0.825	1.52								
	B-43	000829-050	29-Aug-00	0.2			10.34	331.605								
	B-44	000829-052	29-Aug-00	0.2			32.28	99.95								
	B-45	000829-054	29-Aug-00	0.2			234.25	388.2								
	B-46	000829-058	29-Aug-00	0.2			144.25	240.15								
	SS-12	000829-061	29-Aug-00	0.2			1.795	2.925								
	SS-13	000829-062	29-Aug-00	0.2			1.46	3.72								
	SS-14	000829-063	29-Aug-00	0.2			9.795	16.5								
	SS-15	000829-064	29-Aug-00	0.2			255.875	594.8								
			Mean (0-0.2)			565.667	85.812	209.717	0.15	0.15	0.15	0.15				31.7

Summary of Analytical Results for Soil Samples (TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead)

	Soil Boring Number	Sample Number	Sample Date	Depth Feet (bgs)	Analytical Results mg/kg (ppm)											
					ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
					TPH-G	TPH-418.1M										
					Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
		Maximum (0-0.2)				1,600.	324.2	933.22	0.15	0.15	0.15	0.15				57.
	B-42	000828-021	28-Aug-00	1.0			15.535	29.745	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-43	000829-046	29-Aug-00	2.0			4.48	7.535	**0.003**	**0.003**	**0.003**	**0.008**	ND			
	B-45	000829-055	29-Aug-00	2.0			0.073	0.11	**0.002**	**0.002**	**0.002**	**0.005**	ND			
	B-14	950928-B14-02	28-Sep-95	2.5		280.										
	MW-06-61	951107-M6-01	7-Nov-95	2.5			ND	ND								
	B-17	950929-B17-01	29-Sep-95	3.0			24.07	59.079								
	B-22	951003-B22-01	3-Oct-95	3.5		530.										
	B-44	000829-051	29-Aug-00	3.5			5.525	8.46	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-14	950928-B14-03	28-Sep-95	5.0			ND	ND								
	MW-09-29	951023-M9-04	23-Oct-95	5.0		19.	78.5	163.02	**0.15**	**0.15**	**0.15**	**0.15**	ND		518.	
	B-46	000829-059	29-Aug-00	5.0			2.065	3.135	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	M-15	990628-02	28-Jun-99	6.0					**0.013**	**0.01**	**0.013**	**0.038**	ND			
	B-19	950919-B19-03	19-Sep-95	6.5	1,600.	1,500.	35.76	408.26	41.	120.	39.	160.	360.	ND		1.6
	B-42	000828-022	28-Aug-00	7.5			2.	6.315	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-43	000828-048	28-Aug-00	8.5			105.284	186.852	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	B-45	000829-057	29-Aug-00	8.5			5.315	8.355	**0.001**	**0.001**	**0.001**	**0.004**	ND			
	M-15	990628-03	28-Jun-99	9.5					4.8	18.4	111.	289.	423.2			
	B-44	000829-053	29-Aug-00	10.0			13.77	62.405	56.7	9.21	0.792	8.65	75.352			
	B-13	951006-B13-03	6-Oct-95	10.5	1,000.	2,700.	3,915.9	29,366.9	28.	**10.**	110.	22.	160.	ND	**0.05**	1.9
	B-19	950919-B19-04	19-Sep-95	10.5	3,200.	1,500.										11.
	B-20	950929-B20-03	29-Sep-95	10.5	940.	340.	244.51	1,092.61	120.	64.	16.	60.	260.			4.5
	B-23	951003-B23-02	3-Oct-95	10.5	1,300.	930.									0.17	
	B-24	951002-B24-03	2-Oct-95	10.5	1,500.	640.	276.5	1,091.8								
	B-46	000829-060	29-Aug-00	10.5			0.14	0.36	**0.002**	**0.002**	**0.002**	**0.005**	ND			
	B-21	951003-B21-04	3-Oct-95	11.5			0.418	7.107								9.8
	MW-09-29	951023-M9-05	23-Oct-95	11.5			0.163	0.521								
	B-18	950919-B18-05	19-Sep-95	12.0	3,100.	99.	0.659	59.306	360.	280.	31.	220.	891.	0.36	**0.125**	13.
	B-19	950919-B19-05	19-Sep-95	12.0	1,900.	6,800.										
		Mean (0.2-5.5)				280.	498.016	3,526.021	84.668	59.001	26.168	50.336			#DIV/0!	
		Maximum (0.2-5.5)				280.	3,915.9	29,386.9	360.	280.	110.	220.				
		Mean (0.2-12)			1,600.	582.3	248.982	1,714.836	35.922	29.517	18.116	44.699	361.592	#DIV/0!	518.	1.6
		Maximum (0.2-12)			1,600.	1,500.	3,915.9	29,386.9	360.	280.	111.	289.	891.	0.	518.	1.6
Tar Pond	B-26	951003-B26-01	4-Oct-95	0.2			5.13	9.319								
	B-28	951002-B28-01	2-Oct-95	0.2	5.	35.	45.5	86.836	**0.15**	**0.15**	**0.15**	**0.15**	ND	ND		21.
	B-28	951002-B28-02	2-Oct-95	0.2			65.5	135.19								
	B-29	950922-B29-01	22-Sep-95	0.2		190.	138.8	230.07								
	B-30A	950922-B30-01	22-Sep-95	0.2		390.	500.	964.5								
	B-31	950925-B31-01	25-Sep-95	0.2		240.	22.98	38.148	**0.15**	**0.15**	**0.15**	**0.15**	ND		0.59	14.
	B-32	951003-B32-01	4-Oct-95	0.2		66.	34.8	61.21								
	B-33	951005-B33-01	5-Oct-95	0.2		170.	575.3	955.4								
	B-34	950926-B34-01	26-Sep-95	0.2		41.	49.2	94.09								
	B-35	951005-B35-01	5-Oct-95	0.2		27.	19.49	38.94	**0.15**	**0.15**	**0.15**	**0.15**	ND	ND		
	M-11	951102-M11-01	2-Nov-95	0.2		14.	67.4	105.83								9.9
	MW-04-57	951030-M4-01	30-Oct-95	0.2		57.	114.	195.1						ND	0.8	29.
	MW-05-32	951027-M5-01	27-Oct-95	0.2			0.817	1.43								
	MW-08-56	951025-M8-01	25-Oct-95	0.2			203.4	280.8							0.61	
		Mean (0 -0.2)			5.	123.	131.594	228.347	0.15	0.15	0.15	0.15			0.667	18.475
		Maximum (0-0.2)			5.	390.	575.3	964.5	0.15	0.15	0.15	0.15			0.8	29.
	B-50	000828-034	28-Aug-00	1.0			0.37	2.425	14.3	5.68	21.2	43.9	85.08			
	B-49	000828-037	28-Aug-00	1.5			343.4	562.1	**0.002**	**0.002**	**0.002**	**0.005**	ND			
	MW-04-101	981014-M4-01	14-Oct-98	2.0			722.9	973.4	**0.013**	**0.013**	**0.013**	**0.038**	ND			
	B-33	951005-B33-02	5-Oct-95	3.0		140.	151.77	37.51								
	MW-14-110	981014-M14-01	14-Oct-98	3.5			1,610.2	5,875.7	7.6	1.9	10.	19.	38.5			
	MW-05-175	981019-M5-01	19-Oct-98	5.0			63.2	112.35	**0.013**	**0.013**	**0.013**	**0.038**	ND			
	MW-05-175	981019-M5-02	19-Oct-98	5.0			19.53	67.21	**0.013**	**0.013**	**0.013**	**0.038**	ND			
	B-48	000828-031	28-Aug-00	5.0			0.23	1.947	107.	78.1	103.	141.	429.1			
	B-33	951005-B33-03	5-Oct-95	5.5	430.	2,700.	1,054.4	8,238.4	47.	22.	29.	28.	126.	ND	3.9	20.

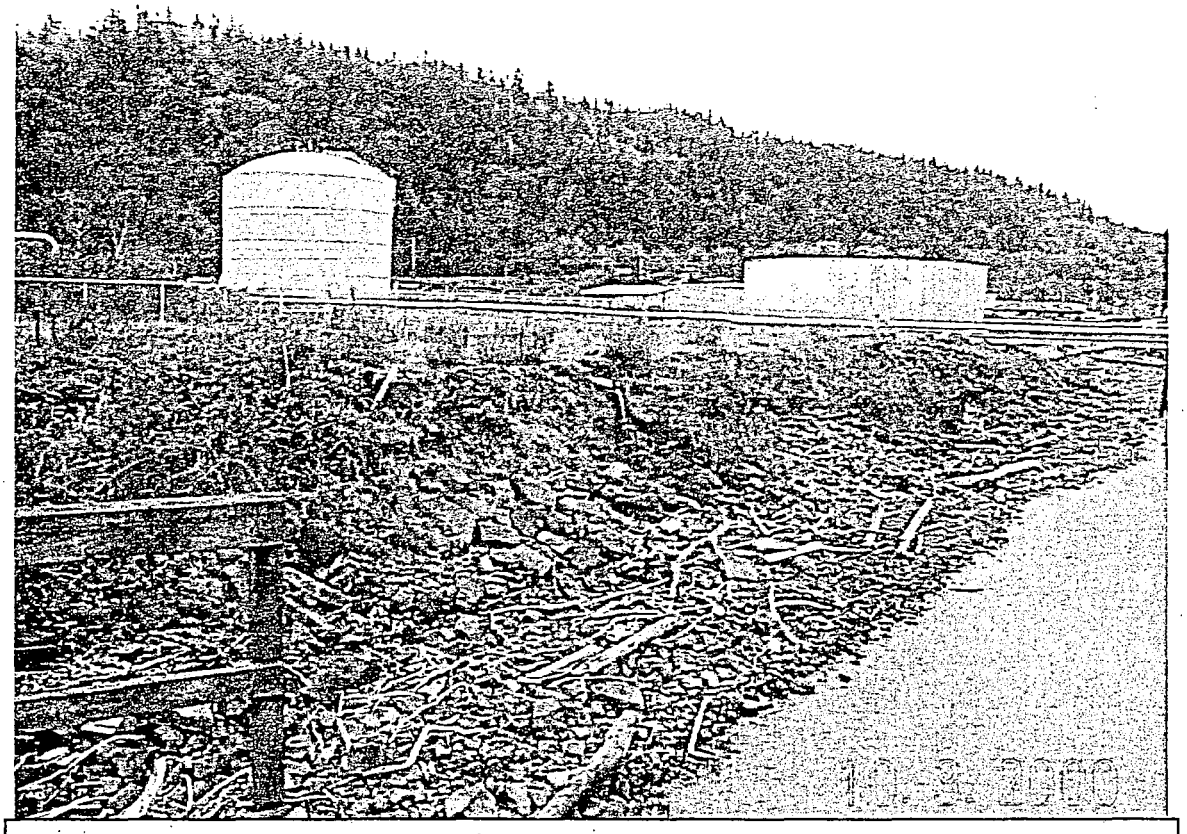
Summary of Analytical Results for Soil Samples (TPH, BTEX, Total PAHs, Total Phenols, Cyanide, and Lead)

	Soil Boring Number	Sample Number	Sample Date	Depth Feet (bgs)	Analytical Results mg/kg (ppm)											
					ODEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010	EPA Method 6010
					TPH-G	TPH-418.1M										
					Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide	Total Lead
	MW04-101	981014-M4-02	14-Oct-98	6.0			0.257	0.367	**0.013**	**0.01**	**0.013**	**0.038**	ND			
	MW-14-110	981014-M14-02	14-Oct-98	6.0			632.4	1,697.2	2.3	**0.75**	5.2	7.7	15.2			
	B-50	000828-035	28-Aug-00	6.0			1.272	10.585	11.6	1.665	27.2	31.5	70.3			
	B-49	000828-038	28-Aug-00	8.0			0.634	3.992	1.78	0.895	18.	24.5	45.175			
	MW-05-175	981019-M5-03	19-Oct-98	9.5			ND	ND	**0.013**	**0.01**	**0.013**	**0.038**	ND		**0.01**	
	B-48	000828-032	28-Aug-00	9.5			0.425	2.387	6.8	8.26	15.6	19.8	50.46			
	B-09	950918-B9-02	18-Sep-95	10.0	1,200.	25.	2,421.5	19,437.5	104.	44.2	78.2	102.6	329.			
	MW-14-110	981014-M14-03	14-Oct-98	10.0			389.8	1,410.1	0.3	0.6	5.	6.4	12.3		1.1	
	MW04-101	981014-M4-03	14-Oct-98	10.5			0.77	1.44	**0.013**	**0.01**	**0.013**	**0.038**	ND		**0.01**	
	B-30	950922-B30-06	22-Sep-95	11.5	320.	3,200.	938.7	6,775.7	18.	1.9	12.	20.	51.9	ND	3.03	25.
	B-32	951003-B32-03	4-Oct-95	11.5	760.	6,600.	3,156.3	28,772.3							3.02	
	B-34	950926-B34-05	26-Sep-95	11.5	3,400.	4,200.	1,639.	13,499.							6.48	
			Mean (0.2-5.5)		#DIV/0!	140.	941.157	6,197.636	17.991	7.402	15.634	23.66	150.86		#DIV/0!	#DIV/0!
			Maximum (0.2-5.5)		0.	140.	3,156.3	28,772.3	104.	44.2	78.2	102.6	329.		0.	0.
			Mean (0.2-12)		430.	1,420.	657.353	4,374.281	17.82	9.223	18.026	24.702	113.91		1.955	20.
			Maximum (0.2-12)		430.	2,700.	3,156.3	28,772.3	107.	78.1	103.	141.	429.1		3.9	20.
FAMM	B-47	000829-039	29-Aug-00	0.2			1.22	1.992								
	B-51	000828-023	28-Aug-00	0.2			9.12	19.055								
	B-52	000828-026	28-Aug-00	0.2			7.355	13.55								
			Mean (0 -0.2)				5.898	11.532								
			Maximum (0-0.2)				9.12	19.055								
	GT-1	971117-001	17-Nov-97	3.0			2.24	4.34	**0.013**	**0.013**	**0.013**	**0.037**	ND		**0.01**	
	GT-3	971118-023	18-Nov-97	3.0			21.9	43.09	**0.013**	**0.013**	**0.013**	**0.037**	ND		**0.01**	
	GT-2	971117-012	17-Nov-97	3.5			ND	0.084	**0.013**	**0.013**	**0.013**	**0.037**	ND		**0.01**	
	B-47	000829-041	29-Aug-00	5.0			54.09	105.89	**0.002**	**0.002**	**0.002**	**0.005**	ND			
	MW-13-61	971218-M13-02	18-Dec-97	6.0			ND	ND	**0.013**	**0.013**	**0.013**	**0.037**	ND		**0.01**	
	B-08	950918-B8-04	18-Sep-95	10.0		54.	185.	338.49								
	MW-13-61	971218-M13-03	18-Dec-97	10.0			ND	ND	**0.013**	**0.013**	**0.013**	**0.037**	ND		**0.01**	
	GT-1	971117-004	17-Nov-97	10.5	300.	13,400.	ND	6.17	**0.013**	**0.013**	0.034	0.13	0.164		**0.015**	
	B-47	000829-042	29-Aug-00	11.5			0.544	1.559	**0.002**	**0.002**	**0.002**	**0.005**	ND			
			Mean (0.2-5.5)				12.07	13.421	0.013	0.013	0.018	0.06			0.01	
			Maximum (0.2-5.5)				21.9	43.09	0.013	0.013	0.034	0.13			0.01	
			Mean (0.2-12)		#DIV/0!	54.	52.755	71.375	0.01	0.01	0.012	0.041	0.164		0.01	
			Maximum (0.2-12)		0.	54.	185.	338.49	0.013	0.013	0.034	0.13	0.164		0.01	

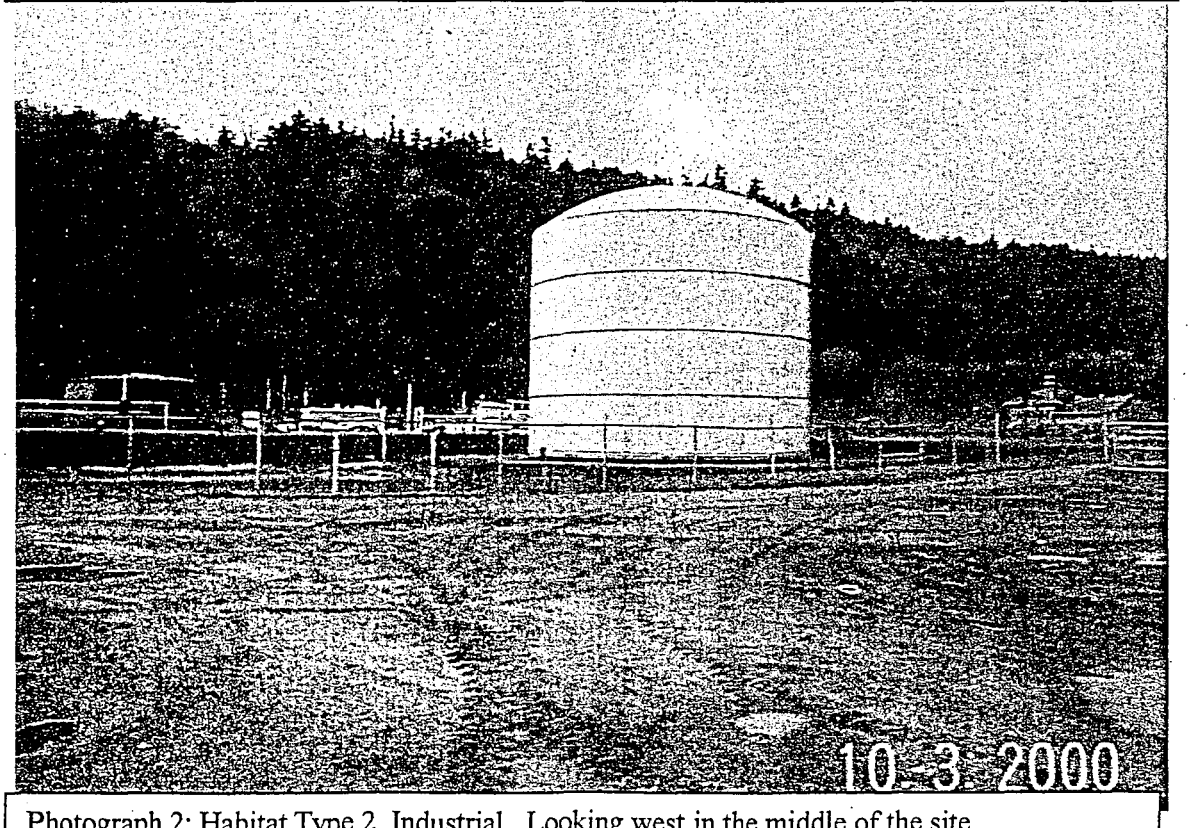
NOTES:

BTEX = benzene, toluene, ethylbenzene, and xylenes
mg/kg = milligrams/kilogram
TPH = total petroleum hydrocarbons
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
BOLD = Not Detected; value reported is 1/2 of detection limit.

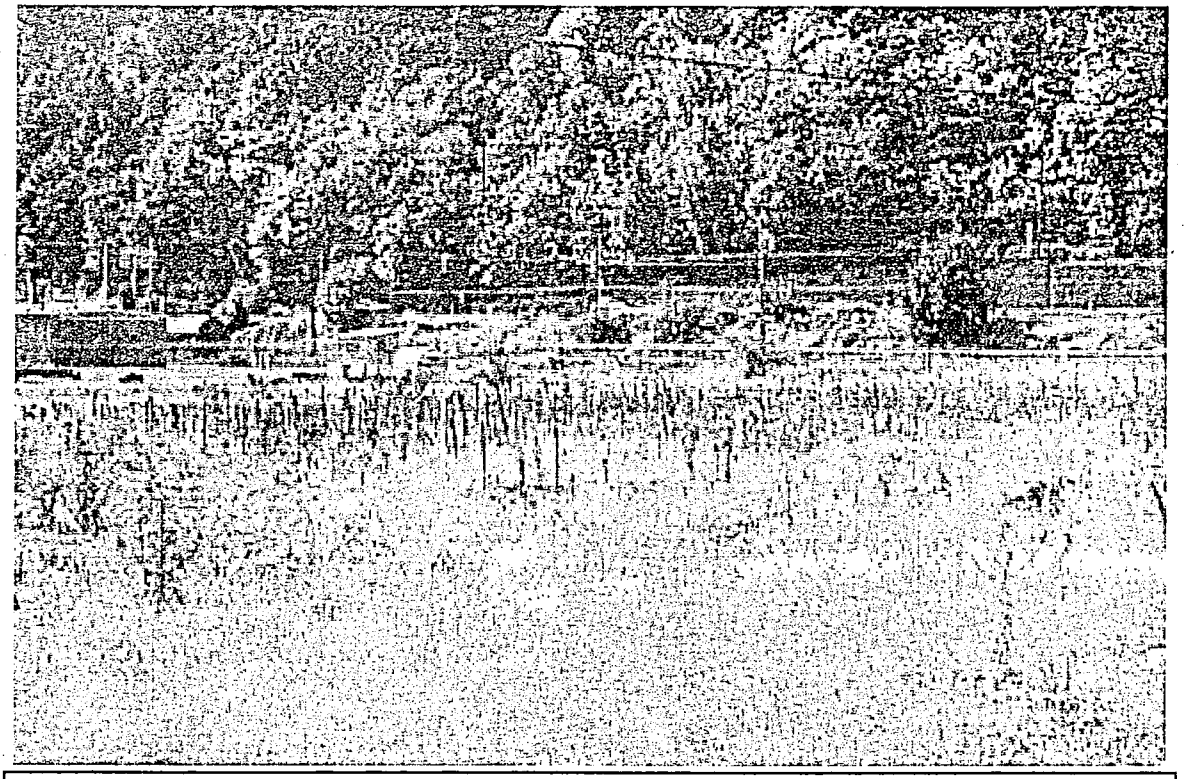
Appendix B – NW Natural "Gasco" Site Photos



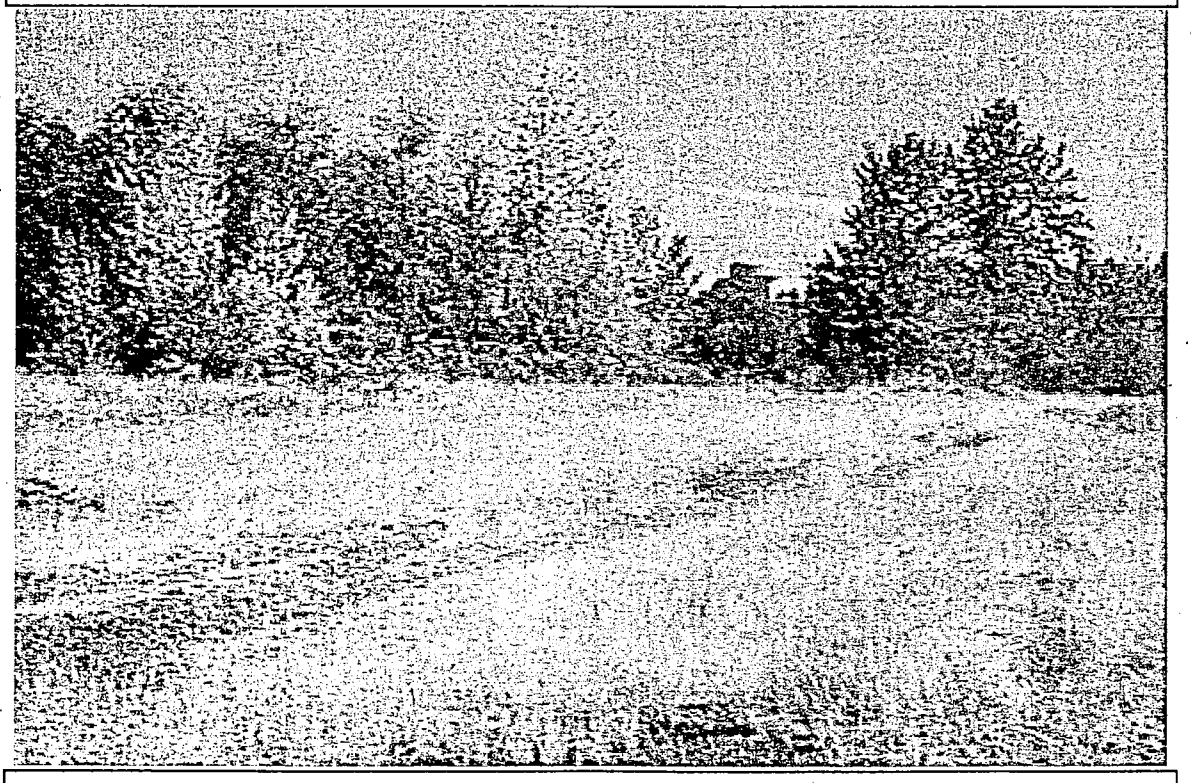
Photograph 1: Habitat Type 1, looking west.



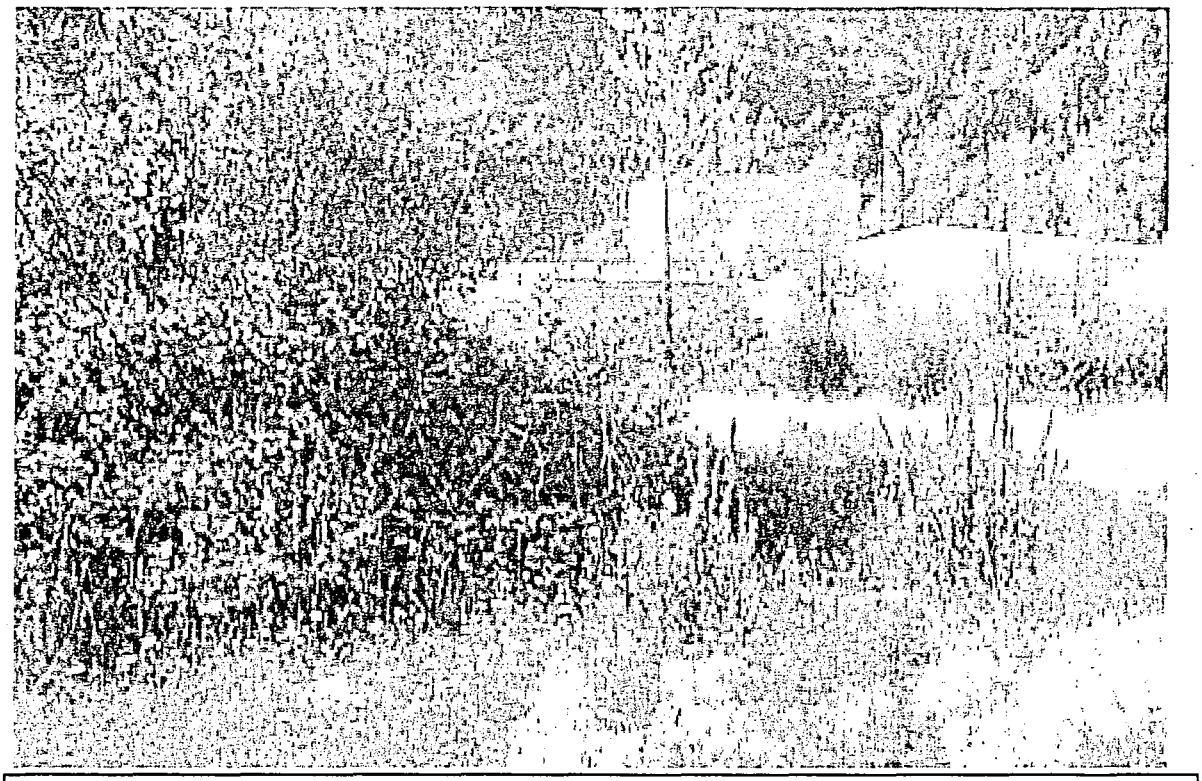
Photograph 2: Habitat Type 2. Industrial. Looking west in the middle of the site.



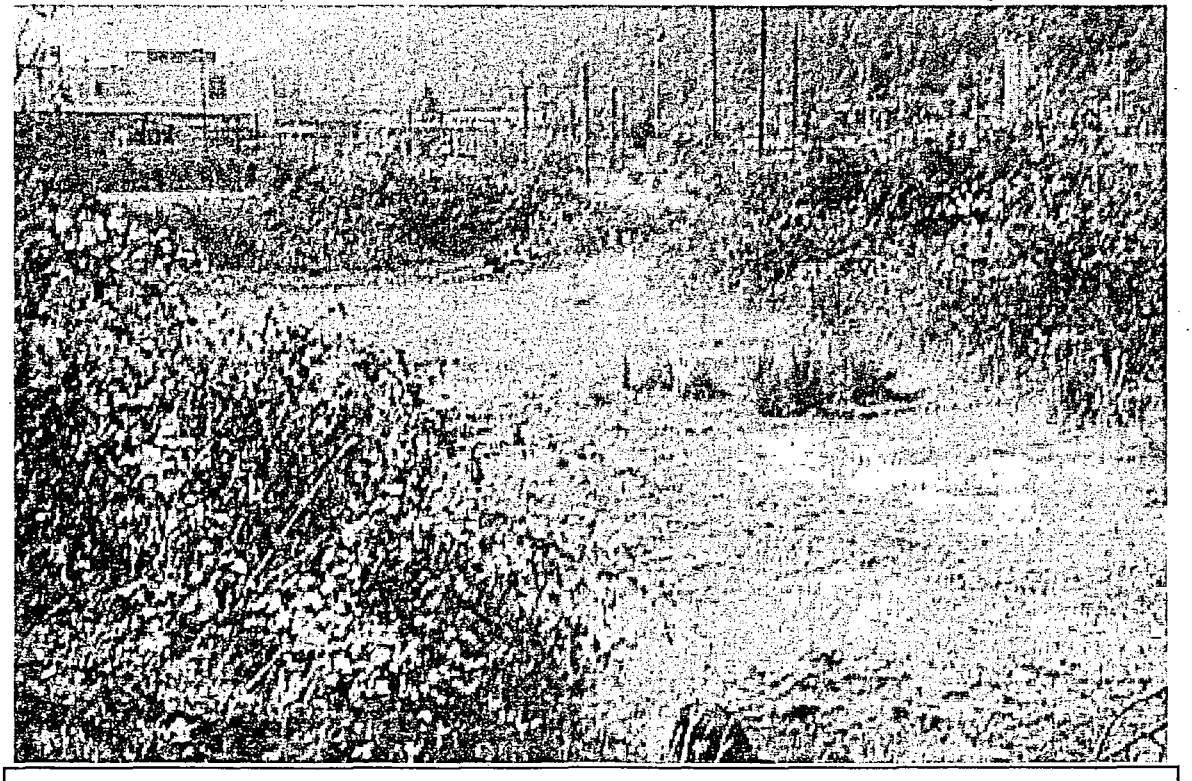
Photograph 3: Habitat Type 3, grass, looking south towards St. Helens Road and Forest Park



Photograph 4: Looking north from the eastern property line at Type 3 in the foreground, Type 4 in the background

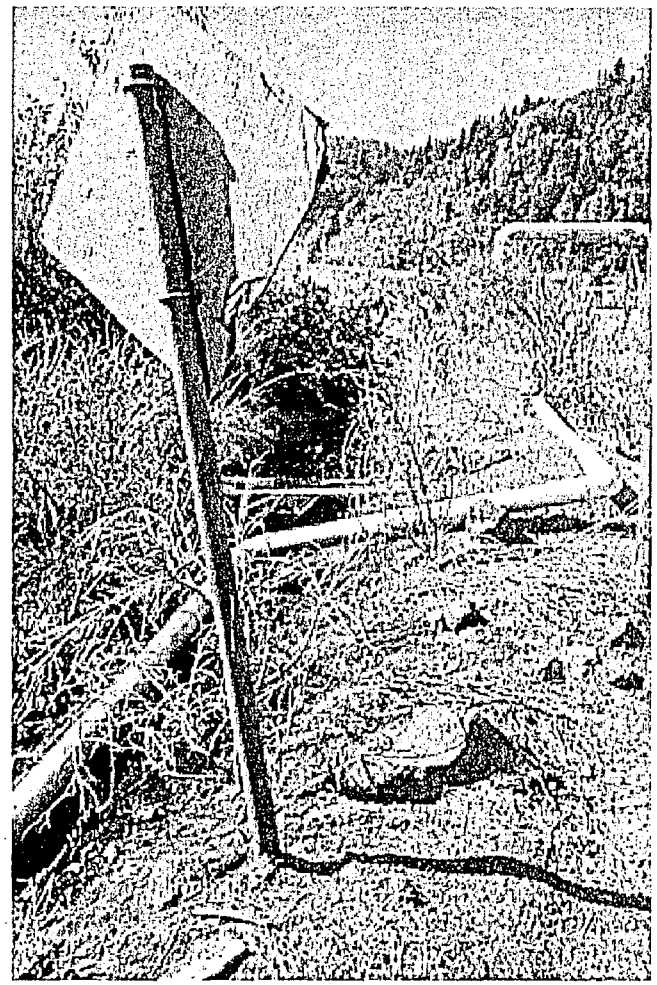


Photograph 5: Looking south toward the Koppers area. Type 4 on the left, Type 3 on the right.

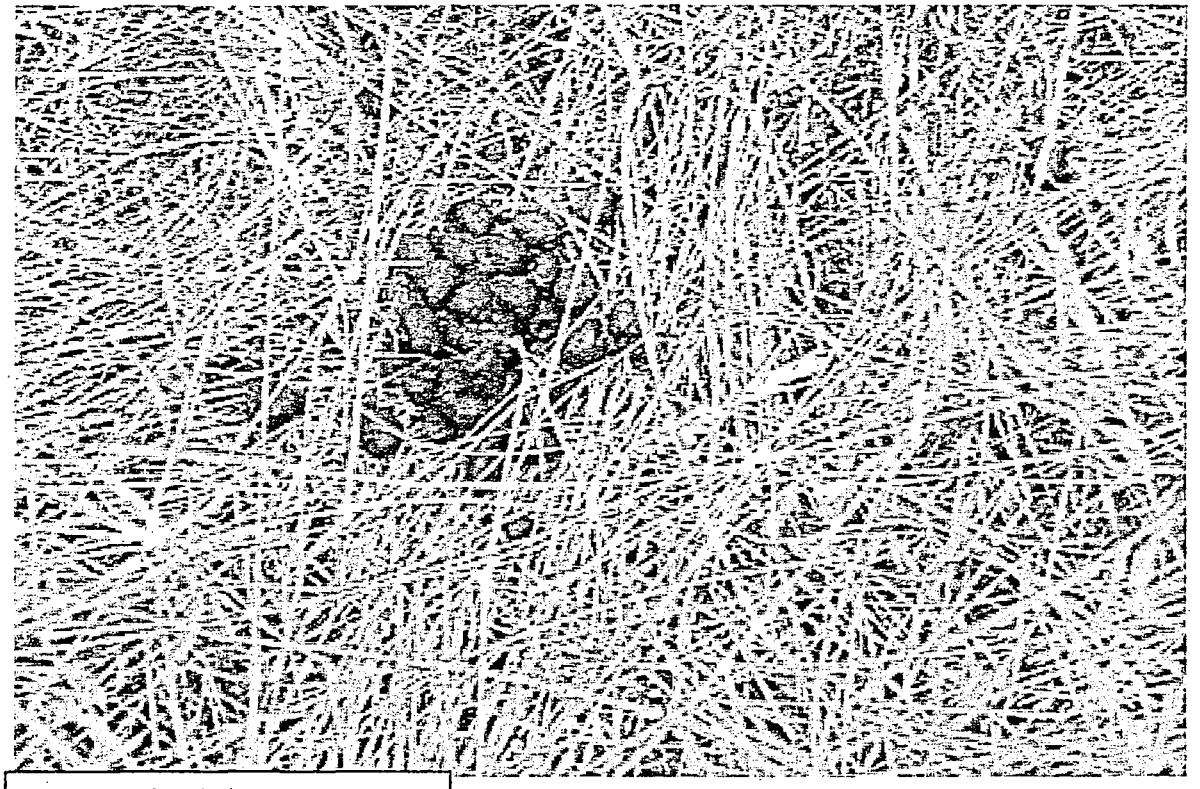


Photograph 6: Habitat Type 5, pond. The low brown area in the center of the photograph is a pond in the winter and spring.

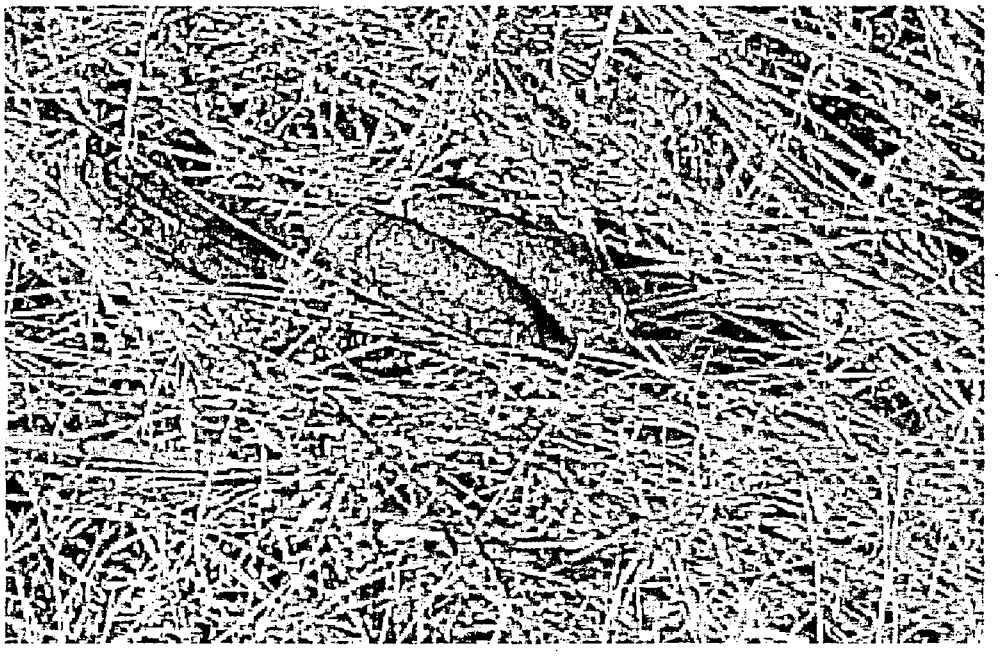
Photograph 7: Drainage ditch, Habitat Type 5, looking east. Alder tree on left.



Photograph 8: Drainage ditch looking west. Treated groundwater is released into the ditch from the white pipe.

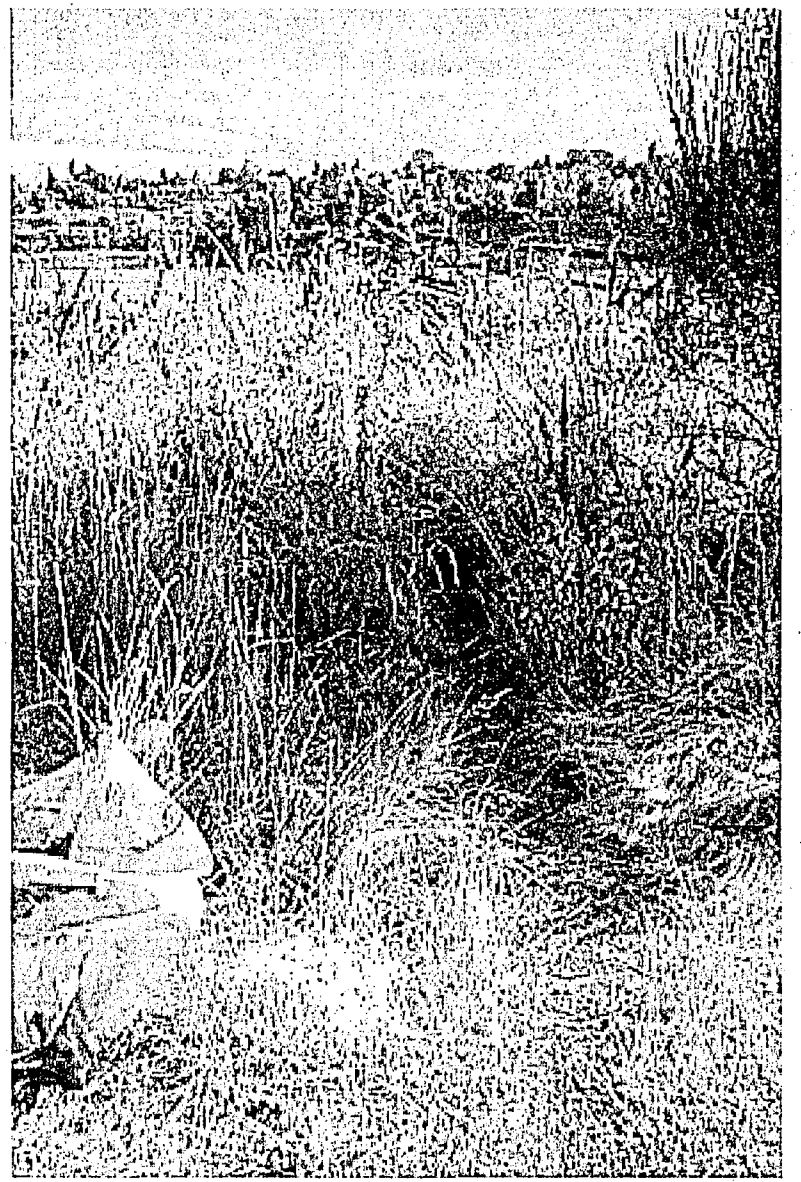


Photograph 9: Deer scat



Photograph 10: Unidentified scat

Photograph 11: Matted vegetation indicating animal sleeping area.



Photograph 12: Animal trail looking towards the River

Photograph 13: Animal trail looking towards Forest Park

Appendix C - Oregon Natural Heritage Program Database Search Results

Oregon NATURAL HERITAGE PROGRAM

A Cooperative Project of :

The Nature Conservancy.

May 25, 2000

Steve Cappellino
Anchor Environmental
1411 Fourth Ave, Suite 1210
Seattle, WA 98101

821 SE 14th Avenue
Portland, Oregon 97214-2537
(503) 731-3070
FAX (503) 230-9639

Dear Mr. Cappellino:

Thank you for requesting information from the Oregon Natural Heritage Program (ONHP). We have conducted a data system search for rare, threatened and endangered plant and animal records for your project in Township 1 North, Range 1 West, Section 12.

Three (3) records were noted within a two-mile radius of your project and are included on the enclosed computer printout. A key to the fields is also included.

Please remember that the lack of rare element information from a given area does not mean that there are no significant elements there, only that there is no information known to us from the site. To assure that there are no important elements present, you should inventory the site, at the appropriate season.

Please note that at this time ONHP does not have computerized records available for all anadromous fish in Oregon. I have listed below the species which may be present within the waterways contained in the project area. I have also included their listing by the National Marine Fisheries Service (NMFS). For more information on anadromous fish you may wish to contact NMFS at: 525 NE Oregon Street; Portland, Oregon 97232-2737.

Columbia River cutthroat trout	*Oncorhynchus clarki*	Proposed Threatened
Chum salmon (Lower Columbia River)	*Oncorhynchus keta*	Threatened

This data is confidential and for the specific purposes of your project and is **not to be distributed.**

If you need additional information or have any questions, please do not hesitate to contact me.

Sincerely,

Terry Campos
Conservation Information Assistant

encl: invoice

NAME: ONCORHYNCHUS KISUTCH POP 1
COMMON NAME: COHO SALMON (LOWER COLUMBIA RIVER/SW WASHINGTON COAST RUNS)
EO-CODE: AFCHA02031*037 LAST OBS: 1999-PRE FED STATUS: C
COUNTY(s): COLUMBIA FIRST OBS: STATE STATUS: SC
MULTNOMAH
CLACKAMAS
QUAD NAMES: OREGON CITY LAT: SIZE:
GLADSTONE
LAKE OSWEGO
PORTLAND
LINNTON
SAUVIE ISLAND
ST HELENS
PHYSIOGRAPHIC PROV: LONG: MINELEV (Feet):
T-R-S: QUADCODE: 4512235 MAXELEV (Feet):
4512245
4512246
4512256
4512257
4512267
4512277
T-R-S COMMENTS: PRECISION: M
EO-RANK/COMM: :
DIRECTIONS: SCAPPOOSE BAY, MULTNOMAH CHANNEL, WILLAMETTE RIVER
DESCRIPTION:
EO-DATA: ODFW DISTRIBUTION MAPS USED TO CREATE THE 1:24,000 COVERAGE
EOTYPE: REARING & MIGRATION - fish
COMMENTS: DISTRIBUTION INFORMATION USED IN THIS EOR WAS DERIVED FROM ODFW GEOGRAPHIC RESOURCES DATA PRODUCED AND DISTRIBUTED IN 1999. UNLESS SPECIFIC DATA EXISTS IN THE DATA FIELD, THE INFORMATION PRESENTED IN THIS EOR REPRESENTS THE "BEST PROFESSIONAL JUDGMENT" BY ODFW'S DISTRICT FISHERIES BIOLOGIST; THE PRESENCE OF COHO IN DESCRIBED AREAS SHOULD BE CONSIDERED UNDOCUMENTED BUT AS HAVING A POTENTIAL OF BEING PRESENT.
ANNUAL OBSERVATION:
OWNER:
MANAGED AREA:
MANAGE COMM:
PROT COMM:
BEST SOURCE: 1999 ODFW GEOGRAPHIC RESOURCES DATA; MASSEY, JAY; BENNETT, DON.

NAME: ONCORHYNCHUS TSHAWYTSCHA POP 1
COMMON NAME: CHINOOK SALMON - LOWER COLUMBIA RIVER
EO-CODE: AFCHA0205C*006 LAST OBS: 1999-PRE FED STATUS: LT
COUNTY(s): CLACKAMAS FIRST OBS: STATE STATUS: SC
MULTNOMAH
COLUMBIA
QUAD NAMES: OREGON CITY LAT: SIZE:
GLADSTONE
LAKE OSWEGO
PORTLAND
LINNTON
SAUVIE ISLAND
PHYSIOGRAPHIC PROV: LONG: MINELEV (Feet):
T-R-S: QUADCODE: 4512235 MAXELEV (Feet):
4512245
4512246
4512256
4512257
4512267
T-R-S COMMENTS: PRECISION: M
EO-RANK/COMM: :
DIRECTIONS: SCAPPOOSE BAY & TRIBS, WILLAMETE RIVER & TRIBS
DESCRIPTION:

EO-DATA: FALL RUN; ODFW DISTRIBUTION MAPS USED TO CREATE THE 1:24,000 COVERAGE
EOTYPE: REARING & MIGRATION - fish
COMMENTS: DISTRIBUTION INFORMATION USED IN THIS EOR WAS DERIVED FROM ODFW GEOGRAPHIC RESOURCES DATA PRODUCED AND DISTRIBUTED IN 1999. UNLESS SPECIFIC DATA EXISTS IN THE DATA FIELD, THE INFORMATION PRESENTED IN THIS EOR REPRESENTS THE "BEST PROFESSIONAL JUDGMENT" BY ODFW'S DISTRICT FISHERIES BIOLOGIST; THE PRESENCE OF CHINOOK IN DESCRIBED AREAS SHOULD BE CONSIDERED UNDOCUMENTED BUT AS HAVING A POTENTIAL OF BEING PRESENT.
ANNUAL OBSERVATION:
OWNER:
MANAGED AREA:
MANAGE COMM:
PROT COMM:
BEST SOURCE: 1999 ODFW GEOGRAPHIC RESOURCES DATA; MASSEY, JAY; BENNETT, DON; CALDWELL, DICK.

NAME: ONCORHYNCHUS MYKISS POP 14
COMMON NAME: LOWER COLUMBIA RIVER STEELHEAD
EO-CODE: AFCHA0209N*001 LAST OBS: 1999-PRE FED STATUS: LT
COUNTY(s): CLACKAMAS FIRST OBS: STATE STATUS: SC
MULTNOMAH
COLUMBIA
QUAD NAMES: OREGON CITY LAT: SIZE:
GLADSTONE
LAKE OSWEGO
PORTLAND
LINNTON
SAUVIE ISLAND
ST HELENS
PHYSIOGRAPHIC PROV: LONG: MINELEV (Feet):
T-R-S: QUADCODE: 4512235 MAXELEV (Feet):
4512245
4512246
4512256
4512257
4512267
4512277
T-R-S COMMENTS: PRECISION: M
EO-RANK/COMM: :
DIRECTIONS: SCAPPOOSE BAY; MULTNOMAH CHANNEL; WILLAMETTE RIVER
DESCRIPTION:
EO-DATA: WINTER RUN: ODFW DISTRIBUTIION MAPS USED TO CREATE THE 1:24,000 COVERAGE
EOTYPE: REARING & MIGRATION - fish
COMMENTS: DISTRIBUTION INFORMATION USED IN THIS EOR WAS DERIVED FROM ODFW GEOGRAPHIC RESOURCES DATA PRODUCED AND DISTRIBUTED IN 1999. UNLESS SPECIFIC DATA EXISTS IN THE DATA FIELD, THE INFORMATION PRESENTED IN THIS EOR REPRESENTS THE "BEST PROFESSIONAL JUDGMENT" BY ODFW'S DISTRICT FISHERIES BIOLOGIST; THE PRESENCE OF STEELHEAD IN DESCRIBED AREAS SHOULD BE CONSIDERED UNDOCUMENTED BUT AS HAVING A POTENTIAL OF BEING PRESENT.
ANNUAL OBSERVATION:
OWNER:
MANAGED AREA:
MANAGE COMM:
PROT COMM:
BEST SOURCE: 1999 ODFW GEOGRAPHIC RESOURCES DATA; MASSEY, JAY; BENNETT, DON.

Records listed.

Output form

KEY TO PRINTOUT

NAME AND COMMON NAME: The scientific and common name of the species.
EO-CODE (element occurrence code): Unique Heritage Program code for this occurrence. The first 10 characters are the code for the species, and the last 3 are the occurrence number.
COUNTY(S): County name(s)
QUAD NAMES: Name of the USGS topographic quadrangle map(s) where the record is mapped.
PHYSIOGRAPHIC PROVINCE: Code for physiographic province. CR=Coast Range, WV=Willamette Valley, KM=Klamath Mountains, WC=West slope and crest of the Cascades, EC=East slope of the Cascades, BM=Ochoco, Blue and Wallowa Mts., BR=Basin and Range, HP=High Lava Plains, OU=Owyhee uplands, CB=Columbia Basin.
T-R-S: Township, Range and Section, with township first, range second and section third (a space appears between range and section). 004S029E 32 = Township 4S, Range 29E, Section 32. Fractional townships and ranges are further defined in the T-R COMMENTS field.
T-R-S COMMENTS: Comments relating to township, range or section(s), e.g. SE4NE4 or SENE=SE 1/4 of the NE 1/4
LASTOBS: Last reported sighting date, in the form YYYY-MM-DD
FIRSTOBS: First reported sighting date for this occurrence in the form YYYY-MM-DD
LAT: latitude, North
LONG: longitude, West
QUADCODE: Heritage Program code for the USGS topo map
FED STATUS: US Fish and Wildlife Service status. LE=listed endangered, LT=listed threatened, PE or PT=proposed endangered or threatened, C=candidate for listing with enough information available for listing, SOC=species of concern.
STATE STATUS: For animals, Oregon Department of Fish and Wildlife status; LE=listed endangered, PE=proposed endangered, PT=proposed threatened, SC or C=sensitive-critical, SV or V=sensitive-vulnerable, SP or P=sensitive peripheral or naturally rare, SU or U=sensitive-undetermined. For plants, Oregon Department of Agriculture status; LE=listed endangered, LT=listed threatened, C=candidate.
SIZE: in acres, whole numbers. 0=unknown
MINELEV: Minimum elevation, in feet.
MAXELEV: Maximum elevation in feet.
PRECISION: Second (S)=exact location, Minute (M)=location known to nearest 1.5 miles, General (G)=location known to nearest 5 miles.
EO-RANK/COMM: Relative quality of this occurrence (A=best site, B=good population or site, C=fair or small population, D=marginal or destroyed occurrence)
DIRECTIONS: Site name and direction to site
DESCRIPTION: Habitat information, e.g. aspect, slope, soils, associated species, community type, etc.
EO-DATA: Species and population biology - numbers, age, nesting success, vigor, phenology, disease, pollinators, etc.
EOTYPE: For animals, type of occurrence, e.g. roost, nest, etc.
COMMENTS: Miscellaneous comments
ANNUAL OBSERVATIONS: Summary of yearly observations
OWNER: federal, state, private, etc.
MANAGED AREA: BLM district, USFS Forest, Private Preserve, etc.
MANAGE COMM: Comments on how the site is managed.
PROT COMM (Protection Comments): Comments regarding protectibility and threats.
BEST SOURCE: Best source of information for this occurrence.

Appendix D – Ecological Risk Screening Tables

Appendix D Ecological Screening - Frequency of Detection - Tar Pond Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	3	3	100%
Arsenic	3	1	33%
Beryllium	3	0	0%
Cadmium	3	0	0%
Chromium	3	3	100%
Copper	3	3	100%
Lead	3	3	100%
Mercury	3	0	0%
Nickel	3	3	100%
Selenium	3	0	0%
Silver	3	0	0%
Thallium	3	0	0%
Zinc	3	3	100%
Cyanide	3	3	100%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	3	0	0%
2,4,5-Trichlorophenol	3	0	0%
2,4,6-Trichlorophenol	3	0	0%
2,4-Dichlorophenol	3	0	0%
2,4-Dimethylphenol	3	0	0%
2,4-Dinitrophenol	3	0	0%
2-Chlorophenol	3	0	0%
2-Methyl-4,6-dinitrophenol	3	0	0%
2-Methylphenol	0	0	--
2-Nitrophenol	3	0	0%
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	3	0	0%
4-Methylphenol	3	0	0%
4-Nitrophenol	3	0	0%
Benzene	3	0	0%
Ethylbenzene	3	0	0%
Pentachlorophenol	3	0	0%
Phenol	3	0	0%
Toluene	3	0	0%
Xylenes	3	0	0%
Polyaromatic Compounds			
Acenaphthene	14	11	79%
Acenaphthylene	14	12	86%
Anthracene	14	13	93%
Benzo(a)anthracene	14	14	100%
Benzo(a)pyrene	14	14	100%
Benzo(b)fluoranthene	14	14	100%
Benzo(g,h,i)perylene	14	14	100%
Benzo(k)fluoranthene	14	14	100%
Chrysene	14	14	100%
Dibenzo(a,h)anthracene	14	13	93%
Fluoranthene	14	14	100%
Fluorene	14	10	71%
Indeno(1,2,3-cd)pyrene	14	14	100%
Naphthalene	14	12	86%
Phenanthrene	14	14	100%
Pyrene	14	14	100%

Appendix D Ecological Screening - Background Concentrations - Tar Pond Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.87	NA
Arsenic	5.81	1.11	0.19
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	11.90	0.45
Copper	34.34	16.70	0.49
Lead	24.02	10.80	0.45
Mercury	0.04	0.50	12.50
Nickel	21.04	5.92	0.28
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	67.20	0.70
Cyanide	NA	0.80	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26.00	NA
2,4,5-Trichlorophenol	NA	26.00	NA
2,4,6-Trichlorophenol	NA	26.00	NA
2,4-Dichlorophenol	NA	26.00	NA
2,4-Dimethylphenol	NA	26.00	NA
2,4-Dinitrophenol	NA	49.00	NA
2-Chlorophenol	NA	26.00	NA
2-Methyl-4,6-dinitrophenol	NA	26.00	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	26.00	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	26.00	NA
4-Methylphenol	NA	26.00	NA
4-Nitrophenol	NA	26.00	NA
Benzene	NA	0.15	NA
Ethylbenzene	NA	0.15	NA
Pentachlorophenol	NA	26.00	NA
Phenol	NA	26.00	NA
Toluene	NA	0.15	NA
Xylenes	NA	0.15	NA
Polyaromatic Compounds			
Acenaphthene	NA	9	NA
Acenaphthylene	NA	29	NA
Anthracene	NA	16	NA
Benzo(a)anthracene	NA	50	NA
Benzo(a)pyrene	NA	129	NA
Benzo(b)fluoranthene	NA	124	NA
Benzo(g,h,i)perylene	NA	202	NA
Benzo(k)fluoranthene	NA	45	NA
Chrysene	NA	75	NA
Dibenzo(a,h)anthracene	NA	33	NA
Fluoranthene	NA	111	NA
Fluorene	NA	6	NA
Indeno(1,2,3-cd)pyrene	NA	141	NA
Naphthalene	NA	9	NA
Phenanthrene	NA	37	NA
Pyrene	NA	134	NA

NWT 002938

Appendix D Ecological Screening - Screening Benchmark Values - Tar Pond Area Surface Soil

No. of COIs = 48

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	1.84	0.37	0.00	0.37	0.37
Arsenic	0	7	1.11	0.16	0.00	0.16	0.16
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.00	0.13	0.13
Chromium	0	30	11.90	0.40	0.00	0.40	0.40
Copper	0	50	16.70	0.33	0.00	0.33	0.33
Lead	0	50	10.80	0.22	0.00	0.22	0.22
Mercury	0	0.1	0.50	5.00	0.03	5.00	5.00
Nickel	0	30	5.95	0.20	0.00	0.20	0.20
Selenium	0	0.3	0.50	1.67	0.01	1.67	1.67
Silver	0	2	0.50	0.25	0.00	0.25	0.25
Thallium	0	1	5.00	5.00	0.03	5.00	5.00
Zinc	0	24	68.39	2.85	0.02	2.85	2.85
Cyanide	0	780	0.78	0.00	0.00	0.00	0.00
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	26.00	1.30	0.01	1.30	1.30
2,4,5-Trichlorophenol	0	9	26.00	2.89	0.02	2.89	2.89
2,4,6-Trichlorophenol	0	10	26.00	2.60	0.02	2.60	2.60
2,4-Dichlorophenol	0	20	26.00	1.30	0.01	1.30	1.30
2,4-Dimethylphenol	0	20	26.00	1.30	0.01	1.30	1.30
2,4-Dinitrophenol	0	20	49.00	2.45	0.01	2.45	2.45
2-Chlorophenol	0	10	26.00	2.60	0.02	2.60	2.60
2-Methyl-4,6-dinitrophenol	0	--	26.00	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	26.00	3.71	0.02	3.71	3.71
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	26.00	--	NA	0.00	0.00
4-Methylphenol	0	--	26.00	--	NA	0.00	0.00
4-Nitrophenol	0	7	26.00	3.71	0.02	3.71	3.71
Benzene	0	172	0.15	0.00	0.00	0.00	0.00
Ethylbenzene	0	--	0.15	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	26.00	29.58	0.17	29.58	29.58
Phenol	0	30	26.00	0.87	0.01	0.87	0.87
Toluene	0	170	0.15	0.00	0.00	0.00	0.00
Xylenes	0	14	0.15	0.01	0.00	0.01	0.01
Polyaromatic Compounds							
Acenaphthene	0	20	9	0.46	0.00	0.46	0.46
Acenaphthylene	0	30	29	0.97	0.01	0.97	0.97
Anthracene	0	30	16	0.53	0.00	0.53	0.53
Benzo(a)anthracene	0	7	50	7.11	0.04	7.11	7.11
Benzo(a)pyrene	0	7	129	18.43	0.11	18.43	18.43
Benzo(b)fluoranthene	0	7	124	17.71	0.10	17.71	17.71
Benzo(g,h,i)perylene	0	30	202	6.73	0.04	6.73	6.73
Benzo(k)fluoranthene	0	7	45	6.43	0.04	6.43	6.43
Chrysene	0	7	75	10.77	0.06	10.77	10.77
Dibenzo(a,h)anthracene	0	7	33	4.67	0.03	4.67	4.67
Fluoranthene	0	30	111	3.68	0.02	3.68	3.68
Fluorene	0	30	6	0.20	0.00	0.20	0.20
Indeno(1,2,3-cd)pyrene	0	7	141	20.14	0.12	20.14	20.14
Naphthalene	0	30	9	0.31	0.00	0.31	0.31
Phenanthrene	0	30	37	1.24	0.01	1.24	1.24
Pyrene	0	30	134	4.46	0.03	4.46	4.46
Sum of R				172.816864			

Appendix D Ecological Screening - Detection Limit / SBV Comparison - Tar Pond Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	3
Arsenic	1	7	1
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	3
Copper	1	50	3
Lead	1	50	3
Mercury	1	0.1	0
Nickel	1	30	3
Selenium	1	0.3	0
Silver	1	2	0
Thallium	10	1	0
Zinc	1	24	3
Cyanide	0.1	780	3
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	52.0	20	0
2,4,5-Trichlorophenol	52.0	9	0
2,4,6-Trichlorophenol	52.0	10	0
2,4-Dichlorophenol	52.0	20	0
2,4-Dimethylphenol	52.0	20	0
2,4-Dinitrophenol	98.0	20	0
2-Chlorophenol	52.0	10	0
2-Methyl-4,6-dinitrophenol	52.0	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	52.0	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	52.0	--	0
4-Methylphenol	52.0	--	0
4-Nitrophenol	52.0	7	0
Benzene	0.3	172	0
Ethylbenzene	0.3	--	0
Pentachlorophenol	52.0	0.879	0
Phenol	52.0	30	0
Toluene	0.3	170	0
Xylenes	0.3	14	0
Polyaromatic Compounds			
Acenaphthene	5	20	11
Acenaphthylene	0.05	30	12
Anthracene	0.05	30	13
Benzo(a)anthracene	0.05	7	14
Benzo(a)pyrene	0.05	7	14
Benzo(b)fluoranthene	0.05	7	14
Benzo(g,h,i)perylene	0.05	30	14
Benzo(k)fluoranthene	0.05	7	14
Chrysene	0.05	7	14
Dibenzo(a,h)anthracene	0.05	7	13
Fluoranthene	0.05	30	14
Fluorene	5	30	10
Indeno(1,2,3-cd)pyrene	0.05	7	14
Naphthalene	0.05	30	12
Phenanthrene	0.05	30	14
Pyrene	0.05	30	14

Appendix D Soil Chemical Data Statistics - Tar Pond Area Surface

	Final EC	Source Statistic Type
Metals and Inorganics		
Antimony	1.84	Upper Confidence Limit Arithmetic
Arsenic	1.11	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	11.90	Maximum
Copper	16.70	Maximum
Lead	10.80	Maximum
Mercury	0.50	Upper Confidence Limit Arithmetic
Nickel	5.95	Upper Confidence Limit Log
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	5.00	Maximum
Zinc	68.39	Upper Confidence Limit Log
Cyanide	0.78	Upper Confidence Limit Arithmetic
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	26.00	Maximum
2,4,5-Trichlorophenol	26.00	Maximum
2,4,6-Trichlorophenol	26.00	Maximum
2,4-Dichlorophenol	26.00	Maximum
2,4-Dimethylphenol	26.00	Maximum
2,4-Dinitrophenol	49.00	Maximum
2-Chlorophenol	26.00	Maximum
2-Methyl-4,6-dinitrophenol	26.00	Maximum
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	26.00	Maximum
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	26.00	Maximum
4-Methylphenol	26.00	Maximum
4-Nitrophenol	26.00	Maximum
Benzene	0.15	Upper Confidence Limit Log
Ethylbenzene	0.15	Upper Confidence Limit Log
Pentachlorophenol	26.00	Maximum
Phenol	26.00	Maximum
Toluene	0.15	Upper Confidence Limit Log
Xylenes	0.15	Upper Confidence Limit Log
Polyaromatic Compounds		
Acenaphthene	9.2	Maximum
Acenaphthylene	29.1	Maximum
Anthracene	16.0	Maximum
Benzo(a)anthracene	49.8	Maximum
Benzo(a)pyrene	129.0	Maximum
Benzo(b)fluoranthene	124.0	Maximum
Benzo(g,h,i)perylene	202.0	Maximum
Benzo(k)fluoranthene	45.0	Maximum
Chrysene	75.4	Maximum
Dibenzo(a,h)anthracene	32.7	Maximum
Fluoranthene	110.5	Maximum
Fluorene	5.9	Maximum
Indeno(1,2,3-cd)pyrene	141.0	Maximum
Naphthalene	9.4	Maximum
Phenanthrene	37.3	Maximum
Pyrene	133.8	Maximum

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Appendix D Ecological Screening - Frequency of Detection - Tar Pond Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	3	3	100%
Arsenic	7	1	14%
Beryllium	3	0	0%
Cadmium	3	0	0%
Chromium	3	3	100%
Copper	3	3	100%
Lead	3	3	100%
Mercury	3	0	0%
Nickel	3	3	100%
Selenium	3	0	0%
Silver	3	0	0%
Thallium	3	0	0%
Zinc	3	3	100%
Cyanide	1	1	100%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	1	0	0%
2,4,5-Trichlorophenol	1	0	0%
2,4,6-Trichlorophenol	1	0	0%
2,4-Dichlorophenol	1	0	0%
2,4-Dimethylphenol	1	0	0%
2,4-Dinitrophenol	1	0	0%
2-Chlorophenol	1	0	0%
2-Methyl-4,6-dinitrophenol	1	0	0%
2-Methylphenol	0	0	--
2-Nitrophenol	1	0	0%
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	1	0	0%
4-Methylphenol	1	0	0%
4-Nitrophenol	1	0	0%
Benzene	8	4	50%
Ethylbenzene	8	4	50%
Pentachlorophenol	1	0	0%
Phenol	1	0	0%
Toluene	8	4	50%
Xylenes	8	4	50%
Polyaromatic Compounds			
Acenaphthene	9	9	100%
Acenaphthylene	9	9	100%
Anthracene	9	9	100%
Benzo(a)anthracene	9	9	100%
Benzo(a)pyrene	9	9	100%
Benzo(b)fluoranthene	9	9	100%
Benzo(g,h,i)perylene	9	7	78%
Benzo(k)fluoranthene	9	9	100%
Chrysene	9	9	100%
Dibenzo(a,h)anthracene	9	8	89%
Fluoranthene	9	9	100%
Fluorene	9	8	89%
Indeno(1,2,3-cd)pyrene	9	8	89%
Naphthalene	9	9	100%
Phenanthrene	9	9	100%
Pyrene	9	9	100%

Appendix D Ecological Screening - Background Concentrations - Tar Pond Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.54	NA
Arsenic	5.81	1.10	0.19
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	10.60	0.40
Copper	34.34	10.70	0.31
Lead	24.02	18.30	0.76
Mercury	0.04	0.50	12.50
Nickel	21.04	11.10	0.53
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	62.60	0.66
Cyanide	NA	3.90	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26.00	NA
2,4,5-Trichlorophenol	NA	26.00	NA
2,4,6-Trichlorophenol	NA	26.00	NA
2,4-Dichlorophenol	NA	26.00	NA
2,4-Dimethylphenol	NA	26.00	NA
2,4-Dinitrophenol	NA	46.00	NA
2-Chlorophenol	NA	26.00	NA
2-Methyl-4,6-dinitrophenol	NA	26.00	NA
2-Methylphenol	NA	–	NA
2-Nitrophenol	NA	26.00	NA
3-Methylphenol	NA	–	NA
4-Chloro-3-methylphenol	NA	26.00	NA
4-Methylphenol	NA	26.00	NA
4-Nitrophenol	NA	26.00	NA
Benzene	NA	107.00	NA
Ethylbenzene	NA	103.00	NA
Pentachlorophenol	NA	26.00	NA
Phenol	NA	26.00	NA
Toluene	NA	78.10	NA
Xylenes	NA	141.00	NA
Polyaromatic Compounds			
Acenaphthene	NA	369	NA
Acenaphthylene	NA	138	NA
Anthracene	NA	263	NA
Benzo(a)anthracene	NA	357	NA
Benzo(a)pyrene	NA	400	NA
Benzo(b)fluoranthene	NA	411	NA
Benzo(g,h,i)perylene	NA	152	NA
Benzo(k)fluoranthene	NA	99	NA
Chrysene	NA	343	NA
Dibenzo(a,h)anthracene	NA	21	NA
Fluoranthene	NA	1390	NA
Fluorene	NA	266	NA
Indeno(1,2,3-cd)pyrene	NA	110	NA
Naphthalene	NA	3460	NA
Phenanthrene	NA	1190	NA
Pyrene	NA	2190	NA

Appendix D Ecological Screening - Screening Benchmark Values - Tar Pond Area Subsurface Soil

No. COIs = 48

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	1.54	0.31	0.00	0.31	0.31
Arsenic	0	7	1.10	0.16	0.00	0.16	0.16
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.00	0.13	0.13
Chromium	0	30	10.78	0.36	0.00	0.36	0.36
Copper	0	50	10.64	0.21	0.00	0.21	0.21
Lead	0	50	18.30	0.37	0.00	0.37	0.37
Mercury	0	0.1	0.50	5.00	0.01	5.00	5.00
Nickel	0	30	11.10	0.37	0.00	0.37	0.37
Selenium	0	0.3	0.50	1.67	0.00	1.67	1.67
Silver	0	2	0.50	0.25	0.00	0.25	0.25
Thallium	0	1	5.00	5.00	0.01	5.00	5.00
Zinc	0	24	62.12	2.59	0.00	2.59	2.59
Cyanide	0	780	3.90	0.01	0.00	0.01	0.01
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	26.00	1.30	0.00	1.30	1.30
2,4,5-Trichlorophenol	0	9	26.00	2.89	0.00	2.89	2.89
2,4,6-Trichlorophenol	0	10	26.00	2.60	0.00	2.60	2.60
2,4-Dichlorophenol	0	20	26.00	1.30	0.00	1.30	1.30
2,4-Dimethylphenol	0	20	26.00	1.30	0.00	1.30	1.30
2,4-Dinitrophenol	0	20	46.00	2.30	0.00	2.30	2.30
2-Chlorophenol	0	10	26.00	2.60	0.00	2.60	2.60
2-Methyl-4,6-dinitrophenol	0	--	26.00	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	26.00	3.71	0.01	3.71	3.71
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	26.00	--	NA	0.00	0.00
4-Methylphenol	0	--	26.00	--	NA	0.00	0.00
4-Nitrophenol	0	7	26.00	3.71	0.01	3.71	3.71
Benzene	0	172	107.00	0.62	0.00	0.62	0.62
Ethylbenzene	0	--	103.00	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	26.00	29.58	0.05	29.58	29.58
Phenol	0	30	26.00	0.87	0.00	0.87	0.87
Toluene	0	170	78.10	0.46	0.00	0.46	0.46
Xylenes	0	14	141.00	10.07	0.02	10.07	10.07
Polyaromatic Compounds							
Acenaphthene	0	20	369	18.45	0.03	18.45	18.45
Acenaphthylene	0	30	138	4.60	0.01	4.60	4.60
Anthracene	0	30	263	8.77	0.01	8.77	8.77
Benzo(a)anthracene	0	7	357	51.00	0.08	51.00	51.00
Benzo(a)pyrene	0	7	400	57.14	0.09	57.14	57.14
Benzo(b)fluoranthene	0	7	411	58.71	0.09	58.71	58.71
Benzo(g,h,i)perylene	0	30	152	5.07	0.01	5.07	5.07
Benzo(k)fluoranthene	0	7	99	14.17	0.02	14.17	14.17
Chrysene	0	7	343	49.00	0.08	49.00	49.00
Dibenzo(a,h)anthracene	0	7	21	3.04	0.00	3.04	3.04
Fluoranthene	0	30	1390	46.33	0.07	46.33	46.33
Fluorene	0	30	266	8.87	0.01	8.87	8.87
Indeno(1,2,3-cd)pyrene	0	7	110	15.71	0.02	15.71	15.71
Naphthalene	0	30	3460	115.33	0.18	115.33	115.33
Phenanthrene	0	30	1190	39.67	0.06	39.67	39.67
Pyrene	0	30	2190	73.00	0.11	73.00	73.00
Sum of R				648.655937			

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Appendix D Ecological Screening - Detection Limit / SBV Comparison - Tar Pond Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	3
Arsenic	1	7	1
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	3
Copper	1	50	3
Lead	1	50	3
Mercury	1	0.1	0
Nickel	1	30	3
Selenium	1	0.3	0
Silver	1	2	0
Thallium	10	1	0
Zinc	1	24	3
Cyanide	0.02	780	1
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	52.0	20	0
2,4,5-Trichlorophenol	52.0	9	0
2,4,6-Trichlorophenol	52.0	10	0
2,4-Dichlorophenol	52.0	20	0
2,4-Dimethylphenol	52.0	20	0
2,4-Dinitrophenol	98.0	20	0
2-Chlorophenol	52.0	10	0
2-Methyl-4,6-dinitrophenol	52.0	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	52.0	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	52.0	--	0
4-Methylphenol	52.0	--	0
4-Nitrophenol	52.0	7	0
Benzene	0.025	172	4
Ethylbenzene	0.025	--	4
Pentachlorophenol	52.0	0.879	0
Phenol	52.0	30	0
Toluene	0.025	170	4
Xylenes	0.074	14	4
Polyaromatic Compounds			
Acenaphthene	5	20	9
Acenaphthylene	0.05	30	9
Anthracene	0.05	30	9
Benzo(a)anthracene	0.05	7	9
Benzo(a)pyrene	0.05	7	9
Benzo(b)fluoranthene	0.05	7	9
Benzo(g,h,i)perylene	1	30	7
Benzo(k)fluoranthene	0.05	7	9
Chrysene	0.05	7	9
Dibenzo(a,h)anthracene	1	7	8
Fluoranthene	0.05	30	9
Fluorene	5	30	8
Indeno(1,2,3-cd)pyrene	1	7	8
Naphthalene	0.05	30	9
Phenanthrene	0.05	30	9
Pyrene	0.05	30	9

Appendix D Soil Chemical Data Statistics - Tar Pond Area Subsurface Soil

	Final EC	Source Statistic Type
Metals and Inorganics		
Antimony	1.54	Maximum
Arsenic	1.10	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	10.78	Upper Confidence Limit Log
Copper	10.64	Upper Confidence Limit Arithmetic
Lead	18.30	Maximum
Mercury	0.50	Upper Confidence Limit Arithmetic
Nickel	11.10	Maximum
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	5.00	Maximum
Zinc	62.12	Upper Confidence Limit Arithmetic
Cyanide	3.90	Upper Confidence Limit Arithmetic
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	26.00	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	26.00	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	26.00	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	26.00	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	26.00	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	46.00	Upper Confidence Limit Arithmetic
2-Chlorophenol	26.00	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	26.00	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	26.00	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	26.00	Upper Confidence Limit Arithmetic
4-Methylphenol	26.00	Upper Confidence Limit Arithmetic
4-Nitrophenol	26.00	Upper Confidence Limit Arithmetic
Benzene	107	Maximum
Ethylbenzene	103	Maximum
Pentachlorophenol	26.00	Upper Confidence Limit Arithmetic
Phenol	26.00	Upper Confidence Limit Arithmetic
Toluene	78	Maximum
Xylenes	141	Maximum
Polyaromatic Compounds		
Acenaphthene	369	Maximum
Acenaphthylene	138	Maximum
Anthracene	263	Maximum
Benzo(a)anthracene	357	Maximum
Benzo(a)pyrene	400	Maximum
Benzo(b)fluoranthene	411	Maximum
Benzo(g,h,i)perylene	152	Maximum
Benzo(k)fluoranthene	99	Maximum
Chrysene	343	Maximum
Dibenzo(a,h)anthracene	21	Maximum
Fluoranthene	1390	Maximum
Fluorene	266	Maximum
Indeno(1,2,3-cd)pyrene	110	Maximum
Naphthalene	3460	Maximum
Phenanthrene	1190	Maximum
Pyrene	2190	Maximum

Appendix D Ecological Screening - Frequency of Detection - Spend Oxide Area Surface Soil

	Site Wide Soil Number of Samples	Site Wide Soil Number of Detects	Site Wide Soil Percent Detect
Metals and Inorganics			
Antimony	4	3	75%
Arsenic	4	3	75%
Beryllium	4	0	0%
Cadmium	4	1	25%
Chromium	4	4	100%
Copper	4	4	100%
Lead	4	4	100%
Mercury	4	0	0%
Nickel	4	4	100%
Selenium	4	0	0%
Silver	4	0	0%
Thallium	4	2	50%
Zinc	4	4	100%
Cyanide	4	4	100%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	1	0	0%
Ethylbenzene	1	0	0%
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	1	0	0%
Xylenes	1	0	0%
Polyaromatic Compounds			
Acenaphthene	6	5	83%
Acenaphthylene	6	3	50%
Anthracene	6	4	67%
Benzo(a)anthracene	6	6	100%
Benzo(a)pyrene	6	6	100%
Benzo(b)fluoranthene	6	6	100%
Benzo(g,h,i)perylene	6	6	100%
Benzo(k)fluoranthene	6	5	83%
Chrysene	6	6	100%
Dibenzo(a,h)anthracene	6	5	83%
Fluoranthene	6	6	100%
Fluorene	6	3	50%
Indeno(1,2,3-cd)pyrene	6	6	100%
Naphthalene	6	5	83%
Phenanthrene	6	5	83%
Pyrene	6	6	100%

Appendix D Ecological Screening - Background Concentrations - Spent Oxide Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	6.60	NA
Arsenic	5.81	21.00	3.61
Beryllium	2.07	0.50	0.24
Cadmium	0.93	1.10	1.18
Chromium	26.57	30.00	1.13
Copper	34.34	60.00	1.75
Lead	24.02	60.00	2.50
Mercury	0.04	0.50	12.50
Nickel	21.04	26.00	1.24
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	7.60	NA
Zinc	95.52	160.00	1.68
Cyanide	NA	0.47	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	0.15	NA
Ethylbenzene	NA	0.15	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	0.15	NA
Xylenes	NA	0.15	NA
Polyaromatic Compounds			
Acenaphthene	NA	1	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	1	NA
Benzo(a)anthracene	NA	5	NA
Benzo(a)pyrene	NA	7	NA
Benzo(b)fluoranthene	NA	7	NA
Benzo(g,h,i)perylene	NA	6	NA
Benzo(k)fluoranthene	NA	5	NA
Chrysene	NA	6	NA
Dibenzo(a,h)anthracene	NA	2	NA
Fluoranthene	NA	9	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	5	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	6	NA
Pyrene	NA	10	NA

Appendix D Ecological Screening - Screening Benchmark Values - Spend Oxide Area Surface Soil

No. of COIs = 34

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	6.60	1.32	0.04	1.32	1.32
Arsenic	0	7	21.00	3.00	0.08	3.00	3.00
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	1.10	0.28	0.01	0.28	0.28
Chromium	0	30	30.00	1.00	0.03	1.00	1.00
Copper	0	50	60.00	1.20	0.03	1.20	1.20
Lead	0	50	60.00	1.20	0.03	1.20	1.20
Mercury	0	0.1	0.50	5.00	0.14	5.00	5.00
Nickel	0	30	26.00	0.87	0.02	0.87	0.87
Selenium	0	0.3	0.50	1.67	0.05	1.67	1.67
Silver	0	2	0.50	0.25	0.01	0.25	0.25
Thallium	0	1	7.60	7.60	0.21	7.60	7.60
Zinc	0	24	160.00	6.67	0.18	6.67	6.67
Cyanide	0	780	0.47	0.00	0.00	0.00	0.00
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	--	--	--	0.00	0.00
2,4,5-Trichlorophenol	0	9	--	--	--	0.00	0.00
2,4,6-Trichlorophenol	0	10	--	--	--	0.00	0.00
2,4-Dichlorophenol	0	20	--	--	--	0.00	0.00
2,4-Dimethylphenol	0	20	--	--	--	0.00	0.00
2,4-Dinitrophenol	0	20	--	--	--	0.00	0.00
2-Chlorophenol	0	10	--	--	--	0.00	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	--	0.00	0.00
2-Methylphenol	0	--	--	--	--	0.00	0.00
2-Nitrophenol	0	7	--	--	--	0.00	0.00
3-Methylphenol	0	--	--	--	--	0.00	0.00
4-Chloro-3-methylphenol	0	--	--	--	--	0.00	0.00
4-Methylphenol	0	--	--	--	--	0.00	0.00
4-Nitrophenol	0	7	--	--	--	0.00	0.00
Benzene	0	172	0.15	0.00	0.00	0.00	0.00
Ethylbenzene	0	--	0.15	--	--	0.00	0.00
Pentachlorophenol	0	0.879	--	--	--	0.00	0.00
Phenol	0	30	--	--	--	0.00	0.00
Toluene	0	170	0.15	0.00	0.00	0.00	0.00
Xylenes	0	14	0.15	0.01	0.00	0.01	0.01
Polyaromatic Compounds							
Acenaphthene	0	20	1	0.03	0.00	0.03	0.03
Acenaphthylene	0	30	0	0.01	0.00	0.01	0.01
Anthracene	0	30	1	0.04	0.00	0.04	0.04
Benzo(a)anthracene	0	7	5	0.67	0.02	0.67	0.67
Benzo(a)pyrene	0	7	7	1.05	0.03	1.05	1.05
Benzo(b)fluoranthene	0	7	7	0.93	0.03	0.93	0.93
Benzo(g,h,i)perylene	0	30	6	0.21	0.01	0.21	0.21
Benzo(k)fluoranthene	0	7	5	0.70	0.02	0.70	0.70
Chrysene	0	7	6	0.84	0.02	0.84	0.84
Dibenzo(a,h)anthracene	0	7	2	0.24	0.01	0.24	0.24
Fluoranthene	0	30	9	0.29	0.01	0.29	0.29
Fluorene	0	30	0	0.01	0.00	0.01	0.01
Indeno(1,2,3-cd)pyrene	0	7	5	0.72	0.02	0.72	0.72
Naphthalene	0	30	0	0.02	0.00	0.02	0.02
Phenanthrene	0	30	6	0.19	0.01	0.19	0.19
Pyrene	0	30	10	0.35	0.01	0.35	0.35
Sum of R				36.4066427			

Appendix D Ecological Screening - Detection Limit / SBV Comparison - Spent Oxide Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	3
Arsenic	1	7	3
Beryllium	1	8	0
Cadmium	1	4	1
Chromium	1	30	4
Copper	1	50	4
Lead	1	50	4
Mercury	1	0.1	0
Nickel	1	30	4
Selenium	1	0.3	0
Silver	1	2	0
Thallium	1	1	2
Zinc	1	24	4
Cyanide	0.5	780	4
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	20	0
2,4,5-Trichlorophenol	NA	9	0
2,4,6-Trichlorophenol	NA	10	0
2,4-Dichlorophenol	NA	20	0
2,4-Dimethylphenol	NA	20	0
2,4-Dinitrophenol	NA	20	0
2-Chlorophenol	NA	10	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	NA	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	--	0
4-Nitrophenol	NA	7	0
Benzene	0.3	172	0
Ethylbenzene	0.3	--	0
Pentachlorophenol	NA	0.879	0
Phenol	NA	30	0
Toluene	0.3	170	0
Xylenes	0.3	14	0
Polyaromatic Compounds			
Acenaphthene	0.05	20	5
Acenaphthylene	0.05	30	3
Anthracene	0.05	30	4
Benzo(a)anthracene	0.05	7	6
Benzo(a)pyrene	0.05	7	6
Benzo(b)fluoranthene	0.05	7	6
Benzo(g,h,i)perylene	0.05	30	6
Benzo(k)fluoranthene	0.05	7	5
Chrysene	0.05	7	6
Dibenzo(a,h)anthracene	0.05	7	5
Fluoranthene	0.05	30	6
Fluorene	0.05	30	3
Indeno(1,2,3-cd)pyrene	0.05	7	6
Naphthalene	0.05	30	5
Phenanthrene	0.05	30	5
Pyrene	0.05	30	6

Appendix D Soil Chemical Data Statistics - Spent Oxide Surface Soil

	Final EC	Source Statistic Type
Metals and Inorganics		
Antimony	6.60	Maximum
Arsenic	21.00	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	1.10	Maximum
Chromium	30.00	Maximum
Copper	60.00	Maximum
Lead	60.00	Maximum
Mercury	0.50	Maximum
Nickel	26.00	Maximum
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	7.60	Maximum
Zinc	160.00	Maximum
Cyanide	0.47	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	--	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Chlorophenol	--	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	--	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	--	Upper Confidence Limit Arithmetic
4-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Nitrophenol	--	Upper Confidence Limit Arithmetic
Benzene	0.15	Upper Confidence Limit Arithmetic
Ethylbenzene	0.15	Upper Confidence Limit Arithmetic
Pentachlorophenol	--	Upper Confidence Limit Arithmetic
Phenol	--	Upper Confidence Limit Arithmetic
Toluene	0.15	Upper Confidence Limit Arithmetic
Xylenes	0.15	Upper Confidence Limit Arithmetic
Polyaromatic Compounds		
Acenaphthene	0.51	Maximum
Acenaphthylene	0.41	Maximum
Anthracene	1.10	Maximum
Benzo(a)anthracene	4.70	Maximum
Benzo(a)pyrene	7.35	Maximum
Benzo(b)fluoranthene	6.50	Maximum
Benzo(g,h,i)perylene	6.30	Maximum
Benzo(k)fluoranthene	4.92	Maximum
Chrysene	5.85	Maximum
Dibenzo(a,h)anthracene	1.67	Maximum
Fluoranthene	8.55	Maximum
Fluorene	0.34	Maximum
Indeno(1,2,3-cd)pyrene	5.05	Maximum
Naphthalene	0.46	Maximum
Phenanthrene	5.80	Maximum
Pyrene	10.40	Maximum

Appendix D Ecological Screening - Frequency of Detection - Spend Oxide Area SubSurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	2	1	50%
Arsenic	4	4	100%
Beryllium	2	0	0%
Cadmium	2	0	0%
Chromium	2	2	100%
Copper	2	2	100%
Lead	2	2	100%
Mercury	2	0	0%
Nickel	2	2	100%
Selenium	2	0	0%
Silver	2	0	0%
Thallium	2	0	0%
Zinc	2	2	100%
Cyanide	2	1	50%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	4	1	25%
Ethylbenzene	4	0	0%
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	4	0	0%
Xylenes	4	1	25%
Polyaromatic Compounds			
Acenaphthene	5	1	20%
Acenaphthylene	5	1	20%
Anthracene	5	2	40%
Benzo(a)anthracene	5	4	80%
Benzo(a)pyrene	5	1	20%
Benzo(b)fluoranthene	5	5	100%
Benzo(g,h,i)perylene	5	5	100%
Benzo(k)fluoranthene	5	4	80%
Chrysene	5	5	100%
Dibenzo(a,h)anthracene	5	5	100%
Fluoranthene	5	5	100%
Fluorene	5	5	100%
Indeno(1,2,3-cd)pyrene	5	5	100%
Naphthalene	5	3	60%
Phenanthrene	5	4	80%
Pyrene	5	5	100%

Appendix D Ecological Screening - Background Concentrations - Spent Oxide Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.59	NA
Arsenic	5.81	4.89	0.84
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	15.20	0.57
Copper	34.34	18.90	0.55
Lead	24.02	47.00	1.96
Mercury	0.04	0.50	12.50
Nickel	21.04	16.10	0.77
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	0.50	NA
Zinc	95.52	67.30	0.70
Cyanide	NA	61.00	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	0.03	NA
Ethylbenzene	NA	0.01	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	0.01	NA
Xylenes	NA	0.17	NA
Polyaromatic Compounds			
Acenaphthene	NA	1	NA
Acenaphthylene	NA	30	NA
Anthracene	NA	34	NA
Benzo(a)anthracene	NA	315	NA
Benzo(a)pyrene	NA	432	NA
Benzo(b)fluoranthene	NA	563	NA
Benzo(g,h,i)perylene	NA	490	NA
Benzo(k)fluoranthene	NA	179	NA
Chrysene	NA	334	NA
Dibenzo(a,h)anthracene	NA	88	NA
Fluoranthene	NA	591	NA
Fluorene	NA	13	NA
Indeno(1,2,3-cd)pyrene	NA	389	NA
Naphthalene	NA	923	NA
Phenanthrene	NA	309	NA
Pyrene	NA	735	NA

Appendix D Ecological Screening - Screening Benchmark Values - Spend Oxide Area Subsurface Soil

No. of COIs = 34

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	1.59	0.32	0.00	0.32	0.32
Arsenic	0	7	4.50	0.64	0.00	0.64	0.64
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.00	0.13	0.13
Chromium	0	30	15.79	0.53	0.00	0.53	0.53
Copper	0	50	18.90	0.38	0.00	0.38	0.38
Lead	0	50	47.00	0.94	0.00	0.94	0.94
Mercury	0	0.1	0.50	5.00	0.01	5.00	5.00
Nickel	0	30	17.56	0.59	0.00	0.59	0.59
Selenium	0	0.3	0.50	1.67	0.00	1.67	1.67
Silver	0	2	0.50	0.25	0.00	0.25	0.25
Thallium	0	1	0.50	0.50	0.00	0.50	0.50
Zinc	0	24	73.18	3.05	0.01	3.05	3.05
Cyanide	0	780	61.00	0.08	0.00	0.08	0.08
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	--	--	NA	0.00	0.00
2,4,5-Trichlorophenol	0	9	--	--	NA	0.00	0.00
2,4,6-Trichlorophenol	0	10	--	--	NA	0.00	0.00
2,4-Dichlorophenol	0	20	--	--	NA	0.00	0.00
2,4-Dimethylphenol	0	20	--	--	NA	0.00	0.00
2,4-Dinitrophenol	0	20	--	--	NA	0.00	0.00
2-Chlorophenol	0	10	--	--	NA	0.00	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	--	--	NA	0.00	0.00
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00	0.00
4-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Nitrophenol	0	7	--	--	NA	0.00	0.00
Benzene	0	172	0.03	0.00	0.00	0.00	0.00
Ethylbenzene	0	--	0.01	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	--	--	NA	0.00	0.00
Phenol	0	30	--	--	NA	0.00	0.00
Toluene	0	170	0.01	0.00	0.00	0.00	0.00
Xylenes	0	14	0.17	0.01	0.00	0.01	0.01
Polyaromatic Compounds							
Acenaphthene	0	20	1	0.07	0.00	0.07	0.07
Acenaphthylene	0	30	30	1.01	0.00	1.01	1.01
Anthracene	0	30	34	1.14	0.00	1.14	1.14
Benzo(a)anthracene	0	7	315	45.00	0.10	45.00	45.00
Benzo(a)pyrene	0	7	432	61.71	0.14	61.71	61.71
Benzo(b)fluoranthene	0	7	563	80.43	0.18	80.43	80.43
Benzo(g,h,i)perylene	0	30	490	16.33	0.04	16.33	16.33
Benzo(k)fluoranthene	0	7	179	25.57	0.06	25.57	25.57
Chrysene	0	7	334	47.71	0.11	47.71	47.71
Dibenzo(a,h)anthracene	0	7	88	12.54	0.03	12.54	12.54
Fluoranthene	0	30	591	19.70	0.04	19.70	19.70
Fluorene	0	30	13	0.43	0.00	0.43	0.43
Indeno(1,2,3-cd)pyrene	0	7	389	55.57	0.12	55.57	55.57
Naphthalene	0	30	923	30.77	0.07	30.77	30.77
Phenanthrene	0	30	309	10.30	0.02	10.30	10.30
Pyrene	0	30	735	24.50	0.05	24.50	24.50
Sum of R				446.925762			

Appendix D Ecological Screening - Detection Limit / SBV Comparison - Spent Oxide Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	1
Arsenic	1	7	4
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	2
Copper	1	50	2
Lead	1	50	2
Mercury	1	0.1	0
Nickel	1	30	2
Selenium	1	0.3	0
Silver	1	2	0
Thallium	1	1	0
Zinc	1	24	2
Cyanide	0.5	780	1
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	20	0
2,4,5-Trichlorophenol	NA	9	0
2,4,6-Trichlorophenol	NA	10	0
2,4-Dichlorophenol	NA	20	0
2,4-Dimethylphenol	NA	20	0
2,4-Dinitrophenol	NA	20	0
2-Chlorophenol	NA	10	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	NA	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	--	0
4-Nitrophenol	NA	7	0
Benzene	0.3	172	1
Ethylbenzene	0.3	--	0
Pentachlorophenol	NA	0.879	0
Phenol	NA	30	0
Toluene	0.3	170	0
Xylenes	0.3	14	1
Polyaromatic Compounds			
Acenaphthene	0.05	20	1
Acenaphthylene	0.05	30	1
Anthracene	0.05	30	2
Benzo(a)anthracene	0.05	7	4
Benzo(a)pyrene	0.05	7	1
Benzo(b)fluoranthene	0.05	7	5
Benzo(g,h,i)perylene	0.05	30	5
Benzo(k)fluoranthene	0.05	7	4
Chrysene	0.05	7	5
Dibenzo(a,h)anthracene	0.05	7	5
Fluoranthene	0.05	30	5
Fluorene	0.05	30	5
Indeno(1,2,3-cd)pyrene	0.05	7	5
Naphthalene	0.05	30	3
Phenanthrene	0.05	30	4
Pyrene	0.05	30	5

Appendix D Soil Chemical Data Statistics - Spent Oxide Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.59	Maximum
Arsenic	4.50	Upper Confidence Limit Arithmetic
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	15.79	Upper Confidence Limit Log
Copper	18.90	Maximum
Lead	47.00	Maximum
Mercury	0.50	Upper Confidence Limit Arithmetic
Nickel	17.56	Upper Confidence Limit Log
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	0.50	Upper Confidence Limit Arithmetic
Zinc	73.18	Upper Confidence Limit Log
Cyanide	61.00	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	--	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Chlorophenol	--	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	--	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	--	Upper Confidence Limit Arithmetic
4-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Nitrophenol	--	Upper Confidence Limit Arithmetic
Benzene	0.03	Maximum
Ethylbenzene	0.01	Maximum
Pentachlorophenol	--	Upper Confidence Limit Arithmetic
Phenol	--	Upper Confidence Limit Arithmetic
Toluene	0.01	Maximum
Xylenes	0.17	Maximum
Polyaromatic Compounds		
Acenaphthene	1.3	Maximum
Acenaphthylene	30	Maximum
Anthracene	34	Maximum
Benzo(a)anthracene	315	Maximum
Benzo(a)pyrene	432	Maximum
Benzo(b)fluoranthene	563	Maximum
Benzo(g,h,i)perylene	490	Maximum
Benzo(k)fluoranthene	179	Maximum
Chrysene	334	Maximum
Dibenzo(a,h)anthracene	88	Maximum
Fluoranthene	591	Maximum
Fluorene	13	Maximum
Indeno(1,2,3-cd)pyrene	389	Maximum
Naphthalene	923	Maximum
Phenanthrene	309	Maximum
Pyrene	735	Maximum

Appendix D Ecological Screening - Frequency of Detection - FAMM Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	3	2	67%
Arsenic	3	1	33%
Beryllium	3	0	0%
Cadmium	3	0	0%
Chromium	3	2	67%
Copper	3	3	100%
Lead	3	2	67%
Mercury	3	0	0%
Nickel	3	3	100%
Selenium	3	0	0%
Silver	3	0	0%
Thallium	3	0	0%
Zinc	3	3	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	0	0	--
Ethylbenzene	0	0	--
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	0	0	--
Xylenes	0	0	--
Polyaromatic Compounds			
Acenaphthene	3	1	33%
Acenaphthylene	3	2	67%
Anthracene	3	1	33%
Benzo(a)anthracene	3	3	100%
Benzo(a)pyrene	3	3	100%
Benzo(b)fluoranthene	3	3	100%
Benzo(g,h,i)perylene	3	3	100%
Benzo(k)fluoranthene	3	3	100%
Chrysene	3	3	100%
Dibenzo(a,h)anthracene	3	3	100%
Fluoranthene	3	3	100%
Fluorene	3	1	33%
Indeno(1,2,3-cd)pyrene	3	3	100%
Naphthalene	3	2	67%
Phenanthrene	3	3	100%
Pyrene	3	3	100%

NWT 002957

Appendix D Ecological Screening - Background Concentrations - FAMM Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	2.26	NA
Arsenic	5.81	3.14	0.54
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	70.90	2.67
Copper	34.34	34.70	1.01
Lead	24.02	30.40	1.27
Mercury	0.04	0.50	12.50
Nickel	21.04	146.00	6.94
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	114.00	1.19
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	--	NA
Ethylbenzene	NA	--	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	--	NA
Xylenes	NA	--	NA
Polyaromatic Compounds			
Acenaphthene	NA	0	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	0	NA
Benzo(a)anthracene	NA	1	NA
Benzo(a)pyrene	NA	2	NA
Benzo(b)fluoranthene	NA	2	NA
Benzo(g,h,i)perylene	NA	2	NA
Benzo(k)fluoranthene	NA	1	NA
Chrysene	NA	2	NA
Dibenzo(a,h)anthracene	NA	0	NA
Fluoranthene	NA	3	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	2	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	2	NA
Pyrene	NA	3	NA

Appendix D Ecological Screening - Screening Benchmark Values - FAMM Area Surface Soil

No. of COIs = 28

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	2.26	0.45	0.02	0.45	0.45
Arsenic	0	7	3.14	0.45	0.02	0.45	0.45
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.00	0.13	0.13
Chromium	0	30	70.90	2.36	0.08	2.36	2.36
Copper	0	50	34.70	0.69	0.02	0.69	0.69
Lead	0	50	30.40	0.61	0.02	0.61	0.61
Mercury	0	0.1	0.50	5.00	0.18	5.00	5.00
Nickel	0	30	146.00	4.87	0.174	4.87	4.87
Selenium	0	0.3	0.50	1.67	0.06	1.67	1.67
Silver	0	2	0.50	0.25	0.01	0.25	0.25
Thallium	0	1	5.00	5.00	0.18	5.00	5.00
Zinc	0	24	114.00	4.75	0.17	4.75	4.75
Cyanide	0	780	--	--	NA	0.00	0.00
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	--	--	NA	0.00	0.00
2,4,5-Trichlorophenol	0	9	--	--	NA	0.00	0.00
2,4,6-Trichlorophenol	0	10	--	--	NA	0.00	0.00
2,4-Dichlorophenol	0	20	--	--	NA	0.00	0.00
2,4-Dimethylphenol	0	20	--	--	NA	0.00	0.00
2,4-Dinitrophenol	0	20	--	--	NA	0.00	0.00
2-Chlorophenol	0	10	--	--	NA	0.00	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	--	--	NA	0.00	0.00
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00	0.00
4-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Nitrophenol	0	7	--	--	NA	0.00	0.00
Benzene	0	172	--	--	NA	0.00	0.00
Ethylbenzene	0	--	--	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	--	--	NA	0.00	0.00
Phenol	0	30	--	--	NA	0.00	0.00
Toluene	0	170	--	--	NA	0.00	0.00
Xylenes	0	14	--	--	NA	0.00	0.00
Polyaromatic Compounds							
Acenaphthene	0	20	0	0.00	0.00	0.00	0.00
Acenaphthylene	0	30	0	0.01	0.00	0.01	0.01
Anthracene	0	30	0	0.01	0.00	0.01	0.01
Benzo(a)anthracene	0	7	1	0.18	0.01	0.18	0.18
Benzo(a)pyrene	0	7	2	0.25	0.01	0.25	0.25
Benzo(b)fluoranthene	0	7	2	0.23	0.01	0.23	0.23
Benzo(g,h,i)perylene	0	30	2	0.06	0.00	0.06	0.06
Benzo(k)fluoranthene	0	7	1	0.15	0.01	0.15	0.15
Chrysene	0	7	2	0.23	0.01	0.23	0.23
Dibenzo(a,h)anthracene	0	7	0	0.06	0.00	0.06	0.06
Fluoranthene	0	30	3	0.09	0.00	0.09	0.09
Fluorene	0	30	0	0.00	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0	7	2	0.22	0.01	0.22	0.22
Naphthalene	0	30	0	0.01	0.00	0.01	0.01
Phenanthrene	0	30	2	0.07	0.00	0.07	0.07
Pyrene	0	30	3	0.09	0.00	0.09	0.09
Sum of R				27.9324286			

Appendix D Ecological Screening - Detection Limit / SBV Comparison - FAMM Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	2
Arsenic	1	7	1
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	2
Copper	1	50	3
Lead	1	50	2
Mercury	1	0.1	0
Nickel	1	30	3
Selenium	1	0.3	0
Silver	1	2	0
Thallium	10	1	0
Zinc	1	24	3
Cyanide	0.5	780	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	20	0
2,4,5-Trichlorophenol	NA	9	0
2,4,6-Trichlorophenol	NA	10	0
2,4-Dichlorophenol	NA	20	0
2,4-Dimethylphenol	NA	20	0
2,4-Dinitrophenol	NA	20	0
2-Chlorophenol	NA	10	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	NA	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	--	0
4-Nitrophenol	NA	7	0
Benzene	NA	172	0
Ethylbenzene	NA	--	0
Pentachlorophenol	NA	0.879	0
Phenol	NA	30	0
Toluene	NA	170	0
Xylenes	NA	14	0
Polyaromatic Compounds			
Acenaphthene	0.05	20	1
Acenaphthylene	0.05	30	2
Anthracene	0.05	30	1
Benzo(a)anthracene	0.05	7	3
Benzo(a)pyrene	0.05	7	3
Benzo(b)fluoranthene	0.05	7	3
Benzo(g,h,i)perylene	0.05	30	3
Benzo(k)fluoranthene	0.05	7	3
Chrysene	0.05	7	3
Dibenzo(a,h)anthracene	0.05	7	3
Fluoranthene	0.05	30	3
Fluorene	0.05	30	1
Indeno(1,2,3-cd)pyrene	0.05	7	3
Naphthalene	0.05	30	2
Phenanthrene	0.05	30	3
Pyrene	0.05	30	3

Appendix D Soil Chemical Data Statistics - FAMM Area Surface Soil

	Final EC	Source Statistic Type
Metals and Inorganics		
Antimony	2.26	Maximum
Arsenic	3.14	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	70.90	Maximum
Copper	34.70	Maximum
Lead	30.40	Maximum
Mercury	0.50	Upper Confidence Limit Arithmetic
Nickel	146.00	Maximum
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	5.00	Maximum
Zinc	114.00	Maximum
Cyanide	--	
Monocyclic Aromatic Compounds		Upper Confidence Limit Arithmetic
2,3,4,6-Tetrachlorophenol	--	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	--	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Chlorophenol	--	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	--	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	--	Upper Confidence Limit Arithmetic
4-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Nitrophenol	--	Upper Confidence Limit Arithmetic
Benzene	--	Upper Confidence Limit Arithmetic
Ethylbenzene	--	Upper Confidence Limit Arithmetic
Pentachlorophenol	--	Upper Confidence Limit Arithmetic
Phenol	--	Upper Confidence Limit Arithmetic
Toluene	--	Upper Confidence Limit Arithmetic
Xylenes	--	Upper Confidence Limit Arithmetic
Polyaromatic Compounds		
Acenaphthene	0.06	Maximum
Acenaphthylene	0.18	Maximum
Anthracene	0.32	Maximum
Benzo(a)anthracene	1.24	Maximum
Benzo(a)pyrene	1.74	Maximum
Benzo(b)fluoranthene	1.60	Maximum
Benzo(g,h,i)perylene	1.82	Maximum
Benzo(k)fluoranthene	1.02	Maximum
Chrysene	1.60	Maximum
Dibenzo(a,h)anthracene	0.39	Maximum
Fluoranthene	2.78	Maximum
Fluorene	0.07	Maximum
Indeno(1,2,3-cd)pyrene	1.53	Maximum
Naphthalene	0.43	Maximum
Phenanthrene	2.02	Maximum
Pyrene	2.59	Maximum

Appendix D Ecological Screening - Frequency of Detection - FAMM Area Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	2	1	50%
Arsenic	5	5	100%
Beryllium	2	0	0%
Cadmium	2	0	0%
Chromium	2	2	100%
Copper	2	2	100%
Lead	2	2	100%
Mercury	2	0	0%
Nickel	2	2	100%
Selenium	2	0	0%
Silver	2	0	0%
Thallium	2	0	0%
Zinc	2	2	100%
Cyanide	3	0	0%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	4	0	0%
Ethylbenzene	4	0	0%
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	4	0	0%
Xylenes	4	0	0%
Polyaromatic Compounds			
Acenaphthene	4	2	50%
Acenaphthylene	4	1	25%
Anthracene	4	2	50%
Benzo(a)anthracene	4	3	75%
Benzo(a)pyrene	4	3	75%
Benzo(b)fluoranthene	4	3	75%
Benzo(g,h,i)perylene	4	4	100%
Benzo(k)fluoranthene	4	3	75%
Chrysene	4	3	75%
Dibenzo(a,h)anthracene	4	1	25%
Fluoranthene	4	3	75%
Fluorene	4	1	25%
Indeno(1,2,3-cd)pyrene	4	3	75%
Naphthalene	4	2	50%
Phenanthrene	4	3	75%
Pyrene	4	3	75%

Appendix D Ecological Screening - Background Concentrations - FAMM Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.02	NA
Arsenic	5.81	5.25	0.90
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	16.10	0.61
Copper	34.34	19.60	0.57
Lead	24.02	12.10	0.50
Mercury	0.04	0.50	12.50
Nickel	21.04	14.30	0.68
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	55.20	0.58
Cyanide	NA	0.01	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	0.01	NA
Ethylbenzene	NA	0.01	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	0.01	NA
Xylenes	NA	0.04	NA
Polyaromatic Compounds			
Acenaphthene	NA	2	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	2	NA
Benzo(a)anthracene	NA	9	NA
Benzo(a)pyrene	NA	11	NA
Benzo(b)fluoranthene	NA	8	NA
Benzo(g,h,i)perylene	NA	8	NA
Benzo(k)fluoranthene	NA	8	NA
Chrysene	NA	9	NA
Dibenzo(a,h)anthracene	NA	1	NA
Fluoranthene	NA	16	NA
Fluorene	NA	1	NA
Indeno(1,2,3-cd)pyrene	NA	7	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	9	NA
Pyrene	NA	15	NA

Appendix D Ecological Screening - Screening Benchmark Values - FAMM Area Subsurface Soil

No. of COIs = 34

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	1.02	0.20	0.01	0.20	0.20
Arsenic	0	7	5.25	0.75	0.03	0.75	0.75
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.00	0.13	0.13
Chromium	0	30	16.10	0.54	0.02	0.54	0.54
Copper	0	50	19.60	0.39	0.01	0.39	0.39
Lead	0	50	12.10	0.24	0.01	0.24	0.24
Mercury	0	0.1	0.50	5.00	0.19	5.00	5.00
Nickel	0	30	14.57	0.49	0.02	0.49	0.49
Selenium	0	0.3	0.50	1.67	0.06	1.67	1.67
Silver	0	2	0.50	0.25	0.01	0.25	0.25
Thallium	0	1	5.00	5.00	0.19	5.00	5.00
Zinc	0	24	55.20	2.30	0.09	2.30	2.30
Cyanide	0	780	0.01	0.00	0.00	0.00	0.00
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	--	--	NA	0.00	0.00
2,4,5-Trichlorophenol	0	9	--	--	NA	0.00	0.00
2,4,6-Trichlorophenol	0	10	--	--	NA	0.00	0.00
2,4-Dichlorophenol	0	20	--	--	NA	0.00	0.00
2,4-Dimethylphenol	0	20	--	--	NA	0.00	0.00
2,4-Dinitrophenol	0	20	--	--	NA	0.00	0.00
2-Chlorophenol	0	10	--	--	NA	0.00	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	--	--	NA	0.00	0.00
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00	0.00
4-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Nitrophenol	0	7	--	--	NA	0.00	0.00
Benzene	0	172	0.01	0.00	0.00	0.00	0.00
Ethylbenzene	0	--	0.01	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	--	--	NA	0.00	0.00
Phenol	0	30	--	--	NA	0.00	0.00
Toluene	0	170	0.01	0.00	0.00	0.00	0.00
Xylenes	0	14	0.04	0.00	0.00	0.00	0.00
Polyaromatic Compounds							
Acenaphthene	0	20	2	0.08	0.00	0.08	0.08
Acenaphthylene	0	30	0	0.01	0.00	0.01	0.01
Anthracene	0	30	2	0.07	0.00	0.07	0.07
Benzo(a)anthracene	0	7	9	1.24	0.05	1.24	1.24
Benzo(a)pyrene	0	7	11	1.63	0.06	1.63	1.63
Benzo(b)fluoranthene	0	7	8	1.21	0.05	1.21	1.21
Benzo(g,h,i)perylene	0	30	8	0.27	0.01	0.27	0.27
Benzo(k)fluoranthene	0	7	8	1.20	0.05	1.20	1.20
Chrysene	0	7	9	1.35	0.05	1.35	1.35
Dibenzo(a,h)anthracene	0	7	1	0.16	0.01	0.16	0.16
Fluoranthene	0	30	16	0.52	0.02	0.52	0.52
Fluorene	0	30	1	0.02	0.00	0.02	0.02
Indeno(1,2,3-cd)pyrene	0	7	7	1.01	0.04	1.01	1.01
Naphthalene	0	30	0	0.00	0.00	0.00	0.00
Phenanthrene	0	30	9	0.28	0.01	0.28	0.28
Pyrene	0	30	15	0.50	0.02	0.50	0.50
Sum of R				26.5886134			

Appendix D Ecological Screening - Detection Limit / SBV Comparison - FAMM Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Area Wide Number of Dectects
Metals and Inorganics			
Antimony	1	5	1
Arsenic	1	7	5
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	2
Copper	1	50	2
Lead	1	50	2
Mercury	1	0.1	0
Nickel	1	30	2
Selenium	1	0.3	0
Silver	1	2	0
Thallium	10	1	0
Zinc	1	24	2
Cyanide	0.02	780	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	20	0
2,4,5-Trichlorophenol	NA	9	0
2,4,6-Trichlorophenol	NA	10	0
2,4-Dichlorophenol	NA	20	0
2,4-Dimethylphenol	NA	20	0
2,4-Dinitrophenol	NA	20	0
2-Chlorophenol	NA	10	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	NA	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	--	0
4-Nitrophenol	NA	7	0
Benzene	0.025	172	0
Ethylbenzene	0.025	--	0
Pentachlorophenol	NA	0.879	0
Phenol	NA	30	0
Toluene	0.025	170	0
Xylenes	0.074	14	0
Polyaromatic Compounds			
Acenaphthene	0.05	20	2
Acenaphthylene	0.7	30	1
Anthracene	0.05	30	2
Benzo(a)anthracene	0.7	7	3
Benzo(a)pyrene	0.7	7	3
Benzo(b)fluoranthene	0.7	7	3
Benzo(g,h,i)perylene	0.7	30	4
Benzo(k)fluoranthene	0.7	7	3
Chrysene	0.7	7	3
Dibenzo(a,h)anthracene	0.7	7	1
Fluoranthene	0.7	30	3
Fluorene	4.2	30	1
Indeno(1,2,3-cd)pyrene	0.7	7	3
Naphthalene	0.7	30	2
Phenanthrene	0.7	30	3
Pyrene	0.05	30	3

Appendix D Soil Chemical Data Statistics - FAMM Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.02	Maximum
Arsenic	5.25	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	16.10	Maximum
Copper	19.60	Maximum
Lead	12.10	Maximum
Mercury	0.50	Upper Confidence Limit Arithmetic
Nickel	14.57	Upper Confidence Limit Log
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	5.00	Maximum
Zinc	55.20	Maximum
Cyanide	0.01	Upper Confidence Limit Log
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	--	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Chlorophenol	--	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	--	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	--	Upper Confidence Limit Arithmetic
4-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Nitrophenol	--	Upper Confidence Limit Arithmetic
Benzene	0.01	Maximum
Ethylbenzene	0.01	Maximum
Pentachlorophenol	--	Upper Confidence Limit Arithmetic
Phenol	--	Upper Confidence Limit Arithmetic
Toluene	0.01	Maximum
Xylenes	0.04	Maximum
Polyaromatic Compounds		
Acenaphthene	1.65	Maximum
Acenaphthylene	0.29	Maximum
Anthracene	2.14	Maximum
Benzo(a)anthracene	8.70	Maximum
Benzo(a)pyrene	11.40	Maximum
Benzo(b)fluoranthene	8.45	Maximum
Benzo(g,h,i)perylene	8.05	Maximum
Benzo(k)fluoranthene	8.40	Maximum
Chrysene	9.45	Maximum
Dibenzo(a,h)anthracene	1.14	Maximum
Fluoranthene	15.60	Maximum
Fluorene	0.68	Maximum
Indeno(1,2,3-cd)pyrene	7.10	Maximum
Naphthalene	0.14	Maximum
Phenanthrene	8.50	Maximum
Pyrene	15.10	Maximum

Appendix D Ecological Screening - Frequency of Detection - Office Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	4	4	100%
Arsenic	4	4	100%
Beryllium	4	0	0%
Cadmium	4	0	0%
Chromium	4	4	100%
Copper	4	4	100%
Lead	4	4	100%
Mercury	4	0	0%
Nickel	4	4	100%
Selenium	4	0	0%
Silver	4	0	0%
Thallium	4	0	0%
Zinc	4	4	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	0	0	--
Ethylbenzene	0	0	--
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	0	0	--
Xylenes	0	0	--
Polyaromatic Compounds			
Acenaphthene	4	4	100%
Acenaphthylene	4	3	75%
Anthracene	4	1	25%
Benzo(a)anthracene	4	4	100%
Benzo(a)pyrene	4	4	100%
Benzo(b)fluoranthene	4	4	100%
Benzo(g,h,i)perylene	4	4	100%
Benzo(k)fluoranthene	4	4	100%
Chrysene	4	4	100%
Dibenzo(a,h)anthracene	4	4	100%
Fluoranthene	4	4	100%
Fluorene	4	2	50%
Indeno(1,2,3-cd)pyrene	4	4	100%
Naphthalene	4	2	50%
Phenanthrene	4	4	100%
Pyrene	4	4	100%

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Appendix D Ecological Screening - Background Concentrations - Office Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.96	NA
Arsenic	5.81	5.26	0.91
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	24.70	0.93
Copper	34.34	52.10	1.52
Lead	24.02	55.40	2.31
Mercury	0.04	0.50	12.50
Nickel	21.04	84.00	3.99
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	0.50	NA
Zinc	95.52	92.90	0.97
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	--	NA
Ethylbenzene	NA	--	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	--	NA
Xylenes	NA	--	NA
Polyaromatic Compounds			
Acenaphthene	NA	0	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	1	NA
Benzo(a)anthracene	NA	5	NA
Benzo(a)pyrene	NA	7	NA
Benzo(b)fluoranthene	NA	5	NA
Benzo(g,h,i)perylene	NA	6	NA
Benzo(k)fluoranthene	NA	4	NA
Chrysene	NA	5	NA
Dibenzo(a,h)anthracene	NA	1	NA
Fluoranthene	NA	7	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	5	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	3	NA
Pyrene	NA	7	NA

Appendix D Ecological Screening - Screening Benchmark Values - Office Area Surface Soil

No. of COIs = 29

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	1.96	0.39	0.02	0.39	0.39
Arsenic	0	7	5.44	0.78	0.03	0.78	0.78
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.01	0.13	0.13
Chromium	0	30	24.70	0.82	0.03	0.82	0.82
Copper	0	50	52.10	1.04	0.04	1.04	1.04
Lead	0	50	55.40	1.11	0.05	1.11	1.11
Mercury	0	0.1	0.50	5.00	0.21	5.00	5.00
Nickel	0	30	84.00	2.80	0.12	2.80	2.80
Selenium	0	0.3	0.50	1.67	0.07	1.67	1.67
Silver	0	2	0.50	0.25	0.01	0.25	0.25
Thallium	0	1	0.50	0.50	0.02	0.50	0.50
Zinc	0	24	88.31	3.68	0.16	3.68	3.68
Cyanide	0	780	--	--	NA	0.00	0.00
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	--	--	NA	0.00	0.00
2,4,5-Trichlorophenol	0	9	--	--	NA	0.00	0.00
2,4,6-Trichlorophenol	0	10	--	--	NA	0.00	0.00
2,4-Dichlorophenol	0	20	--	--	NA	0.00	0.00
2,4-Dimethylphenol	0	20	--	--	NA	0.00	0.00
2,4-Dinitrophenol	0	20	--	--	NA	0.00	0.00
2-Chlorophenol	0	10	--	--	NA	0.00	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	--	--	NA	0.00	0.00
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00	0.00
4-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Nitrophenol	0	7	--	--	NA	0.00	0.00
Benzene	0	172	--	--	NA	0.00	0.00
Ethylbenzene	0	--	--	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	--	--	NA	0.00	0.00
Phenol	0	30	--	--	NA	0.00	0.00
Toluene	0	170	--	--	NA	0.00	0.00
Xylenes	0	14	--	--	NA	0.00	0.00
Polyaromatic Compounds							
Acenaphthene	0	20	0	0.02	0.00	0.02	0.02
Acenaphthylene	0	30	0	0.01	0.00	0.01	0.01
Anthracene	0	30	1	0.02	0.00	0.02	0.02
Benzo(a)anthracene	0	7	5	0.69	0.03	0.69	0.69
Benzo(a)pyrene	0	7	7	0.93	0.04	0.93	0.93
Benzo(b)fluoranthene	0	7	5	0.78	0.03	0.78	0.78
Benzo(g,h,i)perylene	0	30	6	0.19	0.01	0.19	0.19
Benzo(k)fluoranthene	0	7	4	0.59	0.02	0.59	0.59
Chrysene	0	7	5	0.74	0.03	0.74	0.74
Dibenzo(a,h)anthracene	0	7	1	0.21	0.01	0.21	0.21
Fluoranthene	0	30	7	0.24	0.01	0.24	0.24
Fluorene	0	30	0	0.01	0.00	0.01	0.01
Indeno(1,2,3-cd)pyrene	0	7	5	0.68	0.03	0.68	0.68
Naphthalene	0	30	0	0.01	0.00	0.01	0.01
Phenanthrene	0	30	3	0.10	0.00	0.10	0.10
Pyrene	0	30	7	0.23	0.01	0.23	0.23
Sum of R				23.6691313			

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Appendix D Ecological Screening - Detection Limit / SBV Comparison - Office Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	4
Arsenic	1	7	4
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	4
Copper	1	50	4
Lead	1	50	4
Mercury	1	0.1	0
Nickel	1	30	4
Selenium	1	0.3	0
Silver	1	2	0
Thallium	1	1	0
Zinc	1	24	4
Cyanide	0.5	780	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	20	0
2,4,5-Trichlorophenol	NA	9	0
2,4,6-Trichlorophenol	NA	10	0
2,4-Dichlorophenol	NA	20	0
2,4-Dimethylphenol	NA	20	0
2,4-Dinitrophenol	NA	20	0
2-Chlorophenol	NA	10	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	NA	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	--	0
4-Nitrophenol	NA	7	0
Benzene	NA	172	0
Ethylbenzene	NA	--	0
Pentachlorophenol	NA	0.879	0
Phenol	NA	30	0
Toluene	NA	170	0
Xylenes	NA	14	0
Polyaromatic Compounds			
Acenaphthene	0.05	20	4
Acenaphthylene	0.5	30	3
Anthracene	0.5	30	1
Benzo(a)anthracene	0.05	7	4
Benzo(a)pyrene	0.05	7	4
Benzo(b)fluoranthene	0.05	7	4
Benzo(g,h,i)perylene	0.05	30	4
Benzo(k)fluoranthene	0.05	7	4
Chrysene	0.05	7	4
Dibenzo(a,h)anthracene	0.05	7	4
Fluoranthene	0.05	30	4
Fluorene	0.5	30	2
Indeno(1,2,3-cd)pyrene	0.05	7	4
Naphthalene	0.5	30	2
Phenanthrene	0.05	30	4
Pyrene	0.05	30	4

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Appendix D Soil Chemical Data Statistics - Office Area Surface Soil

	Final EC	Source Statistic Type
Metals and Inorganics		
Antimony	1.96	Maximum
Arsenic	5.44	Upper Confidence Limit Log
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	24.70	Maximum
Copper	52.10	Maximum
Lead	55.40	Maximum
Mercury	0.50	Upper Confidence Limit Arithmetic
Nickel	84.00	Maximum
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	0.50	Upper Confidence Limit Arithmetic
Zinc	88.31	Upper Confidence Limit Arithmetic
Cyanide	--	
Monocyclic Aromatic Compounds		Upper Confidence Limit Arithmetic
2,3,4,6-Tetrachlorophenol	--	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	--	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Chlorophenol	--	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	--	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	--	Upper Confidence Limit Arithmetic
4-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Nitrophenol	--	Upper Confidence Limit Arithmetic
Benzene	--	Upper Confidence Limit Arithmetic
Ethylbenzene	--	Upper Confidence Limit Arithmetic
Pentachlorophenol	--	Upper Confidence Limit Arithmetic
Phenol	--	Upper Confidence Limit Arithmetic
Toluene	--	Upper Confidence Limit Arithmetic
Xylenes	--	Upper Confidence Limit Arithmetic
Polyaromatic Compounds		
Acenaphthene	0.36	Maximum
Acenaphthylene	0.25	Maximum
Anthracene	0.56	Maximum
Benzo(a)anthracene	4.86	Maximum
Benzo(a)pyrene	6.50	Maximum
Benzo(b)fluoranthene	5.45	Maximum
Benzo(g,h,i)perylene	5.80	Maximum
Benzo(k)fluoranthene	4.14	Maximum
Chrysene	5.20	Maximum
Dibenzo(a,h)anthracene	1.47	Maximum
Fluoranthene	7.05	Maximum
Fluorene	0.25	Maximum
Indeno(1,2,3-cd)pyrene	4.76	Maximum
Naphthalene	0.25	Maximum
Phenanthrene	3.00	Maximum
Pyrene	6.80	Maximum

Appendix D Ecological Screening - Frequency of Detection - Office Area Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	4	3	75%
Arsenic	4	4	100%
Beryllium	4	0	0%
Cadmium	4	0	0%
Chromium	4	4	100%
Copper	4	4	100%
Lead	4	4	100%
Mercury	4	0	0%
Nickel	4	4	100%
Selenium	4	0	0%
Silver	4	0	0%
Thallium	4	0	0%
Zinc	4	4	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	4	0	0%
Ethylbenzene	4	0	0%
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	4	0	0%
Xylenes	4	0	0%
Polyaromatic Compounds			
Acenaphthene	4	1	25%
Acenaphthylene	4	1	25%
Anthracene	4	0	0%
Benzo(a)anthracene	4	2	50%
Benzo(a)pyrene	4	2	50%
Benzo(b)fluoranthene	4	2	50%
Benzo(g,h,i)perylene	4	2	50%
Benzo(k)fluoranthene	4	1	25%
Chrysene	4	2	50%
Dibenzo(a,h)anthracene	4	1	25%
Fluoranthene	4	2	50%
Fluorene	4	0	0%
Indeno(1,2,3-cd)pyrene	4	2	50%
Naphthalene	4	1	25%
Phenanthrene	4	2	50%
Pyrene	4	2	50%

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Appendix D Ecological Screening - Background Concentrations - Office Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	2.92	NA
Arsenic	5.81	6.37	1.10
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	19.70	0.74
Copper	34.34	35.20	1.03
Lead	24.02	40.30	1.68
Mercury	0.04	0.50	12.50
Nickel	21.04	21.10	1.00
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	0.50	NA
Zinc	95.52	70.30	0.74
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	0.00	NA
Ethylbenzene	NA	0.00	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	0.00	NA
Xylenes	NA	0.00	NA
Polyaromatic Compounds			
Acenaphthene	NA	0	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	0	NA
Benzo(a)anthracene	NA	2	NA
Benzo(a)pyrene	NA	3	NA
Benzo(b)fluoranthene	NA	2	NA
Benzo(g,h,i)perylene	NA	2	NA
Benzo(k)fluoranthene	NA	2	NA
Chrysene	NA	2	NA
Dibenzo(a,h)anthracene	NA	0	NA
Fluoranthene	NA	3	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	1	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	2	NA
Pyrene	NA	5	NA

Appendix D Ecological Screening - Screening Benchmark Values - Office Area Subsurface Soil

No. of COIs = 33

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	2.92	0.58	0.03	0.58	0.58
Arsenic	0	7	6.37	0.91	0.05	0.91	0.91
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.01	0.13	0.13
Chromium	0	30	17.86	0.60	0.03	0.60	0.60
Copper	0	50	35.20	0.70	0.04	0.70	0.70
Lead	0	50	40.30	0.81	0.05	0.81	0.81
Mercury	0	0.1	0.50	5.00	0.29	5.00	5.00
Nickel	0	30	21.10	0.70	0.04	0.70	0.70
Selenium	0	0.3	0.50	1.67	0.10	1.67	1.67
Silver	0	2	0.50	0.25	0.01	0.25	0.25
Thallium	0	1	0.50	0.50	0.03	0.50	0.50
Zinc	0	24	70.30	2.93	0.17	2.93	2.93
Cyanide	0	780	--	--	NA	0.00	0.00
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	--	--	NA	0.00	0.00
2,4,5-Trichlorophenol	0	9	--	--	NA	0.00	0.00
2,4,6-Trichlorophenol	0	10	--	--	NA	0.00	0.00
2,4-Dichlorophenol	0	20	--	--	NA	0.00	0.00
2,4-Dimethylphenol	0	20	--	--	NA	0.00	0.00
2,4-Dinitrophenol	0	20	--	--	NA	0.00	0.00
2-Chlorophenol	0	10	--	--	NA	0.00	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	--	--	NA	0.00	0.00
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00	0.00
4-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Nitrophenol	0	7	--	--	NA	0.00	0.00
Benzene	0	172	0.00	0.00	0.00	0.00	0.00
Ethylbenzene	0	--	0.00	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	--	--	NA	0.00	0.00
Phenol	0	30	--	--	NA	0.00	0.00
Toluene	0	170	0.00	0.00	0.00	0.00	0.00
Xylenes	0	14	0.00	0.00	0.00	0.00	0.00
Polyaromatic Compounds							
Acenaphthene	0	20	0	0.01	0.00	0.01	0.01
Acenaphthylene	0	30	0	0.01	0.00	0.01	0.01
Anthracene	0	30	0	0.01	0.00	0.01	0.01
Benzo(a)anthracene	0	7	2	0.27	0.02	0.27	0.27
Benzo(a)pyrene	0	7	3	0.41	0.02	0.41	0.41
Benzo(b)fluoranthene	0	7	2	0.30	0.02	0.30	0.30
Benzo(g,h,i)perylene	0	30	2	0.07	0.00	0.07	0.07
Benzo(k)fluoranthene	0	7	2	0.23	0.01	0.23	0.23
Chrysene	0	7	2	0.32	0.02	0.32	0.32
Dibenzo(a,h)anthracene	0	7	0	0.06	0.00	0.06	0.06
Fluoranthene	0	30	3	0.11	0.01	0.11	0.11
Fluorene	0	30	0	0.01	0.00	0.01	0.01
Indeno(1,2,3-cd)pyrene	0	7	1	0.21	0.01	0.21	0.21
Naphthalene	0	30	0	0.01	0.00	0.01	0.01
Phenanthrene	0	30	2	0.08	0.00	0.08	0.08
Pyrene	0	30	5	0.17	0.01	0.17	0.17
Sum of R				17.1064832			

Appendix D Ecological Screening - Detection Limit / SBV Comparison - Office Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	3
Arsenic	1	7	4
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	4
Copper	1	50	4
Lead	1	50	4
Mercury	1	0.1	0
Nickel	1	30	4
Selenium	1	0.3	0
Silver	1	2	0
Thallium	1	1	0
Zinc	1	24	4
Cyanide	0.5	780	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	20	0
2,4,5-Trichlorophenol	NA	9	0
2,4,6-Trichlorophenol	NA	10	0
2,4-Dichlorophenol	NA	20	0
2,4-Dimethylphenol	NA	20	0
2,4-Dinitrophenol	NA	20	0
2-Chlorophenol	NA	10	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	NA	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	--	0
4-Nitrophenol	NA	7	0
Benzene	0.002	172	0
Ethylbenzene	0.002	--	0
Pentachlorophenol	NA	0.879	0
Phenol	NA	30	0
Toluene	0.002	170	0
Xylenes	0.008	14	0
Polyaromatic Compounds			
Acenaphthene	0.05	20	1
Acenaphthylene	0.05	30	1
Anthracene	0.05	30	0
Benzo(a)anthracene	0.05	7	2
Benzo(a)pyrene	0.05	7	2
Benzo(b)fluoranthene	0.05	7	2
Benzo(g,h,i)perylene	0.05	30	2
Benzo(k)fluoranthene	0.05	7	1
Chrysene	0.05	7	2
Dibenzo(a,h)anthracene	0.05	7	1
Fluoranthene	0.05	30	2
Fluorene	0.05	30	0
Indeno(1,2,3-cd)pyrene	0.05	7	2
Naphthalene	0.05	30	1
Phenanthrene	0.05	30	2
Pyrene	0.05	30	2

Appendix D Soil Chemical Data Statistics - Office Area Subsurface Soil

	Final EC	Source Statistic Type
Metals and Inorganics		
Antimony	2.92	Maximum
Arsenic	6.37	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	17.86	Upper Confidence Limit Arithmetic
Copper	35.20	Maximum
Lead	40.30	Maximum
Mercury	0.50	Upper Confidence Limit Arithmetic
Nickel	21.10	Maximum
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	0.50	Upper Confidence Limit Arithmetic
Zinc	70.30	Maximum
Cyanide	--	
Monocyclic Aromatic Compounds		Upper Confidence Limit Arithmetic
2,3,4,6-Tetrachlorophenol	--	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	--	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Chlorophenol	--	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	--	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	--	Upper Confidence Limit Arithmetic
4-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Nitrophenol	--	Upper Confidence Limit Arithmetic
Benzene	0.001	Upper Confidence Limit Arithmetic
Ethylbenzene	0.001	Upper Confidence Limit Arithmetic
Pentachlorophenol	--	Upper Confidence Limit Arithmetic
Phenol	--	Upper Confidence Limit Arithmetic
Toluene	0.001	Upper Confidence Limit Arithmetic
Xylenes	0.004	Upper Confidence Limit Arithmetic
Polyaromatic Compounds		
Acenaphthene	0.25	Maximum
Acenaphthylene	0.26	Maximum
Anthracene	0.25	Maximum
Benzo(a)anthracene	1.87	Maximum
Benzo(a)pyrene	2.86	Maximum
Benzo(b)fluoranthene	2.13	Maximum
Benzo(g,h,i)perylene	2.09	Maximum
Benzo(k)fluoranthene	1.58	Maximum
Chrysene	2.23	Maximum
Dibenzo(a,h)anthracene	0.42	Maximum
Fluoranthene	3.26	Maximum
Fluorene	0.25	Maximum
Indeno(1,2,3-cd)pyrene	1.49	Maximum
Naphthalene	0.25	Maximum
Phenanthrene	2.26	Maximum
Pyrene	5.20	Maximum

Appendix E Soil Chemical Data Statistics - Tar Pond Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.59	Maximum
Arsenic	1.80	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	10.60	Maximum
Copper	10.70	Maximum
Lead	18.30	Maximum
Mercury	0.50	Maximum
Nickel	11.10	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	5.00	Maximum
Zinc	62.60	Maximum
Cyanide	6.48	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	26	Maximum
2,4,5-Trichlorophenol	26	Maximum
2,4,6-Trichlorophenol	26	Maximum
2,4-Dichlorophenol	26	Maximum
2,4-Dimethylphenol	26	Maximum
2,4-Dinitrophenol	46	Maximum
2-Chlorophenol	26	Maximum
2-Methyl-4,6-dinitrophenol	26	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	26	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	26	Maximum
4-Methylphenol	26	Maximum
4-Nitrophenol	26	Maximum
Benzene	107	Maximum
Ethylbenzene	103	Maximum
Pentachlorophenol	26	Maximum
Phenol	26	Maximum
Toluene	78	Maximum
Xylenes	141	Maximum
Polyaromatic Compounds		
Acenaphthene	990	Maximum
Acenaphthylene	807	Maximum
Anthracene	1289	Maximum
Benzo(a)anthracene	495	Maximum
Benzo(a)pyrene	585	Maximum
Benzo(b)fluoranthene	500	Maximum
Benzo(g,h,i)perylene	529	Maximum
Benzo(k)fluoranthene	292	Maximum
Chrysene	824	Maximum
Dibenzo(a,h)anthracene	87	Maximum
Fluoranthene	2050	Maximum
Fluorene	810	Maximum
Indeno(1,2,3-cd)pyrene	373	Maximum
Naphthalene	11100	Maximum
Phenanthrene	4560	Maximum
Pyrene	3580	Maximum

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Appendix D Ecological Screening - Frequency of Detection - Koppers Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	9	6	67%
Arsenic	9	3	33%
Beryllium	9	0	0%
Cadmium	9	0	0%
Chromium	9	8	89%
Copper	9	9	100%
Lead	9	8	89%
Mercury	9	2	22%
Nickel	9	7	78%
Selenium	9	0	0%
Silver	9	0	0%
Thallium	9	0	0%
Zinc	9	9	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	2	0	0%
2,4,5-Trichlorophenol	2	0	0%
2,4,6-Trichlorophenol	2	0	0%
2,4-Dichlorophenol	2	0	0%
2,4-Dimethylphenol	2	0	0%
2,4-Dinitrophenol	2	0	0%
2-Chlorophenol	2	0	0%
2-Methyl-4,6-dinitrophenol	2	0	0%
2-Methylphenol	0	0	--
2-Nitrophenol	2	0	0%
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	2	0	0%
4-Methylphenol	2	0	0%
4-Nitrophenol	2	0	0%
Benzene	1	0	0%
Ethylbenzene	1	0	0%
Pentachlorophenol	2	0	0%
Phenol	2	0	0%
Toluene	1	0	0%
Xylenes	1	0	0%
Polyaromatic Compounds			
Acenaphthene	14	11	79%
Acenaphthylene	14	5	36%
Anthracene	14	10	71%
Benzo(a)anthracene	14	14	100%
Benzo(a)pyrene	14	14	100%
Benzo(b)fluoranthene	14	14	100%
Benzo(g,h,i)perylene	14	14	100%
Benzo(k)fluoranthene	14	14	100%
Chrysene	14	14	100%
Dibenzo(a,h)anthracene	14	13	93%
Fluoranthene	14	14	100%
Fluorene	14	10	71%
Indeno(1,2,3-cd)pyrene	14	14	100%
Naphthalene	14	7	50%
Phenanthrene	14	14	100%
Pyrene	14	14	100%

Appendix D Ecological Screening - Background Concentrations - Koppers Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	3.76	NA
Arsenic	5.81	3.40	0.59
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	22.30	0.84
Copper	34.34	40.90	1.19
Lead	24.02	94.60	3.94
Mercury	0.04	3.23	80.75
Nickel	21.04	19.80	0.94
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	226.00	2.37
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	1.70	NA
2,4,5-Trichlorophenol	NA	1.70	NA
2,4,6-Trichlorophenol	NA	1.70	NA
2,4-Dichlorophenol	NA	1.70	NA
2,4-Dimethylphenol	NA	1.70	NA
2,4-Dinitrophenol	NA	3.30	NA
2-Chlorophenol	NA	1.70	NA
2-Methyl-4,6-dinitrophenol	NA	1.70	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	1.70	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	1.70	NA
4-Methylphenol	NA	1.70	NA
4-Nitrophenol	NA	1.70	NA
Benzene	NA	0.15	NA
Ethylbenzene	NA	0.15	NA
Pentachlorophenol	NA	1.70	NA
Phenol	NA	1.70	NA
Toluene	NA	0.15	NA
Xylenes	NA	0.15	NA
Polyaromatic Compounds			
Acenaphthene	NA	110	NA
Acenaphthylene	NA	4	NA
Anthracene	NA	212	NA
Benzo(a)anthracene	NA	53	NA
Benzo(a)pyrene	NA	61	NA
Benzo(b)fluoranthene	NA	58	NA
Benzo(g,h,i)perylene	NA	46	NA
Benzo(k)fluoranthene	NA	37	NA
Chrysene	NA	71	NA
Dibenzo(a,h)anthracene	NA	10	NA
Fluoranthene	NA	135	NA
Fluorene	NA	55	NA
Indeno(1,2,3-cd)pyrene	NA	42	NA
Naphthalene	NA	11	NA
Phenanthrene	NA	92	NA
Pyrene	NA	217	NA

Appendix D Ecological Screening - Screening Benchmark Values - Koppers Area Surface Soil

No. of COIs = 47

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	3.76	0.75	0.01	0.75	0.75
Arsenic	0	7	3.40	0.49	0.00	0.49	0.49
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.00	0.13	0.13
Chromium	0	30	22.30	0.74	0.01	0.74	0.74
Copper	0	50	40.90	0.82	0.01	0.82	0.82
Lead	0	50	94.60	1.89	0.01	1.89	1.89
Mercury	0	0.1	3.23	32.30	0.24	32.30	32.30
Nickel	0	30	19.80	0.66	0.00	0.66	0.66
Selenium	0	0.3	0.50	1.67	0.01	1.67	1.67
Silver	0	2	0.50	0.25	0.00	0.25	0.25
Thallium	0	1	5.00	5.00	0.04	5.00	5.00
Zinc	0	24	226.00	9.42	0.07	9.42	9.42
Cyanide	0	780	--	--	NA	0.00	0.00
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	1.70	0.09	0.00	0.09	0.09
2,4,5-Trichlorophenol	0	9	1.70	0.19	0.00	0.19	0.19
2,4,6-Trichlorophenol	0	10	1.70	0.17	0.00	0.17	0.17
2,4-Dichlorophenol	0	20	1.70	0.09	0.00	0.09	0.09
2,4-Dimethylphenol	0	20	1.70	0.09	0.00	0.09	0.09
2,4-Dinitrophenol	0	20	3.30	0.17	0.00	0.17	0.17
2-Chlorophenol	0	10	1.70	0.17	0.00	0.17	0.17
2-Methyl-4,6-dinitrophenol	0	--	1.70	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	1.70	0.24	0.00	0.24	0.24
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	1.70	--	NA	0.00	0.00
4-Methylphenol	0	--	1.70	--	NA	0.00	0.00
4-Nitrophenol	0	7	1.70	0.24	0.00	0.24	0.24
Benzene	0	172	0.15	0.00	0.00	0.00	0.00
Ethylbenzene	0	--	0.15	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	1.70	1.93	0.01	1.93	1.93
Phenol	0	30	1.70	0.06	0.00	0.06	0.06
Toluene	0	170	0.15	0.00	0.00	0.00	0.00
Xylenes	0	14	0.15	0.01	0.00	0.01	0.01
Polyaromatic Compounds							
Acenaphthene	0	20	110	5.50	0.04	5.50	5.50
Acenaphthylene	0	30	4	0.14	0.00	0.14	0.14
Anthracene	0	30	212	7.07	0.05	7.07	7.07
Benzo(a)anthracene	0	7	53	7.59	0.06	7.59	7.59
Benzo(a)pyrene	0	7	61	8.71	0.06	8.71	8.71
Benzo(b)fluoranthene	0	7	58	8.23	0.06	8.23	8.23
Benzo(g,h,i)perylene	0	30	46	1.53	0.01	1.53	1.53
Benzo(k)fluoranthene	0	7	37	5.23	0.04	5.23	5.23
Chrysene	0	7	71	10.20	0.07	10.20	10.20
Dibenzo(a,h)anthracene	0	7	10	1.43	0.01	1.43	1.43
Fluoranthene	0	30	135	4.49	0.03	4.49	4.49
Fluorene	0	30	55	1.83	0.01	1.83	1.83
Indeno(1,2,3-cd)pyrene	0	7	42	5.93	0.04	5.93	5.93
Naphthalene	0	30	11	0.37	0.00	0.37	0.37
Phenanthrene	0	30	92	3.06	0.02	3.06	3.06
Pyrene	0	30	217	7.23	0.05	7.23	7.23
Sum of R				136.142255			

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Appendix D Ecological Screening - Detection Limit / SBV Comparison - Koppers Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	6
Arsenic	1	7	3
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	8
Copper	1	50	9
Lead	1	50	8
Mercury	1	0.1	2
Nickel	1	30	7
Selenium	1	0.3	0
Silver	1	2	0
Thallium	10	1	0
Zinc	1	24	9
Cyanide	0.5	780	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	3.4	20	0
2,4,5-Trichlorophenol	3.4	9	0
2,4,6-Trichlorophenol	3.4	10	0
2,4-Dichlorophenol	3.4	20	0
2,4-Dimethylphenol	3.4	20	0
2,4-Dinitrophenol	6.6	20	0
2-Chlorophenol	3.4	10	0
2-Methyl-4,6-dinitrophenol	3.4	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	3.4	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	3.4	--	0
4-Methylphenol	3.4	--	0
4-Nitrophenol	3.4	7	0
Benzene	0.3	172	0
Ethylbenzene	0.3	--	0
Pentachlorophenol	3.4	0.879	0
Phenol	3.4	30	0
Toluene	0.3	170	0
Xylenes	0.3	14	0
Polyaromatic Compounds			
Acenaphthene	0.05	20	11
Acenaphthylene	5	30	5
Anthracene	0.05	30	10
Benzo(a)anthracene	0.05	7	14
Benzo(a)pyrene	0.05	7	14
Benzo(b)fluoranthene	0.05	7	14
Benzo(g,h,i)perylene	0.05	30	14
Benzo(k)fluoranthene	0.05	7	14
Chrysene	0.05	7	14
Dibenzo(a,h)anthracene	0.05	7	13
Fluoranthene	0.05	30	14
Fluorene	0.1	30	10
Indeno(1,2,3-cd)pyrene	0.05	7	14
Naphthalene	1.0	30	7
Phenanthrene	0.05	30	14
Pyrene	0.05	30	14

Appendix D Soil Chemical Data Statistics - Koppers Area Surface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	3.76	Maximum
Arsenic	3.40	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	22.30	Maximum
Copper	40.90	Maximum
Lead	94.60	Maximum
Mercury	3.23	Maximum
Nickel	19.80	Maximum
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	5.00	Maximum
Zinc	226.00	Maximum
Cyanide	--	Upper Confidence Limit Arithmetic
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	1.70	Maximum
2,4,5-Trichlorophenol	1.70	Maximum
2,4,6-Trichlorophenol	1.70	Maximum
2,4-Dichlorophenol	1.70	Maximum
2,4-Dimethylphenol	1.70	Maximum
2,4-Dinitrophenol	3.30	Maximum
2-Chlorophenol	1.70	Maximum
2-Methyl-4,6-dinitrophenol	1.70	Maximum
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	1.70	Maximum
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	1.70	Maximum
4-Methylphenol	1.70	Maximum
4-Nitrophenol	1.70	Maximum
Benzene	0.15	Upper Confidence Limit Arithmetic
Ethylbenzene	0.15	Upper Confidence Limit Arithmetic
Pentachlorophenol	1.70	Maximum
Phenol	1.70	Maximum
Toluene	0.15	Upper Confidence Limit Arithmetic
Xylenes	0.15	Upper Confidence Limit Arithmetic
Polyaromatic Compounds		
Acenaphthene	110	Maximum
Acenaphthylene	4	Maximum
Anthracene	212	Maximum
Benzo(a)anthracene	53	Maximum
Benzo(a)pyrene	61	Maximum
Benzo(b)fluoranthene	58	Maximum
Benzo(g,h,i)perylene	46	Maximum
Benzo(k)fluoranthene	37	Maximum
Chrysene	71	Maximum
Dibenzo(a,h)anthracene	10	Maximum
Fluoranthene	135	Maximum
Fluorene	55	Maximum
Indeno(1,2,3-cd)pyrene	42	Maximum
Naphthalene	11	Maximum
Phenanthrene	92	Maximum
Pyrene	217	Maximum

Appendix D Ecological Screening - Frequency of Detection - Koppers Area Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	5	3	60%
Arsenic	5	5	100%
Beryllium	5	0	0%
Cadmium	5	0	0%
Chromium	5	5	100%
Copper	5	5	100%
Lead	5	5	100%
Mercury	5	1	20%
Nickel	5	5	100%
Selenium	5	3	60%
Silver	5	3	60%
Thallium	5	3	60%
Zinc	5	5	100%
Cyanide	1	1	100%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	6	0	0%
Ethylbenzene	6	0	0%
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	6	0	0%
Xylenes	6	0	0%
Polyaromatic Compounds			
Acenaphthene	9	4	44%
Acenaphthylene	9	5	56%
Anthracene	9	2	22%
Benzo(a)anthracene	9	6	67%
Benzo(a)pyrene	9	6	67%
Benzo(b)fluoranthene	9	7	78%
Benzo(g,h,i)perylene	9	6	67%
Benzo(k)fluoranthene	9	6	67%
Chrysene	9	6	67%
Dibenzo(a,h)anthracene	9	6	67%
Fluoranthene	9	7	78%
Fluorene	9	3	33%
Indeno(1,2,3-cd)pyrene	9	6	67%
Naphthalene	9	4	44%
Phenanthrene	9	5	56%
Pyrene	9	6	67%

Appendix D Ecological Screening - Background Concentrations - Koppers Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.06	NA
Arsenic	5.81	7.27	1.25
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	16.20	0.61
Copper	34.34	46.00	1.34
Lead	24.02	20.60	0.86
Mercury	0.04	0.50	12.50
Nickel	21.04	16.60	0.79
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	50.00	NA
Zinc	95.52	64.20	0.67
Cyanide	NA	518.00	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	0.15	NA
Ethylbenzene	NA	0.15	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	0.15	NA
Xylenes	NA	0.15	NA
Polyaromatic Compounds			
Acenaphthene	NA	0	NA
Acenaphthylene	NA	1	NA
Anthracene	NA	2	NA
Benzo(a)anthracene	NA	7	NA
Benzo(a)pyrene	NA	14	NA
Benzo(b)fluoranthene	NA	20	NA
Benzo(g,h,i)perylene	NA	23	NA
Benzo(k)fluoranthene	NA	5	NA
Chrysene	NA	13	NA
Dibenzo(a,h)anthracene	NA	3	NA
Fluoranthene	NA	18	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	16	NA
Naphthalene	NA	1	NA
Phenanthrene	NA	9	NA
Pyrene	NA	30	NA

Appendix D Ecological Screening - Screening Benchmark Values - Koppers Area Subsurface Soil

No. COIs = 34

Chemical of Interest		(mg/kg) Soil Screening Benchmark Value	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Soil R Value	Cross Medium Sum of Rs
Metals and Inorganics							
Antimony	0	5	1.06	0.21	0.00	0.21	0.21
Arsenic	0	7	7.27	1.04	0.01	1.04	1.04
Beryllium	0	8	0.50	0.06	0.00	0.06	0.06
Cadmium	0	4	0.50	0.13	0.00	0.13	0.13
Chromium	0	30	14.53	0.48	0.01	0.48	0.48
Copper	0	50	46.00	0.92	0.01	0.92	0.92
Lead	0	50	20.60	0.41	0.01	0.41	0.41
Mercury	0	0.1	0.50	5.00	0.06	5.00	5.00
Nickel	0	30	16.52	0.55	0.01	0.55	0.55
Selenium	0	0.3	0.50	1.67	0.02	1.67	1.67
Silver	0	2	0.50	0.25	0.00	0.25	0.25
Thallium	0	1	50.00	50.00	0.64	50.00	50.00
Zinc	0	24	64.20	2.68	0.03	2.68	2.68
Cyanide	0	780	518.00	0.66	0.01	0.66	0.66
Monocyclic Aromatic Compounds							
2,3,4,6-Tetrachlorophenol	0	20	--	--	NA	0.00	0.00
2,4,5-Trichlorophenol	0	9	--	--	NA	0.00	0.00
2,4,6-Trichlorophenol	0	10	--	--	NA	0.00	0.00
2,4-Dichlorophenol	0	20	--	--	NA	0.00	0.00
2,4-Dimethylphenol	0	20	--	--	NA	0.00	0.00
2,4-Dinitrophenol	0	20	--	--	NA	0.00	0.00
2-Chlorophenol	0	10	--	--	NA	0.00	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00	0.00
2-Methylphenol	0	--	--	--	NA	0.00	0.00
2-Nitrophenol	0	7	--	--	NA	0.00	0.00
3-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00	0.00
4-Methylphenol	0	--	--	--	NA	0.00	0.00
4-Nitrophenol	0	7	--	--	NA	0.00	0.00
Benzene	0	172	0.15	0.00	0.00	0.00	0.00
Ethylbenzene	0	--	0.15	--	NA	0.00	0.00
Pentachlorophenol	0	0.879	--	--	NA	0.00	0.00
Phenol	0	30	--	--	NA	0.00	0.00
Toluene	0	170	0.15	0.00	0.00	0.00	0.00
Xylenes	0	14	0.15	0.01	0.00	0.01	0.01
Polyaromatic Compounds							
Acenaphthene	0	20	0	0.01	0.00	0.01	0.01
Acenaphthylene	0	30	1	0.04	0.00	0.04	0.04
Anthracene	0	30	2	0.07	0.00	0.07	0.07
Benzo(a)anthracene	0	7	7	1.06	0.01	1.06	1.06
Benzo(a)pyrene	0	7	14	2.06	0.03	2.06	2.06
Benzo(b)fluoranthene	0	7	20	2.80	0.04	2.80	2.80
Benzo(g,h,i)perylene	0	30	23	0.75	0.01	0.75	0.75
Benzo(k)fluoranthene	0	7	5	0.71	0.01	0.71	0.71
Chrysene	0	7	13	1.90	0.02	1.90	1.90
Dibenzo(a,h)anthracene	0	7	3	0.39	0.00	0.39	0.39
Fluoranthene	0	30	18	0.60	0.01	0.60	0.60
Fluorene	0	30	0	0.01	0.00	0.01	0.01
Indeno(1,2,3-cd)pyrene	0	7	16	2.30	0.03	2.30	2.30
Naphthalene	0	30	1	0.04	0.00	0.04	0.04
Phenanthrene	0	30	9	0.29	0.00	0.29	0.29
Pyrene	0	30	30	1.01	0.01	1.01	1.01
Sum of R				78.1117559			

Appendix D Ecological Screening - Detection Limit / SBV Comparison - Koppers Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg Soil Screening Benchmark Value	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	5	3
Arsenic	1	7	5
Beryllium	1	8	0
Cadmium	1	4	0
Chromium	1	30	5
Copper	1	50	5
Lead	1	50	5
Mercury	1	0.1	1
Nickel	1	30	5
Selenium	1	0.3	3
Silver	1	2	3
Thallium	100	1	3
Zinc	1	24	5
Cyanide	0.5	780	1
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	20	0
2,4,5-Trichlorophenol	NA	9	0
2,4,6-Trichlorophenol	NA	10	0
2,4-Dichlorophenol	NA	20	0
2,4-Dimethylphenol	NA	20	0
2,4-Dinitrophenol	NA	20	0
2-Chlorophenol	NA	10	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	--	0
2-Nitrophenol	NA	7	0
3-Methylphenol	NA	--	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	--	0
4-Nitrophenol	NA	7	0
Benzene	5.2	172	0
Ethylbenzene	5.2	--	0
Pentachlorophenol	NA	0.879	0
Phenol	NA	30	0
Toluene	5.2	170	0
Xylenes	16	14	0
Polyaromatic Compounds			
Acenaphthene	5	20	4
Acenaphthylene	0.05	30	5
Anthracene	0.05	30	2
Benzo(a)anthracene	0.05	7	6
Benzo(a)pyrene	0.05	7	6
Benzo(b)fluoranthene	0.05	7	7
Benzo(g,h,i)perylene	0.05	30	6
Benzo(k)fluoranthene	0.05	7	6
Chrysene	0.05	7	6
Dibenzo(a,h)anthracene	0.05	7	6
Fluoranthene	0.05	30	7
Fluorene	5	30	3
Indeno(1,2,3-cd)pyrene	0.05	7	6
Naphthalene	0.05	30	4
Phenanthrene	0.05	30	5
Pyrene	0.05	30	6

Appendix D Soil Chemical Data Statistics - Koppers Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.06	Maximum
Arsenic	7.27	Maximum
Beryllium	0.50	Upper Confidence Limit Arithmetic
Cadmium	0.50	Upper Confidence Limit Arithmetic
Chromium	14.53	Upper Confidence Limit Arithmetic
Copper	46.00	Maximum
Lead	20.60	Maximum
Mercury	0.50	Maximum
Nickel	16.52	Upper Confidence Limit Arithmetic
Selenium	0.50	Upper Confidence Limit Arithmetic
Silver	0.50	Upper Confidence Limit Arithmetic
Thallium	50.00	Maximum
Zinc	64.20	Maximum
Cyanide	518.00	Upper Confidence Limit Arithmetic
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Upper Confidence Limit Arithmetic
2,4,5-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4,6-Trichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dichlorophenol	--	Upper Confidence Limit Arithmetic
2,4-Dimethylphenol	--	Upper Confidence Limit Arithmetic
2,4-Dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Chlorophenol	--	Upper Confidence Limit Arithmetic
2-Methyl-4,6-dinitrophenol	--	Upper Confidence Limit Arithmetic
2-Methylphenol	--	Upper Confidence Limit Arithmetic
2-Nitrophenol	--	Upper Confidence Limit Arithmetic
3-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Chloro-3-methylphenol	--	Upper Confidence Limit Arithmetic
4-Methylphenol	--	Upper Confidence Limit Arithmetic
4-Nitrophenol	--	Upper Confidence Limit Arithmetic
Benzene	0.15	Max
Ethylbenzene	0.15	Max
Pentachlorophenol	--	Upper Confidence Limit Arithmetic
Phenol	--	Upper Confidence Limit Arithmetic
Toluene	0.15	Max
Xylenes	0.15	Max
Polyaromatic Compounds		
Acenaphthene	0.22	Maximum
Acenaphthylene	1.30	Maximum
Anthracene	2.00	Maximum
Benzo(a)anthracene	7.40	Maximum
Benzo(a)pyrene	14.40	Maximum
Benzo(b)fluoranthene	19.60	Maximum
Benzo(g,h,i)perylene	22.60	Maximum
Benzo(k)fluoranthene	5.00	Maximum
Chrysene	13.30	Maximum
Dibenzo(a,h)anthracene	2.70	Maximum
Fluoranthene	17.90	Maximum
Fluorene	0.40	Maximum
Indeno(1,2,3-cd)pyrene	16.10	Maximum
Naphthalene	1.20	Maximum
Phenanthrene	8.60	Maximum
Pyrene	30.40	Maximum

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Appendix E – Human Health Risk Screening Tables

Appendix E Human Health Screening - Frequency of Detection - Tar Pond Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	3	3	100%
Arsenic	3	1	33%
Beryllium	3	0	0%
Cadmium	3	0	0%
Chromium	3	3	100%
Copper	3	3	100%
Lead	3	3	100%
Mercury	3	0	0%
Nickel	3	3	100%
Selenium	3	0	0%
Silver	3	0	0%
Thallium	3	0	0%
Zinc	3	3	100%
Cyanide	3	3	100%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	3	0	0%
2,4,5-Trichlorophenol	3	0	0%
2,4,6-Trichlorophenol	3	0	0%
2,4-Dichlorophenol	3	0	0%
2,4-Dimethylphenol	3	0	0%
2,4-Dinitrophenol	3	0	0%
2-Chlorophenol	3	0	0%
2-Methyl-4,6-dinitrophenol	3	0	0%
2-Methylphenol	0	0	--
2-Nitrophenol	3	0	0%
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	3	0	0%
4-Methylphenol	3	0	0%
4-Nitrophenol	3	0	0%
Benzene	3	0	0%
Ethylbenzene	3	0	0%
Pentachlorophenol	3	0	0%
Phenol	3	0	0%
Toluene	3	0	0%
Xylenes	3	0	0%
Polyaromatic Compounds			
Acenaphthene	14	11	79%
Acenaphthylene	14	12	86%
Anthracene	14	13	93%
Benzo(a)anthracene	14	14	100%
Benzo(a)pyrene	14	14	100%
Benzo(b)fluoranthene	14	14	100%
Benzo(g,h,i)perylene	14	14	100%
Benzo(k)fluoranthene	14	14	100%
Chrysene	14	14	100%
Dibenzo(a,h)anthracene	14	13	93%
Fluoranthene	14	14	100%
Fluorene	14	10	71%
Indeno(1,2,3-cd)pyrene	14	14	100%
Naphthalene	14	12	86%
Phenanthrene	14	14	100%
Pyrene	14	14	100%

Appendix E Human Health Screening - Background Concentrations - Tar Pond Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.87	NA
Arsenic	5.81	1.11	0.19
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	11.90	0.45
Copper	34.34	16.70	0.49
Lead	24.02	10.80	0.45
Mercury	0.04	0.50	12.50
Nickel	21.04	5.92	0.28
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	67.20	0.70
Cyanide	NA	0.80	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26.00	NA
2,4,5-Trichlorophenol	NA	26.00	NA
2,4,6-Trichlorophenol	NA	26.00	NA
2,4-Dichlorophenol	NA	26.00	NA
2,4-Dimethylphenol	NA	26.00	NA
2,4-Dinitrophenol	NA	49.00	NA
2-Chlorophenol	NA	26.00	NA
2-Methyl-4,6-dinitrophenol	NA	26.00	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	26.00	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	26.00	NA
4-Methylphenol	NA	26.00	NA
4-Nitrophenol	NA	26.00	NA
Benzene	NA	0.15	NA
Ethylbenzene	NA	0.15	NA
Pentachlorophenol	NA	26.00	NA
Phenol	NA	26.00	NA
Toluene	NA	0.15	NA
Xylenes	NA	0.15	NA
Polyaromatic Compounds			
Acenaphthene	NA	9	NA
Acenaphthylene	NA	29	NA
Anthracene	NA	16	NA
Benzo(a)anthracene	NA	50	NA
Benzo(a)pyrene	NA	129	NA
Benzo(b)fluoranthene	NA	124	NA
Benzo(g,h,i)perylene	NA	202	NA
Benzo(k)fluoranthene	NA	45	NA
Chrysene	NA	75	NA
Dibenzo(a,h)anthracene	NA	33	NA
Fluoranthene	NA	111	NA
Fluorene	NA	6	NA
Indeno(1,2,3-cd)pyrene	NA	141	NA
Naphthalene	NA	9	NA
Phenanthrene	NA	37	NA
Pyrene	NA	134	NA

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Appendix E Human Health Screening - Screening Preliminary Remedial Goals - Tar Pond Area Surface Soil

No. of COIs = 48

Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goals	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	1.87	0.00	0.00	0.00
Arsenic	0	27	1.11	0.04	0.00	0.04
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	11.90	0.19	0.00	0.19
Copper	0	76000	16.70	0.00	0.00	0.00
Lead	0	1000	10.80	0.01	0.00	0.01
Mercury	0	88	0.50	0.01	0.00	0.01
Nickel	0	41000	5.92	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	5.00	0.03	0.00	0.03
Zinc	0	100000	67.20	0.00	0.00	0.00
Cyanide	0	4400	0.80	0.00	0.00	0.00
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	26.00	0.00	0.00	0.00
2,4,5-Trichlorophenol	0	88000	26.00	0.00	0.00	0.00
2,4,6-Trichlorophenol	0	220	26.00	0.12	0.00	0.12
2,4-Dichlorophenol	0	2600	26.00	0.01	0.00	0.01
2,4-Dimethylphenol	0	18000	26.00	0.00	0.00	0.00
2,4-Dinitrophenol	0	1800	49.00	0.03	0.00	0.03
2-Chlorophenol	0	240	26.00	0.11	0.00	0.11
2-Methyl-4,6-dinitrophenol	0	--	26.00	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	26.00	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	26.00	--	NA	0.00
4-Methylphenol	0	4400	26.00	0.01	0.00	0.01
4-Nitrophenol	0	7000	26.00	0.00	0.00	0.00
Benzene	0	1.5	0.15	0.10	0.00	0.10
Ethylbenzene	0	230	0.15	0.00	0.00	0.00
Pentachlorophenol	0	11	26.00	2.36	0.00	2.36
Phenol	0	100000	26.00	0.00	0.00	0.00
Toluene	0	520	0.15	0.00	0.00	0.00
Xylenes	0	210	0.15	0.00	0.00	0.00
Polyaromatic Compounds						
Acenaphthene	0	38000	9	0.00	0.00	0.00
Acenaphthylene	0	190	29	0.15	0.00	0.15
Anthracene	0	100000	16	0.00	0.00	0.00
Benzo(a)anthracene	0	2.9	50	17.17	0.01	17.17
Benzo(a)pyrene	0	0.29	129	444.83	0.30	444.83
Benzo(b)fluoranthene	0	2.9	124	42.76	0.03	42.76
Benzo(g,h,i)perylene	0	0.29	202	696.55	0.47	696.55
Benzo(k)fluoranthene	0	29	45	1.55	0.00	1.55
Chrysene	0	290	75	0.26	0.00	0.26
Dibenzo(a,h)anthracene	0	0.29	33	112.76	0.08	112.76
Fluoranthene	0	30000	111	0.00	0.00	0.00
Fluorene	0	33000	6	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0	2.9	141	48.62	0.03	48.62
Naphthalene	0	190	9	0.05	0.00	0.05
Phenanthrene	0	0.29	37	128.62	0.09	128.62
Pyrene	0	54000	134	0.00	0.00	0.00
Sum of R				1496.35232		

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Appendix E Human Health Screening - Detection Limit / PRG Comparison - Tar Pond Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Preliminary Remedial Goal	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	820	3
Arsenic	1	27	1
Beryllium	1	2200	0
Cadmium	1	810	0
Chromium	1	64	3
Copper	1	76000	3
Lead	1	1000	3
Mercury	1	88	0
Nickel	1	41000	3
Selenium	1	10000	0
Silver	1	10000	0
Thallium	10	160	0
Zinc	1	100000	3
Cyanide	0.1	4400	3
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	52.0	26000	0
2,4,5-Trichlorophenol	52.0	88000	0
2,4,6-Trichlorophenol	52.0	220	0
2,4-Dichlorophenol	52.0	2600	0
2,4-Dimethylphenol	52.0	18000	0
2,4-Dinitrophenol	98.0	1800	0
2-Chlorophenol	52.0	240	0
2-Methyl-4,6-dinitrophenol	52.0	--	0
2-Methylphenol	NA	44000	0
2-Nitrophenol	52.0	--	0
3-Methylphenol	NA	44000	0
4-Chloro-3-methylphenol	52.0	--	0
4-Methylphenol	52.0	4400	0
4-Nitrophenol	52.0	7000	0
Benzene	0.3	1.5	0
Ethylbenzene	0.3	230	0
Pentachlorophenol	52.0	11	0
Phenol	52.0	100000	0
Toluene	0.3	520	0
Xylenes	0.3	210	0
Polyaromatic Compounds			
Acenaphthene	5	38000	11
Acenaphthylene	0.05	190	12
Anthracene	0.05	100000	13
Benzo(a)anthracene	0.05	2.9	14
Benzo(a)pyrene	0.05	0.29	14
Benzo(b)fluoranthene	0.05	2.9	14
Benzo(g,h,i)perylene	0.05	0.29	14
Benzo(k)fluoranthene	0.05	29	14
Chrysene	0.05	290	14
Dibenzo(a,h)anthracene	0.05	0.29	13
Fluoranthene	0.05	30000	14
Fluorene	5	33000	10
Indeno(1,2,3-cd)pyrene	0.05	2.9	14
Naphthalene	0.05	190	12
Phenanthrene	0.05	0.29	14
Pyrene	0.05	54000	14

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Appendix E Soil Chemical Data Statistics - Tar Pond Area Surface Soil

	EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.87	Maximum
Arsenic	1.11	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	11.90	Maximum
Copper	16.70	Maximum
Lead	10.80	Maximum
Mercury	0.50	Maximum
Nickel	5.92	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	5.00	Maximum
Zinc	67.20	Maximum
Cyanide	0.80	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	26.00	Maximum
2,4,5-Trichlorophenol	26.00	Maximum
2,4,6-Trichlorophenol	26.00	Maximum
2,4-Dichlorophenol	26.00	Maximum
2,4-Dimethylphenol	26.00	Maximum
2,4-Dinitrophenol	49.00	Maximum
2-Chlorophenol	26.00	Maximum
2-Methyl-4,6-dinitrophenol	26.00	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	26.00	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	26.00	Maximum
4-Methylphenol	26.00	Maximum
4-Nitrophenol	26.00	Maximum
Benzene	0.15	Maximum
Ethylbenzene	0.15	Maximum
Pentachlorophenol	26.00	Maximum
Phenol	26.00	Maximum
Toluene	0.15	Maximum
Xylenes	0.15	Maximum
Polyaromatic Compounds		
Acenaphthene	9.20	Maximum
Acenaphthylene	29.10	Maximum
Anthracene	16.00	Maximum
Benzo(a)anthracene	49.80	Maximum
Benzo(a)pyrene	129.00	Maximum
Benzo(b)fluoranthene	124.00	Maximum
Benzo(g,h,i)perylene	202.00	Maximum
Benzo(k)fluoranthene	45.00	Maximum
Chrysene	75.40	Maximum
Dibenzo(a,h)anthracene	32.70	Maximum
Fluoranthene	110.50	Maximum
Fluorene	5.90	Maximum
Indeno(1,2,3-cd)pyrene	141.00	Maximum
Naphthalene	9.40	Maximum
Phenanthrene	37.30	Maximum
Pyrene	133.80	Maximum

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Appendix E Human Health - Frequency of Detection - Tar Pond Area Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	4	4	100%
Arsenic	12	2	17%
Beryllium	4	0	0%
Cadmium	4	0	0%
Chromium	4	4	100%
Copper	4	4	100%
Lead	4	4	100%
Mercury	4	0	0%
Nickel	4	4	100%
Selenium	4	0	0%
Silver	4	0	0%
Thallium	4	0	0%
Zinc	4	4	100%
Cyanide	7	5	71%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	2	0	0%
2,4,5-Trichlorophenol	2	0	0%
2,4,6-Trichlorophenol	2	0	0%
2,4-Dichlorophenol	2	0	0%
2,4-Dimethylphenol	2	0	0%
2,4-Dinitrophenol	2	0	0%
2-Chlorophenol	2	0	0%
2-Methyl-4,6-dinitrophenol	2	0	0%
2-Methylphenol	0	0	--
2-Nitrophenol	2	0	0%
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	2	0	0%
4-Methylphenol	2	0	0%
4-Nitrophenol	2	0	0%
Benzene	18	11	61%
Ethylbenzene	18	11	61%
Pentachlorophenol	2	0	0%
Phenol	2	0	0%
Toluene	18	10	56%
Xylenes	18	11	61%
Polyaromatic Compounds			
Acenaphthene	22	18	82%
Acenaphthylene	22	18	82%
Anthracene	22	19	86%
Benzo(a)anthracene	22	20	91%
Benzo(a)pyrene	22	21	95%
Benzo(b)fluoranthene	22	21	95%
Benzo(g,h,i)perylene	22	16	73%
Benzo(k)fluoranthene	22	18	82%
Chrysene	22	21	95%
Dibenzo(a,h)anthracene	22	14	64%
Fluoranthene	22	20	91%
Fluorene	22	17	77%
Indeno(1,2,3-cd)pyrene	22	16	73%
Naphthalene	22	18	82%
Phenanthrene	22	19	86%
Pyrene	22	21	95%

Appendix E Human Health - Background Concentrations - Tar Pond Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.59	NA
Arsenic	5.81	1.80	0.31
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	10.60	0.40
Copper	34.34	10.70	0.31
Lead	24.02	18.30	0.76
Mercury	0.04	0.50	12.50
Nickel	21.04	11.10	0.53
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	62.60	0.66
Cyanide	NA	6.48	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26.00	NA
2,4,5-Trichlorophenol	NA	26.00	NA
2,4,6-Trichlorophenol	NA	26.00	NA
2,4-Dichlorophenol	NA	26.00	NA
2,4-Dimethylphenol	NA	26.00	NA
2,4-Dinitrophenol	NA	46.00	NA
2-Chlorophenol	NA	26.00	NA
2-Methyl-4,6-dinitrophenol	NA	26.00	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	26.00	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	26.00	NA
4-Methylphenol	NA	26.00	NA
4-Nitrophenol	NA	26.00	NA
Benzene	NA	107.00	NA
Ethylbenzene	NA	103.00	NA
Pentachlorophenol	NA	26.00	NA
Phenol	NA	26.00	NA
Toluene	NA	78.10	NA
Xylenes	NA	141.00	NA
Polyaromatic Compounds			
Acenaphthene	NA	990	NA
Acenaphthylene	NA	807	NA
Anthracene	NA	1289	NA
Benzo(a)anthracene	NA	495	NA
Benzo(a)pyrene	NA	585	NA
Benzo(b)fluoranthene	NA	500	NA
Benzo(g,h,i)perylene	NA	529	NA
Benzo(k)fluoranthene	NA	292	NA
Chrysene	NA	824	NA
Dibenzo(a,h)anthracene	NA	87	NA
Fluoranthene	NA	2050	NA
Fluorene	NA	810	NA
Indeno(1,2,3-cd)pyrene	NA	373	NA
Naphthalene	NA	11100	NA
Phenanthrene	NA	4560	NA
Pyrene	NA	3580	NA

Appendix E Human Health - Preliminary Remdial Goals - Tar Pond Area Subsurface Soil

No. of COIs = 48

Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goals	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	1.59	0.00	0.00	0.00
Arsenic	0	27	1.80	0.07	0.00	0.07
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	10.60	0.17	0.00	0.17
Copper	0	76000	10.70	0.00	0.00	0.00
Lead	0	1000	18.30	0.02	0.00	0.02
Mercury	0	88	0.50	0.01	0.00	0.01
Nickel	0	41000	11.10	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	5.00	0.03	0.00	0.03
Zinc	0	100000	62.60	0.00	0.00	0.00
Cyanide	0	4400	6.48	0.00	0.00	0.00
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	26.00	0.00	0.00	0.00
2,4,5-Trichlorophenol	0	88000	26.00	0.00	0.00	0.00
2,4,6-Trichlorophenol	0	220	26.00	0.12	0.00	0.12
2,4-Dichlorophenol	0	2600	26.00	0.01	0.00	0.01
2,4-Dimethylphenol	0	18000	26.00	0.00	0.00	0.00
2,4-Dinitrophenol	0	1800	46.00	0.03	0.00	0.03
2-Chlorophenol	0	240	26.00	0.11	0.00	0.11
2-Methyl-4,6-dinitrophenol	0	--	26.00	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	26.00	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	26.00	--	NA	0.00
4-Methylphenol	0	4400	26.00	0.01	0.00	0.01
4-Nitrophenol	0	7000	26.00	0.00	0.00	0.00
Benzene	0	1.5	107.00	71.33	0.00	71.33
Ethylbenzene	0	230	103.00	0.45	0.00	0.45
Pentachlorophenol	0	11	26.00	2.36	0.00	2.36
Phenol	0	100000	26.00	0.00	0.00	0.00
Toluene	0	520	78.10	0.15	0.00	0.15
Xylenes	0	210	141.00	0.67	0.00	0.67
Polyaromatic Compounds						
Acenaphthene	0	38000	990	0.03	0.00	0.03
Acenaphthylene	0	190	807	4.25	0.00	4.25
Anthracene	0	100000	1289	0.01	0.00	0.01
Benzo(a)anthracene	0	2.9	495	170.69	0.01	170.69
Benzo(a)pyrene	0	0.29	585	2017.24	0.10	2017.24
Benzo(b)fluoranthene	0	2.9	500	172.41	0.01	172.41
Benzo(g,h,i)perylene	0	0.29	529	1824.14	0.09	1824.14
Benzo(k)fluoranthene	0	29	292	10.07	0.00	10.07
Chrysene	0	290	824	2.84	0.00	2.84
Dibenzo(a,h)anthracene	0	0.29	87	301.03	0.01	301.03
Fluoranthene	0	30000	2050	0.07	0.00	0.07
Fluorene	0	33000	810	0.02	0.00	0.02
Indeno(1,2,3-cd)pyrene	0	2.9	373	128.62	0.01	128.62
Naphthalene	0	190	11100	58.42	0.00	58.42
Phenanthrene	0	0.29	4560	15724.14	0.77	15724.14
Pyrene	0	54000	3580	0.07	0.00	0.07
Sum of R				20489.5868		

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Appendix E Human Health - Detection Limit / PRG Comparison - Tar Pond Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Preliminary Remedial Goal	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	820	4
Arsenic	1	27	2
Beryllium	1	2200	0
Cadmium	1	810	0
Chromium	1	64	4
Copper	1	76000	4
Lead	1	1000	4
Mercury	1	88	0
Nickel	1	41000	4
Selenium	1	10000	0
Silver	1	10000	0
Thallium	10	160	0
Zinc	1	100000	4
Cyanide	0.02	4400	5
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	52.0	26000	0
2,4,5-Trichlorophenol	52.0	88000	0
2,4,6-Trichlorophenol	52.0	220	0
2,4-Dichlorophenol	52.0	2600	0
2,4-Dimethylphenol	52.0	18000	0
2,4-Dinitrophenol	98.0	1800	0
2-Chlorophenol	52.0	240	0
2-Methyl-4,6-dinitrophenol	52.0	--	0
2-Methylphenol	NA	44000	0
2-Nitrophenol	52.0	--	0
3-Methylphenol	NA	44000	0
4-Chloro-3-methylphenol	52.0	--	0
4-Methylphenol	52.0	4400	0
4-Nitrophenol	52.0	7000	0
Benzene	0.03	1.5	11
Ethylbenzene	0.03	230	11
Pentachlorophenol	52.0	11	0
Phenol	52.0	100000	0
Toluene	1.5	520	10
Xylenes	0.08	210	11
Polyaromatic Compounds			
Acenaphthene	0.05	38000	18
Acenaphthylene	0.05	190	18
Anthracene	0.05	100000	19
Benzo(a)anthracene	0.05	2.9	20
Benzo(a)pyrene	0.05	0.29	21
Benzo(b)fluoranthene	0.05	2.9	21
Benzo(g,h,i)perylene	1	0.29	16
Benzo(k)fluoranthene	0.05	29	18
Chrysene	0.05	290	21
Dibenzo(a,h)anthracene	1	0.29	14
Fluoranthene	0.05	30000	20
Fluorene	0.5	33000	17
Indeno(1,2,3-cd)pyrene	1	2.9	16
Naphthalene	0.05	190	18
Phenanthrene	0.05	0.29	19
Pyrene	0.05	54000	21

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Appendix E Soil Chemical Data Statistics - Tar Pond Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.59	Maximum
Arsenic	1.80	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	10.60	Maximum
Copper	10.70	Maximum
Lead	18.30	Maximum
Mercury	0.50	Maximum
Nickel	11.10	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	5.00	Maximum
Zinc	62.60	Maximum
Cyanide	6.48	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	26	Maximum
2,4,5-Trichlorophenol	26	Maximum
2,4,6-Trichlorophenol	26	Maximum
2,4-Dichlorophenol	26	Maximum
2,4-Dimethylphenol	26	Maximum
2,4-Dinitrophenol	46	Maximum
2-Chlorophenol	26	Maximum
2-Methyl-4,6-dinitrophenol	26	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	26	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	26	Maximum
4-Methylphenol	26	Maximum
4-Nitrophenol	26	Maximum
Benzene	107	Maximum
Ethylbenzene	103	Maximum
Pentachlorophenol	26	Maximum
Phenol	26	Maximum
Toluene	78	Maximum
Xylenes	141	Maximum
Polyaromatic Compounds		
Acenaphthene	990	Maximum
Acenaphthylene	807	Maximum
Anthracene	1289	Maximum
Benzo(a)anthracene	495	Maximum
Benzo(a)pyrene	585	Maximum
Benzo(b)fluoranthene	500	Maximum
Benzo(g,h,i)perylene	529	Maximum
Benzo(k)fluoranthene	292	Maximum
Chrysene	824	Maximum
Dibenzo(a,h)anthracene	87	Maximum
Fluoranthene	2050	Maximum
Fluorene	810	Maximum
Indeno(1,2,3-cd)pyrene	373	Maximum
Naphthalene	11100	Maximum
Phenanthrene	4560	Maximum
Pyrene	3580	Maximum

NWT 002998

Appendix E Human Health Screening - Frequency of Detection - FAMM Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	3	2	67%
Arsenic	3	1	33%
Beryllium	3	0	0%
Cadmium	3	0	0%
Chromium	3	2	67%
Copper	3	3	100%
Lead	3	2	67%
Mercury	3	0	0%
Nickel	3	3	100%
Selenium	3	0	0%
Silver	3	0	0%
Thallium	3	0	0%
Zinc	3	3	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	0	0	--
Ethylbenzene	0	0	--
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	0	0	--
Xylenes	0	0	--
Polyaromatic Compounds			
Acenaphthene	3	1	33%
Acenaphthylene	3	2	67%
Anthracene	3	1	33%
Benzo(a)anthracene	3	3	100%
Benzo(a)pyrene	3	3	100%
Benzo(b)fluoranthene	3	3	100%
Benzo(g,h,i)perylene	3	3	100%
Benzo(k)fluoranthene	3	3	100%
Chrysene	3	3	100%
Dibenzo(a,h)anthracene	3	3	100%
Fluoranthene	3	3	100%
Fluorene	3	1	33%
Indeno(1,2,3-cd)pyrene	3	3	100%
Naphthalene	3	2	67%
Phenanthrene	3	3	100%
Pyrene	3	3	100%

Appendix E Human Health Screening - Background Concentrations - FAMM Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	2.26	NA
Arsenic	5.81	3.14	0.54
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	70.90	2.67
Copper	34.34	34.70	1.01
Lead	24.02	30.40	1.27
Mercury	0.04	0.50	12.50
Nickel	21.04	146.00	6.94
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	114.00	1.19
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	--	NA
Ethylbenzene	NA	--	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	--	NA
Xylenes	NA	--	NA
Polyaromatic Compounds			
Acenaphthene	NA	0	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	0	NA
Benzo(a)anthracene	NA	1	NA
Benzo(a)pyrene	NA	2	NA
Benzo(b)fluoranthene	NA	2	NA
Benzo(g,h,i)perylene	NA	2	NA
Benzo(k)fluoranthene	NA	1	NA
Chrysene	NA	2	NA
Dibenzo(a,h)anthracene	NA	0	NA
Fluoranthene	NA	3	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	2	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	2	NA
Pyrene	NA	3	NA

Appendix E Human Health Screening - Preliminary Remedial Goals - FAMM Area Surface Soil

No. of COIs =	29					
Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goal	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	2.26	0.00	0.00	0.00
Arsenic	0	27	3.14	0.12	0.00	0.12
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	70.90	1.11	0.05	1.11
Copper	0	76000	34.70	0.00	0.00	0.00
Lead	0	1000	30.40	0.03	0.00	0.03
Mercury	0	88	0.50	0.01	0.00	0.01
Nickel	0	41000	146.00	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	5.00	0.03	0.00	0.03
Zinc	0	100000	114.00	0.00	0.00	0.00
Cyanide	0	4400	--	--	NA	0.00
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	--	--	NA	0.00
2,4,5-Trichlorophenol	0	88000	--	--	NA	0.00
2,4,6-Trichlorophenol	0	220	--	--	NA	0.00
2,4-Dichlorophenol	0	2600	--	--	NA	0.00
2,4-Dimethylphenol	0	18000	--	--	NA	0.00
2,4-Dinitrophenol	0	1800	--	--	NA	0.00
2-Chlorophenol	0	240	--	--	NA	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	--	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00
4-Methylphenol	0	4400	--	--	NA	0.00
4-Nitrophenol	0	7000	--	--	NA	0.00
Benzene	0	1.5	--	--	NA	0.00
Ethylbenzene	0	230	--	--	NA	0.00
Pentachlorophenol	0	11	--	--	NA	0.00
Phenol	0	100000	--	--	NA	0.00
Toluene	0	520	--	--	NA	0.00
Xylenes	0	210	--	--	NA	0.00
Polyaromatic Compounds						
Acenaphthene	0	38000	0	0.00	0.00	0.00
Acenaphthylene	0	190	0	0.00	0.00	0.00
Anthracene	0	100000	0	0.00	0.00	0.00
Benzo(a)anthracene	0	2.9	1	0.43	0.02	0.43
Benzo(a)pyrene	0	0.29	2	6.00	0.26	6.00
Benzo(b)fluoranthene	0	2.9	2	0.55	0.02	0.55
Benzo(g,h,i)perylene	0	0.29	2	6.28	0.27	6.28
Benzo(k)fluoranthene	0	29	1	0.04	0.00	0.04
Chrysene	0	290	2	0.01	0.00	0.01
Dibenzo(a,h)anthracene	0	0.29	0	1.34	0.06	1.34
Fluoranthene	0	30000	3	0.00	0.00	0.00
Fluorene	0	33000	0	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0	2.9	2	0.53	0.02	0.53
Naphthalene	0	190	0	0.00	0.00	0.00
Phenanthrene	0	0.29	2	6.97	0.30	6.97
Pyrene	0	54000	3	0.00	0.00	0.00
Sum of R				23.4373972		

Appendix E Human Health - Detection Limit / PRG Comparison - FAMM Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Preliminary Remedial Goal	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	820	2
Arsenic	1	27	1
Beryllium	1	2200	0
Cadmium	1	810	0
Chromium	1	64	2
Copper	1	76000	3
Lead	1	1000	2
Mercury	1	88	0
Nickel	1	41000	3
Selenium	1	10000	0
Silver	1	10000	0
Thallium	10	160	0
Zinc	1	100000	3
Cyanide	0.5	4400	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26000	0
2,4,5-Trichlorophenol	NA	88000	0
2,4,6-Trichlorophenol	NA	220	0
2,4-Dichlorophenol	NA	2600	0
2,4-Dimethylphenol	NA	18000	0
2,4-Dinitrophenol	NA	1800	0
2-Chlorophenol	NA	240	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	44000	0
2-Nitrophenol	NA	--	0
3-Methylphenol	NA	44000	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	4400	0
4-Nitrophenol	NA	7000	0
Benzene	NA	1.5	0
Ethylbenzene	NA	230	0
Pentachlorophenol	NA	11	0
Phenol	NA	100000	0
Toluene	NA	520	0
Xylenes	NA	210	0
Polyaromatic Compounds			
Acenaphthene	0.05	38000	1
Acenaphthylene	0.05	190	2
Anthracene	0.05	100000	1
Benzo(a)anthracene	0.05	2.9	3
Benzo(a)pyrene	0.05	0.29	3
Benzo(b)fluoranthene	0.05	2.9	3
Benzo(g,h,i)perylene	0.05	0.29	3
Benzo(k)fluoranthene	0.05	29	3
Chrysene	0.05	290	3
Dibenzo(a,h)anthracene	0.05	0.29	3
Fluoranthene	0.05	30000	3
Fluorene	0.05	33000	1
Indeno(1,2,3-cd)pyrene	0.05	2.9	3
Naphthalene	0.05	190	2
Phenanthrene	0.05	0.29	3
Pyrene	0.05	54000	3

Appendix E Soil Chemical Data Statistics - FAMM Area Surface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	2.26	Maximum
Arsenic	3.14	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	70.90	Maximum
Copper	34.70	Maximum
Lead	30.40	Maximum
Mercury	0.50	Maximum
Nickel	146.00	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	5.00	Maximum
Zinc	114.00	Maximum
Cyanide	--	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Maximum
2,4,5-Trichlorophenol	--	Maximum
2,4,6-Trichlorophenol	--	Maximum
2,4-Dichlorophenol	--	Maximum
2,4-Dimethylphenol	--	Maximum
2,4-Dinitrophenol	--	Maximum
2-Chlorophenol	--	Maximum
2-Methyl-4,6-dinitrophenol	--	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	--	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	--	Maximum
4-Methylphenol	--	Maximum
4-Nitrophenol	--	Maximum
Benzene	--	Maximum
Ethylbenzene	--	Maximum
Pentachlorophenol	--	Maximum
Phenol	--	Maximum
Toluene	--	Maximum
Xylenes	--	Maximum
Polyaromatic Compounds		
Acenaphthene	0.06	Maximum
Acenaphthylene	0.18	Maximum
Anthracene	0.32	Maximum
Benzo(a)anthracene	1.24	Maximum
Benzo(a)pyrene	1.74	Maximum
Benzo(b)fluoranthene	1.60	Maximum
Benzo(g,h,i)perylene	1.82	Maximum
Benzo(k)fluoranthene	1.02	Maximum
Chrysene	1.60	Maximum
Dibenzo(a,h)anthracene	0.39	Maximum
Fluoranthene	2.78	Maximum
Fluorene	0.07	Maximum
Indeno(1,2,3-cd)pyrene	1.53	Maximum
Naphthalene	0.43	Maximum
Phenanthrene	2.02	Maximum
Pyrene	2.59	Maximum

Appendix E Human Health Screening - Frequency of Detection - FAMM Area Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	3	2	67%
Arsenic	9	9	100%
Beryllium	3	0	0%
Cadmium	3	0	0%
Chromium	3	3	100%
Copper	3	3	100%
Lead	3	1	33%
Mercury	3	1	33%
Nickel	3	0	0%
Selenium	3	0	0%
Silver	3	1	33%
Thallium	3	1	33%
Zinc	3	3	100%
Cyanide	6	0	0%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	8	0	0%
Ethylbenzene	8	1	13%
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	8	0	0%
Xylenes	8	1	13%
Polyaromatic Compounds			
Acenaphthene	9	5	56%
Acenaphthylene	9	2	22%
Anthracene	9	5	56%
Benzo(a)anthracene	9	5	56%
Benzo(a)pyrene	9	5	56%
Benzo(b)fluoranthene	9	5	56%
Benzo(g,h,i)perylene	9	6	67%
Benzo(k)fluoranthene	9	5	56%
Chrysene	9	5	56%
Dibenzo(a,h)anthracene	9	3	33%
Fluoranthene	9	5	56%
Fluorene	9	3	33%
Indeno(1,2,3-cd)pyrene	9	5	56%
Naphthalene	9	4	44%
Phenanthrene	9	5	56%
Pyrene	9	5	56%

Appendix E Human Health Screening - Background Concentrations - FAMM Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.02	NA
Arsenic	5.81	5.25	0.90
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	16.10	0.61
Copper	34.34	19.60	0.57
Lead	24.02	13.20	0.55
Mercury	0.04	3.50	87.50
Nickel	21.04	14.30	0.68
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	27.50	NA
Zinc	95.52	55.20	0.58
Cyanide	NA	0.02	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	0.01	NA
Ethylbenzene	NA	0.03	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	0.01	NA
Xylenes	NA	0.13	NA
Polyaromatic Compounds			
Acenaphthene	NA	2	NA
Acenaphthylene	NA	4	NA
Anthracene	NA	3	NA
Benzo(a)anthracene	NA	18	NA
Benzo(a)pyrene	NA	47	NA
Benzo(b)fluoranthene	NA	40	NA
Benzo(g,h,i)perylene	NA	58	NA
Benzo(k)fluoranthene	NA	12	NA
Chrysene	NA	24	NA
Dibenzo(a,h)anthracene	NA	6	NA
Fluoranthene	NA	26	NA
Fluorene	NA	2	NA
Indeno(1,2,3-cd)pyrene	NA	38	NA
Naphthalene	NA	2	NA
Phenanthrene	NA	9	NA
Pyrene	NA	52	NA

Appendix E Human Health Screening - Preliminary Remedial Goals - FAMM Area Subsurface Soil

No. of COIs =	34					
Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goal	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	1.02	0.00	0.00	0.00
Arsenic	0	27	5.25	0.19	0.00	0.19
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	16.10	0.25	0.00	0.25
Copper	0	76000	19.60	0.00	0.00	0.00
Lead	0	1000	13.20	0.01	0.00	0.01
Mercury	0	88	3.50	0.04	0.00	0.04
Nickel	0	41000	14.30	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	27.50	0.17	0.00	0.17
Zinc	0	100000	55.20	0.00	0.00	0.00
Cyanide	0	4400	0.02	0.00	0.00	0.00
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	--	--	NA	0.00
2,4,5-Trichlorophenol	0	88000	--	--	NA	0.00
2,4,6-Trichlorophenol	0	220	--	--	NA	0.00
2,4-Dichlorophenol	0	2600	--	--	NA	0.00
2,4-Dimethylphenol	0	18000	--	--	NA	0.00
2,4-Dinitrophenol	0	1800	--	--	NA	0.00
2-Chlorophenol	0	240	--	--	NA	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	--	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00
4-Methylphenol	0	4400	--	--	NA	0.00
4-Nitrophenol	0	7000	--	--	NA	0.00
Benzene	0	1.5	0.01	0.01	0.00	0.01
Ethylbenzene	0	230	0.03	0.00	0.00	0.00
Pentachlorophenol	0	11	--	--	NA	0.00
Phenol	0	100000	--	--	NA	0.00
Toluene	0	520	0.01	0.00	0.00	0.00
Xylenes	0	210	0.13	0.00	0.00	0.00
Polyaromatic Compounds						
Acenaphthene	0	38000	2	0.00	0.00	0.00
Acenaphthylene	0	190	4	0.02	0.00	0.02
Anthracene	0	100000	3	0.00	0.00	0.00
Benzo(a)anthracene	0	2.9	18	6.21	0.01	6.21
Benzo(a)pyrene	0	0.29	47	162.07	0.36	162.07
Benzo(b)fluoranthene	0	2.9	40	13.79	0.03	13.79
Benzo(g,h,i)perylene	0	0.29	58	200.00	0.45	200.00
Benzo(k)fluoranthene	0	29	12	0.41	0.00	0.41
Chrysene	0	290	24	0.08	0.00	0.08
Dibenzo(a,h)anthracene	0	0.29	6	20.69	0.05	20.69
Fluoranthene	0	30000	26	0.00	0.00	0.00
Fluorene	0	33000	2	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0	2.9	38	13.10	0.03	13.10
Naphthalene	0	190	2	0.01	0.00	0.01
Phenanthrene	0	0.29	9	29.31	0.07	29.31
Pyrene	0	54000	52	0.00	0.00	0.00
Sum of R				446.387418		

Appendix E Human Health Screening - Detection Limit / PRG Comparison - FAMM Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Preliminary Remedial Goal	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	820	2
Arsenic	1	27	9
Beryllium	1	2200	0
Cadmium	1	810	0
Chromium	1	64	3
Copper	1	76000	3
Lead	1	1000	1
Mercury	1	88	1
Nickel	1	41000	0
Selenium	1	10000	0
Silver	1	10000	1
Thallium	10	160	1
Zinc	1	100000	3
Cyanide	0.03	4400	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26000	0
2,4,5-Trichlorophenol	NA	88000	0
2,4,6-Trichlorophenol	NA	220	0
2,4-Dichlorophenol	NA	2600	0
2,4-Dimethylphenol	NA	18000	0
2,4-Dinitrophenol	NA	1800	0
2-Chlorophenol	NA	240	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	44000	0
2-Nitrophenol	NA	--	0
3-Methylphenol	NA	44000	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	4400	0
4-Nitrophenol	NA	7000	0
Benzene	0.026	1.5	0
Ethylbenzene	0.026	230	1
Pentachlorophenol	NA	11	0
Phenol	NA	100000	0
Toluene	0.026	520	0
Xylenes	0.074	210	1
Polyaromatic Compounds			
Acenaphthene	0.7	38000	5
Acenaphthylene	0.7	190	2
Anthracene	0.7	100000	5
Benzo(a)anthracene	0.7	2.9	5
Benzo(a)pyrene	0.7	0.29	5
Benzo(b)fluoranthene	0.7	2.9	5
Benzo(g,h,i)perylene	0.7	0.29	6
Benzo(k)fluoranthene	0.7	29	5
Chrysene	0.7	290	5
Dibenzo(a,h)anthracene	0.7	0.29	3
Fluoranthene	0.7	30000	5
Fluorene	0.7	33000	3
Indeno(1,2,3-cd)pyrene	0.7	2.9	5
Naphthalene	0.7	190	4
Phenanthrene	0.7	0.29	5
Pyrene	0.7	54000	5

Appendix E Soil Chemical Data Statistics - FAMM Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.02	Maximum
Arsenic	5.25	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	16.10	Maximum
Copper	19.60	Maximum
Lead	13.20	Maximum
Mercury	3.50	Maximum
Nickel	14.30	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	27.50	Maximum
Zinc	55.20	Maximum
Cyanide	0.02	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Maximum
2,4,5-Trichlorophenol	--	Maximum
2,4,6-Trichlorophenol	--	Maximum
2,4-Dichlorophenol	--	Maximum
2,4-Dimethylphenol	--	Maximum
2,4-Dinitrophenol	--	Maximum
2-Chlorophenol	--	Maximum
2-Methyl-4,6-dinitrophenol	--	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	--	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	--	Maximum
4-Methylphenol	--	Maximum
4-Nitrophenol	--	Maximum
Benzene	0.01	Maximum
Ethylbenzene	0.03	Maximum
Pentachlorophenol	--	Maximum
Phenol	--	Maximum
Toluene	0.01	Maximum
Xylenes	0.13	Maximum
Polyaromatic Compounds		
Acenaphthene	1.65	Maximum
Acenaphthylene	4.00	Maximum
Anthracene	2.80	Maximum
Benzo(a)anthracene	18.00	Maximum
Benzo(a)pyrene	47.00	Maximum
Benzo(b)fluoranthene	40.00	Maximum
Benzo(g,h,i)perylene	58.00	Maximum
Benzo(k)fluoranthene	12.00	Maximum
Chrysene	24.00	Maximum
Dibenzo(a,h)anthracene	6.00	Maximum
Fluoranthene	26.00	Maximum
Fluorene	2.10	Maximum
Indeno(1,2,3-cd)pyrene	38.00	Maximum
Naphthalene	2.30	Maximum
Phenanthrene	8.50	Maximum
Pyrene	52.00	Maximum

NWT 003008

Appendix E Human Health Screening - Frequency of Detection - Office Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	4	4	100%
Arsenic	4	4	100%
Beryllium	4	0	0%
Cadmium	4	0	0%
Chromium	4	4	100%
Copper	4	4	100%
Lead	4	4	100%
Mercury	4	0	0%
Nickel	4	4	100%
Selenium	4	0	0%
Silver	4	0	0%
Thallium	4	0	0%
Zinc	4	4	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	0	0	--
Ethylbenzene	0	0	--
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	0	0	--
Xylenes	0	0	--
Polyaromatic Compounds			
Acenaphthene	4	4	100%
Acenaphthylene	4	3	75%
Anthracene	4	1	25%
Benzo(a)anthracene	4	4	100%
Benzo(a)pyrene	4	4	100%
Benzo(b)fluoranthene	4	4	100%
Benzo(g,h,i)perylene	4	4	100%
Benzo(k)fluoranthene	4	4	100%
Chrysene	4	4	100%
Dibenzo(a,h)anthracene	4	4	100%
Fluoranthene	4	4	100%
Fluorene	4	2	50%
Indeno(1,2,3-cd)pyrene	4	4	100%
Naphthalene	4	2	50%
Phenanthrene	4	4	100%
Pyrene	4	4	100%

Appendix E Human Health Screening - Background Concentrations - Office Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.96	NA
Arsenic	5.81	5.26	0.91
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	24.70	0.93
Copper	34.34	52.10	1.52
Lead	24.02	55.40	2.31
Mercury	0.04	0.50	12.50
Nickel	21.04	84.00	3.99
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	0.50	NA
Zinc	95.52	92.90	0.97
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	--	NA
Ethylbenzene	NA	--	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	--	NA
Xylenes	NA	--	NA
Polyaromatic Compounds			
Acenaphthene	NA	0	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	1	NA
Benzo(a)anthracene	NA	5	NA
Benzo(a)pyrene	NA	7	NA
Benzo(b)fluoranthene	NA	5	NA
Benzo(g,h,i)perylene	NA	6	NA
Benzo(k)fluoranthene	NA	4	NA
Chrysene	NA	5	NA
Dibenzo(a,h)anthracene	NA	1	NA
Fluoranthene	NA	7	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	5	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	3	NA
Pyrene	NA	7	NA

Appendix E Human Health Screening - Preliminary Remedial Goals - Office Area Surface Soil

No. of COIs = 29

Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goal	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	1.96	0.00	0.00	0.00
Arsenic	0	27	5.26	0.19	0.00	0.19
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	24.70	0.39	0.01	0.39
Copper	0	76000	52.10	0.00	0.00	0.00
Lead	0	1000	55.40	0.06	0.00	0.06
Mercury	0	88	0.50	0.01	0.00	0.01
Nickel	0	41000	84.00	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	0.50	0.00	0.00	0.00
Zinc	0	100000	92.90	0.00	0.00	0.00
Cyanide	0	4400	--	--	NA	0.00
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	--	--	NA	0.00
2,4,5-Trichlorophenol	0	88000	--	--	NA	0.00
2,4,6-Trichlorophenol	0	220	--	--	NA	0.00
2,4-Dichlorophenol	0	2600	--	--	NA	0.00
2,4-Dimethylphenol	0	18000	--	--	NA	0.00
2,4-Dinitrophenol	0	1800	--	--	NA	0.00
2-Chlorophenol	0	240	--	--	NA	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	--	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00
4-Methylphenol	0	4400	--	--	NA	0.00
4-Nitrophenol	0	7000	--	--	NA	0.00
Benzene	0	1.5	--	--	NA	0.00
Ethylbenzene	0	230	--	--	NA	0.00
Pentachlorophenol	0	11	--	--	NA	0.00
Phenol	0	100000	--	--	NA	0.00
Toluene	0	520	--	--	NA	0.00
Xylenes	0	210	--	--	NA	0.00
Polyaromatic Compounds						
Acenaphthene	0	38000	0	0.00	0.00	0.00
Acenaphthylene	0	190	0	0.00	0.00	0.00
Anthracene	0	100000	1	0.00	0.00	0.00
Benzo(a)anthracene	0	2.9	5	1.68	0.03	1.68
Benzo(a)pyrene	0	0.29	7	22.41	0.35	22.41
Benzo(b)fluoranthene	0	2.9	5	1.88	0.03	1.88
Benzo(g,h,i)perylene	0	0.29	6	20.00	0.31	20.00
Benzo(k)fluoranthene	0	29	4	0.14	0.00	0.14
Chrysene	0	290	5	0.02	0.00	0.02
Dibenzo(a,h)anthracene	0	0.29	1	5.07	0.08	5.07
Fluoranthene	0	30000	7	0.00	0.00	0.00
Fluorene	0	33000	0	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0	2.9	5	1.64	0.03	1.64
Naphthalene	0	190	0	0.00	0.00	0.00
Phenanthrene	0	0.29	3	10.34	0.16	10.34
Pyrene	0	54000	7	0.00	0.00	0.00
Sum of R				63.8398		

Appendix E Soil Chemical Data Statistics - Office Area Surface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.96	Maximum
Arsenic	5.26	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	24.70	Maximum
Copper	52.10	Maximum
Lead	55.40	Maximum
Mercury	0.50	Maximum
Nickel	84.00	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	0.50	Maximum
Zinc	92.90	Maximum
Cyanide	--	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Maximum
2,4,5-Trichlorophenol	--	Maximum
2,4,6-Trichlorophenol	--	Maximum
2,4-Dichlorophenol	--	Maximum
2,4-Dimethylphenol	--	Maximum
2,4-Dinitrophenol	--	Maximum
2-Chlorophenol	--	Maximum
2-Methyl-4,6-dinitrophenol	--	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	--	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	--	Maximum
4-Methylphenol	--	Maximum
4-Nitrophenol	--	Maximum
Benzene	--	Maximum
Ethylbenzene	--	Maximum
Pentachlorophenol	--	Maximum
Phenol	--	Maximum
Toluene	--	Maximum
Xylenes	--	Maximum
Polyaromatic Compounds		
Acenaphthene	0.36	Maximum
Acenaphthylene	0.25	Maximum
Anthracene	0.56	Maximum
Benzo(a)anthracene	4.86	Maximum
Benzo(a)pyrene	6.50	Maximum
Benzo(b)fluoranthene	5.45	Maximum
Benzo(g,h,i)perylene	5.80	Maximum
Benzo(k)fluoranthene	4.14	Maximum
Chrysene	5.20	Maximum
Dibenzo(a,h)anthracene	1.47	Maximum
Fluoranthene	7.05	Maximum
Fluorene	0.25	Maximum
Indeno(1,2,3-cd)pyrene	4.76	Maximum
Naphthalene	0.25	Maximum
Phenanthrene	3.00	Maximum
Pyrene	6.80	Maximum

Appendix E Human Health Screening - Frequency of Detection - Office Area Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	5	3	60%
Arsenic	5	5	100%
Beryllium	5	0	0%
Cadmium	5	0	0%
Chromium	5	5	100%
Copper	5	5	100%
Lead	5	5	100%
Mercury	5	0	0%
Nickel	5	5	100%
Selenium	5	0	0%
Silver	5	0	0%
Thallium	5	0	0%
Zinc	5	5	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	0	0	--
2,4,5-Trichlorophenol	0	0	--
2,4,6-Trichlorophenol	0	0	--
2,4-Dichlorophenol	0	0	--
2,4-Dimethylphenol	0	0	--
2,4-Dinitrophenol	0	0	--
2-Chlorophenol	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--
2-Methylphenol	0	0	--
2-Nitrophenol	0	0	--
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	0	0	--
4-Methylphenol	0	0	--
4-Nitrophenol	0	0	--
Benzene	8	0	0%
Ethylbenzene	8	0	0%
Pentachlorophenol	0	0	--
Phenol	0	0	--
Toluene	8	0	0%
Xylenes	8	0	0%
Polyaromatic Compounds			
Acenaphthene	8	1	13%
Acenaphthylene	8	1	13%
Anthracene	8	0	0%
Benzo(a)anthracene	8	2	25%
Benzo(a)pyrene	8	2	25%
Benzo(b)fluoranthene	8	2	25%
Benzo(g,h,i)perylene	8	2	25%
Benzo(k)fluoranthene	8	1	13%
Chrysene	8	2	25%
Dibenzo(a,h)anthracene	8	1	13%
Fluoranthene	8	2	25%
Fluorene	8	0	0%
Indeno(1,2,3-cd)pyrene	8	2	25%
Naphthalene	8	1	13%
Phenanthrene	8	2	25%
Pyrene	8	2	25%

Appendix E Human Health Screening - Background Concentrations - Office Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	2.92	NA
Arsenic	5.81	6.37	1.10
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	19.70	0.74
Copper	34.34	35.20	1.03
Lead	24.02	40.30	1.68
Mercury	0.04	0.50	12.50
Nickel	21.04	21.10	1.00
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	0.50	NA
Zinc	95.52	70.30	0.74
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	--	NA
2,4,5-Trichlorophenol	NA	--	NA
2,4,6-Trichlorophenol	NA	--	NA
2,4-Dichlorophenol	NA	--	NA
2,4-Dimethylphenol	NA	--	NA
2,4-Dinitrophenol	NA	--	NA
2-Chlorophenol	NA	--	NA
2-Methyl-4,6-dinitrophenol	NA	--	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	--	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	--	NA
4-Methylphenol	NA	--	NA
4-Nitrophenol	NA	--	NA
Benzene	NA	0.00	NA
Ethylbenzene	NA	0.00	NA
Pentachlorophenol	NA	--	NA
Phenol	NA	--	NA
Toluene	NA	0.00	NA
Xylenes	NA	0.00	NA
Polyaromatic Compounds			
Acenaphthene	NA	0	NA
Acenaphthylene	NA	0	NA
Anthracene	NA	0	NA
Benzo(a)anthracene	NA	2	NA
Benzo(a)pyrene	NA	3	NA
Benzo(b)fluoranthene	NA	2	NA
Benzo(g,h,i)perylene	NA	2	NA
Benzo(k)fluoranthene	NA	2	NA
Chrysene	NA	2	NA
Dibenzo(a,h)anthracene	NA	0	NA
Fluoranthene	NA	3	NA
Fluorene	NA	0	NA
Indeno(1,2,3-cd)pyrene	NA	1	NA
Naphthalene	NA	0	NA
Phenanthrene	NA	2	NA
Pyrene	NA	5	NA

Appendix E Human Health Screening - Preliminary Remedial Goals - Office Area Subsurface Soil

No. of COIs =	33					
Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goal	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	2.92	0.00	0.00	0.00
Arsenic	0	27	6.37	0.24	0.01	0.24
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	19.70	0.31	0.01	0.31
Copper	0	76000	35.20	0.00	0.00	0.00
Lead	0	1000	40.30	0.04	0.00	0.04
Mercury	0	88	0.50	0.01	0.00	0.01
Nickel	0	41000	21.10	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	0.50	0.00	0.00	0.00
Zinc	0	100000	70.30	0.00	0.00	0.00
Cyanide	0	4400	--	--	NA	0.00
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	--	--	NA	0.00
2,4,5-Trichlorophenol	0	88000	--	--	NA	0.00
2,4,6-Trichlorophenol	0	220	--	--	NA	0.00
2,4-Dichlorophenol	0	2600	--	--	NA	0.00
2,4-Dimethylphenol	0	18000	--	--	NA	0.00
2,4-Dinitrophenol	0	1800	--	--	NA	0.00
2-Chlorophenol	0	240	--	--	NA	0.00
2-Methyl-4,6-dinitrophenol	0	--	--	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	--	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	--	--	NA	0.00
4-Methylphenol	0	4400	--	--	NA	0.00
4-Nitrophenol	0	7000	--	--	NA	0.00
Benzene	0	1.5	0.00	0.00	0.00	0.00
Ethylbenzene	0	230	0.00	0.00	0.00	0.00
Pentachlorophenol	0	11	--	--	NA	0.00
Phenol	0	100000	--	--	NA	0.00
Toluene	0	520	0.00	0.00	0.00	0.00
Xylenes	0	210	0.00	0.00	0.00	0.00
Polyaromatic Compounds						
Acenaphthene	0	38000	0	0.00	0.00	0.00
Acenaphthylene	0	190	0	0.00	0.00	0.00
Anthracene	0	100000	0	0.00	0.00	0.00
Benzo(a)anthracene	0	2.9	2	0.64	0.02	0.64
Benzo(a)pyrene	0	0.29	3	9.86	0.34	9.86
Benzo(b)fluoranthene	0	2.9	2	0.73	0.03	0.73
Benzo(g,h,i)perylene	0	0.29	2	7.21	0.25	7.21
Benzo(k)fluoranthene	0	29	2	0.05	0.00	0.05
Chrysene	0	290	2	0.01	0.00	0.01
Dibenzo(a,h)anthracene	0	0.29	0	1.45	0.05	1.45
Fluoranthene	0	30000	3	0.00	0.00	0.00
Fluorene	0	33000	0	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0	2.9	1	0.51	0.02	0.51
Naphthalene	0	190	0	0.00	0.00	0.00
Phenanthrene	0	0.29	2	7.79	0.27	7.79
Pyrene	0	54000	5	0.00	0.00	0.00
Sum of R				28.8682501		

Appendix E Human Health Screeing - Detection Limit / PRG Comparison - Office Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Preliminary Remedial Goal	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	820	3
Arsenic	1	27	5
Beryllium	1	2200	0
Cadmium	1	810	0
Chromium	1	64	5
Copper	1	76000	5
Lead	1	1000	5
Mercury	1	88	0
Nickel	1	41000	5
Selenium	1	10000	0
Silver	1	10000	0
Thallium	1	160	0
Zinc	1	100000	5
Cyanide	0.5	4400	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26000	0
2,4,5-Trichlorophenol	NA	88000	0
2,4,6-Trichlorophenol	NA	220	0
2,4-Dichlorophenol	NA	2600	0
2,4-Dimethylphenol	NA	18000	0
2,4-Dinitrophenol	NA	1800	0
2-Chlorophenol	NA	240	0
2-Methyl-4,6-dinitrophenol	NA	--	0
2-Methylphenol	NA	44000	0
2-Nitrophenol	NA	--	0
3-Methylphenol	NA	44000	0
4-Chloro-3-methylphenol	NA	--	0
4-Methylphenol	NA	4400	0
4-Nitrophenol	NA	7000	0
Benzene	0.002	1.5	0
Ethylbenzene	0.002	230	0
Pentachlorophenol	NA	11	0
Phenol	NA	100000	0
Toluene	0.002	520	0
Xylenes	0.008	210	0
Polyaromatic Compounds			
Acenaphthene	0.05	38000	1
Acenaphthylene	0.05	190	1
Anthracene	0.05	100000	0
Benzo(a)anthracene	0.05	2.9	2
Benzo(a)pyrene	0.05	0.29	2
Benzo(b)fluoranthene	0.05	2.9	2
Benzo(g,h,i)perylene	0.05	0.29	2
Benzo(k)fluoranthene	0.05	29	1
Chrysene	0.05	290	2
Dibenzo(a,h)anthracene	0.05	0.29	1
Fluoranthene	0.05	30000	2
Fluorene	0.05	33000	0
Indeno(1,2,3-cd)pyrene	0.05	2.9	2
Naphthalene	0.05	190	1
Phenanthrene	0.05	0.29	2
Pyrene	0.05	54000	2

Appendix E Soil Chemical Data Statistics - Office Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	2.92	Maximum
Arsenic	6.37	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	19.70	Maximum
Copper	35.20	Maximum
Lead	40.30	Maximum
Mercury	0.50	Maximum
Nickel	21.10	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	0.50	Maximum
Zinc	70.30	Maximum
Cyanide	--	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	--	Maximum
2,4,5-Trichlorophenol	--	Maximum
2,4,6-Trichlorophenol	--	Maximum
2,4-Dichlorophenol	--	Maximum
2,4-Dimethylphenol	--	Maximum
2,4-Dinitrophenol	--	Maximum
2-Chlorophenol	--	Maximum
2-Methyl-4,6-dinitrophenol	--	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	--	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	--	Maximum
4-Methylphenol	--	Maximum
4-Nitrophenol	--	Maximum
Benzene	0.001	Maximum
Ethylbenzene	0.001	Maximum
Pentachlorophenol	--	Maximum
Phenol	--	Maximum
Toluene	0.001	Maximum
Xylenes	0.004	Maximum
Polyaromatic Compounds		
Acenaphthene	0.25	Maximum
Acenaphthylene	0.26	Maximum
Anthracene	0.25	Maximum
Benzo(a)anthracene	1.87	Maximum
Benzo(a)pyrene	2.86	Maximum
Benzo(b)fluoranthene	2.13	Maximum
Benzo(g,h,i)perylene	2.09	Maximum
Benzo(k)fluoranthene	1.58	Maximum
Chrysene	2.23	Maximum
Dibenzo(a,h)anthracene	0.42	Maximum
Fluoranthene	3.26	Maximum
Fluorene	0.25	Maximum
Indeno(1,2,3-cd)pyrene	1.49	Maximum
Naphthalene	0.25	Maximum
Phenanthrene	2.26	Maximum
Pyrene	5.20	Maximum

Appendix E Human Health Screening - Frequency of Detection - Koppers Area Surface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	9	6	67%
Arsenic	9	3	33%
Beryllium	9	0	0%
Cadmium	9	0	0%
Chromium	9	8	89%
Copper	9	9	100%
Lead	9	8	89%
Mercury	9	2	22%
Nickel	9	7	78%
Selenium	9	0	0%
Silver	9	0	0%
Thallium	9	0	0%
Zinc	9	9	100%
Cyanide	0	0	--
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	2	0	0%
2,4,5-Trichlorophenol	2	0	0%
2,4,6-Trichlorophenol	2	0	0%
2,4-Dichlorophenol	2	0	0%
2,4-Dimethylphenol	2	0	0%
2,4-Dinitrophenol	2	0	0%
2-Chlorophenol	2	0	0%
2-Methyl-4,6-dinitrophenol	2	0	0%
2-Methylphenol	0	0	--
2-Nitrophenol	2	0	0%
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	2	0	0%
4-Methylphenol	2	0	0%
4-Nitrophenol	2	0	0%
Benzene	1	0	0%
Ethylbenzene	1	0	0%
Pentachlorophenol	2	0	0%
Phenol	2	0	0%
Toluene	1	0	0%
Xylenes	1	0	0%
Polyaromatic Compounds			
Acenaphthene	14	11	79%
Acenaphthylene	14	5	36%
Anthracene	14	10	71%
Benzo(a)anthracene	14	14	100%
Benzo(a)pyrene	14	14	100%
Benzo(b)fluoranthene	14	14	100%
Benzo(g,h,i)perylene	14	14	100%
Benzo(k)fluoranthene	14	14	100%
Chrysene	14	14	100%
Dibenzo(a,h)anthracene	14	13	93%
Fluoranthene	14	14	100%
Fluorene	14	10	71%
Indeno(1,2,3-cd)pyrene	14	14	100%
Naphthalene	14	7	50%
Phenanthrene	14	14	100%
Pyrene	14	14	100%

Appendix E Human Health Screening - Background Concentrations - Koppers Area Surface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	3.76	NA
Arsenic	5.81	3.40	0.59
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	22.30	0.84
Copper	34.34	40.90	1.19
Lead	24.02	94.60	3.94
Mercury	0.04	3.23	80.75
Nickel	21.04	19.80	0.94
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	5.00	NA
Zinc	95.52	226.00	2.37
Cyanide	NA	--	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	1.70	NA
2,4,5-Trichlorophenol	NA	1.70	NA
2,4,6-Trichlorophenol	NA	1.70	NA
2,4-Dichlorophenol	NA	1.70	NA
2,4-Dimethylphenol	NA	1.70	NA
2,4-Dinitrophenol	NA	3.30	NA
2-Chlorophenol	NA	1.70	NA
2-Methyl-4,6-dinitrophenol	NA	1.70	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	1.70	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	1.70	NA
4-Methylphenol	NA	1.70	NA
4-Nitrophenol	NA	1.70	NA
Benzene	NA	0.15	NA
Ethylbenzene	NA	0.15	NA
Pentachlorophenol	NA	1.70	NA
Phenol	NA	1.70	NA
Toluene	NA	0.15	NA
Xylenes	NA	0.15	NA
Polyaromatic Compounds			
Acenaphthene	NA	110	NA
Acenaphthylene	NA	4	NA
Anthracene	NA	212	NA
Benzo(a)anthracene	NA	53	NA
Benzo(a)pyrene	NA	61	NA
Benzo(b)fluoranthene	NA	58	NA
Benzo(g,h,i)perylene	NA	46	NA
Benzo(k)fluoranthene	NA	37	NA
Chrysene	NA	71	NA
Dibenzo(a,h)anthracene	NA	10	NA
Fluoranthene	NA	135	NA
Fluorene	NA	55	NA
Indeno(1,2,3-cd)pyrene	NA	42	NA
Naphthalene	NA	11	NA
Phenanthrene	NA	92	NA
Pyrene	NA	217	NA

Appendix E Human Health Screening - Preliminary Remedial Goals - Koppers Area Surface Soil

No. of COIs =	47					
Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goal	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	3.76	0.00	0.00	0.00
Arsenic	0	27	3.40	0.13	0.00	0.13
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	22.30	0.35	0.00	0.35
Copper	0	76000	40.90	0.00	0.00	0.00
Lead	0	1000	94.60	0.09	0.00	0.09
Mercury	0	88	3.23	0.04	0.00	0.04
Nickel	0	41000	19.80	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	5.00	0.03	0.00	0.03
Zinc	0	100000	226.00	0.00	0.00	0.00
Cyanide	0	4400	--	--	NA	0.00
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	1.70	0.00	0.00	0.00
2,4,5-Trichlorophenol	0	88000	1.70	0.00	0.00	0.00
2,4,6-Trichlorophenol	0	220	1.70	0.01	0.00	0.01
2,4-Dichlorophenol	0	2600	1.70	0.00	0.00	0.00
2,4-Dimethylphenol	0	18000	1.70	0.00	0.00	0.00
2,4-Dinitrophenol	0	1800	3.30	0.00	0.00	0.00
2-Chlorophenol	0	240	1.70	0.01	0.00	0.01
2-Methyl-4,6-dinitrophenol	0	--	1.70	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	1.70	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	1.70	--	NA	0.00
4-Methylphenol	0	4400	1.70	0.00	0.00	0.00
4-Nitrophenol	0	7000	1.70	0.00	0.00	0.00
Benzene	0	1.5	0.15	0.10	0.00	0.10
Ethylbenzene	0	230	0.15	0.00	0.00	0.00
Pentachlorophenol	0	11	1.70	0.15	0.00	0.15
Phenol	0	100000	1.70	0.00	0.00	0.00
Toluene	0	520	0.15	0.00	0.00	0.00
Xylenes	0	210	0.15	0.00	0.00	0.00
Polyaromatic Compounds						
Acenaphthene	0	38000	110	0.00	0.00	0.00
Acenaphthylene	0	190	4	0.02	0.00	0.02
Anthracene	0	100000	212	0.00	0.00	0.00
Benzo(a)anthracene	0	2.9	53	18.31	0.02	18.31
Benzo(a)pyrene	0	0.29	61	210.34	0.27	210.34
Benzo(b)fluoranthene	0	2.9	58	19.86	0.03	19.86
Benzo(g,h,i)perylene	0	0.29	46	158.62	0.20	158.62
Benzo(k)fluoranthene	0	29	37	1.26	0.00	1.26
Chrysene	0	290	71	0.25	0.00	0.25
Dibenzo(a,h)anthracene	0	0.29	10	34.48	0.04	34.48
Fluoranthene	0	30000	135	0.00	0.00	0.00
Fluorene	0	33000	55	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	0	2.9	42	14.31	0.02	14.31
Naphthalene	0	190	11	0.06	0.00	0.06
Phenanthrene	0	0.29	92	316.21	0.41	316.21
Pyrene	0	54000	217	0.00	0.00	0.00
Sum of R				774.660925		

NWT 003020

Appendix E Human Health Screening - Detection Limit / PRG Comparison - Koppers Area Surface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Preliminary Remedial Goal	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	820	6
Arsenic	1	27	3
Beryllium	1	2200	0
Cadmium	1	810	0
Chromium	1	64	8
Copper	1	76000	9
Lead	1	1000	8
Mercury	1	88	2
Nickel	1	41000	7
Selenium	1	10000	0
Silver	1	10000	0
Thallium	10	160	0
Zinc	1	100000	9
Cyanide	0.5	4400	0
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	3.4	26000	0
2,4,5-Trichlorophenol	3.4	88000	0
2,4,6-Trichlorophenol	3.4	220	0
2,4-Dichlorophenol	3.4	2600	0
2,4-Dimethylphenol	3.4	18000	0
2,4-Dinitrophenol	6.6	1800	0
2-Chlorophenol	3.4	240	0
2-Methyl-4,6-dinitrophenol	3.4	--	0
2-Methylphenol	NA	44000	0
2-Nitrophenol	3.4	--	0
3-Methylphenol	NA	44000	0
4-Chloro-3-methylphenol	3.4	--	0
4-Methylphenol	3.4	4400	0
4-Nitrophenol	3.4	7000	0
Benzene	0.3	1.5	0
Ethylbenzene	0.3	230	0
Pentachlorophenol	3.4	11	0
Phenol	3.4	100000	0
Toluene	0.3	520	0
Xylenes	0.3	210	0
Polyaromatic Compounds			
Acenaphthene	0.05	38000	11
Acenaphthylene	5	190	5
Anthracene	0.05	100000	10
Benzo(a)anthracene	0.05	2.9	14
Benzo(a)pyrene	0.05	0.29	14
Benzo(b)fluoranthene	0.05	2.9	14
Benzo(g,h,i)perylene	0.05	0.29	14
Benzo(k)fluoranthene	0.05	29	14
Chrysene	0.05	290	14
Dibenzo(a,h)anthracene	0.05	0.29	13
Fluoranthene	0.05	30000	14
Fluorene	0.1	33000	10
Indeno(1,2,3-cd)pyrene	0.05	2.9	14
Naphthalene	1.0	190	7
Phenanthrene	0.05	0.29	14
Pyrene	0.05	54000	14

NWT 003021

Appendix E Soil Chemical Data Statistics - Koppers Area Surface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	3.76	Maximum
Arsenic	3.40	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	22.30	Maximum
Copper	40.90	Maximum
Lead	94.60	Maximum
Mercury	3.23	Maximum
Nickel	19.80	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	5.00	Maximum
Zinc	226.00	Maximum
Cyanide	--	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	1.70	Maximum
2,4,5-Trichlorophenol	1.70	Maximum
2,4,6-Trichlorophenol	1.70	Maximum
2,4-Dichlorophenol	1.70	Maximum
2,4-Dimethylphenol	1.70	Maximum
2,4-Dinitrophenol	3.30	Maximum
2-Chlorophenol	1.70	Maximum
2-Methyl-4,6-dinitrophenol	1.70	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	1.70	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	1.70	Maximum
4-Methylphenol	1.70	Maximum
4-Nitrophenol	1.70	Maximum
Benzene	0.15	Maximum
Ethylbenzene	0.15	Maximum
Pentachlorophenol	1.70	Maximum
Phenol	1.70	Maximum
Toluene	0.15	Maximum
Xylenes	0.15	Maximum
Polyaromatic Compounds		
Acenaphthene	110	Maximum
Acenaphthylene	4	Maximum
Anthracene	212	Maximum
Benzo(a)anthracene	53	Maximum
Benzo(a)pyrene	61	Maximum
Benzo(b)fluoranthene	58	Maximum
Benzo(g,h,i)perylene	46	Maximum
Benzo(k)fluoranthene	37	Maximum
Chrysene	71	Maximum
Dibenzo(a,h)anthracene	10	Maximum
Fluoranthene	135	Maximum
Fluorene	55	Maximum
Indeno(1,2,3-cd)pyrene	42	Maximum
Naphthalene	11	Maximum
Phenanthrene	92	Maximum
Pyrene	217	Maximum

Appendix E Human Health Screening - Frequency of Detection - Koppers Area Subsurface Soil

	Area Wide Soil Number of Samples	Area Wide Soil Number of Detects	Area Wide Soil Percent Detect
Metals and Inorganics			
Antimony	6	4	67%
Arsenic	6	6	100%
Beryllium	6	0	0%
Cadmium	6	0	0%
Chromium	6	6	100%
Copper	6	6	100%
Lead	6	6	100%
Mercury	6	1	17%
Nickel	6	6	100%
Selenium	6	4	67%
Silver	6	4	67%
Thallium	6	4	67%
Zinc	6	6	100%
Cyanide	4	2	50%
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	4	0	0%
2,4,5-Trichlorophenol	4	0	0%
2,4,6-Trichlorophenol	4	0	0%
2,4-Dichlorophenol	4	0	0%
2,4-Dimethylphenol	4	0	0%
2,4-Dinitrophenol	4	0	0%
2-Chlorophenol	4	0	0%
2-Methyl-4,6-dinitrophenol	4	0	0%
2-Methylphenol	0	0	--
2-Nitrophenol	4	0	0%
3-Methylphenol	0	0	--
4-Chloro-3-methylphenol	4	0	0%
4-Methylphenol	4	0	0%
4-Nitrophenol	4	0	0%
Benzene	17	6	35%
Ethylbenzene	17	6	35%
Pentachlorophenol	4	1	25%
Phenol	4	0	0%
Toluene	17	5	29%
Xylenes	17	6	35%
Polyaromatic Compounds			
Acenaphthene	20	13	65%
Acenaphthylene	20	14	70%
Anthracene	20	10	50%
Benzo(a)anthracene	20	16	80%
Benzo(a)pyrene	20	15	75%
Benzo(b)fluoranthene	20	18	90%
Benzo(g,h,i)perylene	20	16	80%
Benzo(k)fluoranthene	20	16	80%
Chrysene	20	16	80%
Dibenzo(a,h)anthracene	20	14	70%
Fluoranthene	20	17	85%
Fluorene	20	13	65%
Indeno(1,2,3-cd)pyrene	20	16	80%
Naphthalene	20	13	65%
Phenanthrene	20	15	75%
Pyrene	20	16	80%

Appendix E Human Health Screening - Background Concentrations - Koppers Area Subsurface Soil

Chemical of Interest	(mg/kg) Soil Background Concentration	(mg/kg) Max. Soil Chemical Concentration	(unitless) Soil Background Ratio
Metals and Inorganics			
Antimony	NA	1.06	NA
Arsenic	5.81	7.27	1.25
Beryllium	2.07	0.50	0.24
Cadmium	0.93	0.50	0.54
Chromium	26.57	16.20	0.61
Copper	34.34	46.00	1.34
Lead	24.02	20.60	0.86
Mercury	0.04	2.60	65.00
Nickel	21.04	16.60	0.79
Selenium	NA	0.50	NA
Silver	NA	0.50	NA
Thallium	NA	50.00	NA
Zinc	95.52	64.20	0.67
Cyanide	NA	518.00	NA
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	NA	26.00	NA
2,4,5-Trichlorophenol	NA	26.00	NA
2,4,6-Trichlorophenol	NA	26.00	NA
2,4-Dichlorophenol	NA	26.00	NA
2,4-Dimethylphenol	NA	26.00	NA
2,4-Dinitrophenol	NA	46.00	NA
2-Chlorophenol	NA	26.00	NA
2-Methyl-4,6-dinitrophenol	NA	26.00	NA
2-Methylphenol	NA	--	NA
2-Nitrophenol	NA	26.00	NA
3-Methylphenol	NA	--	NA
4-Chloro-3-methylphenol	NA	26.00	NA
4-Methylphenol	NA	26.00	NA
4-Nitrophenol	NA	26.00	NA
Benzene	NA	360.00	NA
Ethylbenzene	NA	111.00	NA
Pentachlorophenol	NA	26.00	NA
Phenol	NA	26.00	NA
Toluene	NA	280.00	NA
Xylenes	NA	289.00	NA
Polyaromatic Compounds			
Acenaphthene	NA	1630	NA
Acenaphthylene	NA	155	NA
Anthracene	NA	578	NA
Benzo(a)anthracene	NA	564	NA
Benzo(a)pyrene	NA	942	NA
Benzo(b)fluoranthene	NA	752	NA
Benzo(g,h,i)perylene	NA	747	NA
Benzo(k)fluoranthene	NA	238	NA
Chrysene	NA	811	NA
Dibenzo(a,h)anthracene	NA	4707	NA
Fluoranthene	NA	2350	NA
Fluorene	NA	481	NA
Indeno(1,2,3-cd)pyrene	NA	519	NA
Naphthalene	NA	13000	NA
Phenanthrene	NA	2950	NA
Pyrene	NA	3580	NA

Appendix E Human Health Screening - Preliminary Remedial Goals - Koppers Area Subsurface Soil

No. of COIs =	52					
Chemical of Interest		(mg/kg) Soil Preliminary Remedial Goal	(mg/kg) EC Soil Chemical Concentration	(ratio) Soil Hazard Quotient (R)	(ratio) Sum Rs over R	Cross Medium Sum of Rs
Metals and Inorganics						
Antimony	0	820	1.06	0.00	0.00	0.00
Arsenic	0	27	7.27	0.27	0.00	0.27
Beryllium	0	2200	0.50	0.00	0.00	0.00
Cadmium	0	810	0.50	0.00	0.00	0.00
Chromium	0	64	16.20	0.25	0.00	0.25
Copper	0	76000	46.00	0.00	0.00	0.00
Lead	0	1000	20.60	0.02	0.00	0.02
Mercury	0	88	2.60	0.03	0.00	0.03
Nickel	0	41000	16.60	0.00	0.00	0.00
Selenium	0	10000	0.50	0.00	0.00	0.00
Silver	0	10000	0.50	0.00	0.00	0.00
Thallium	0	160	50.00	0.31	0.00	0.31
Zinc	0	100000	64.20	0.00	0.00	0.00
Cyanide	0	4400	518.00	0.12	0.00	0.12
Monocyclic Aromatic Compounds						
2,3,4,6-Tetrachlorophenol	0	26000	26.00	0.00	0.00	0.00
2,4,5-Trichlorophenol	0	88000	26.00	0.00	0.00	0.00
2,4,6-Trichlorophenol	0	220	26.00	0.12	0.00	0.12
2,4-Dichlorophenol	0	2600	26.00	0.01	0.00	0.01
2,4-Dimethylphenol	0	18000	26.00	0.00	0.00	0.00
2,4-Dinitrophenol	0	1800	46.00	0.03	0.00	0.03
2-Chlorophenol	0	240	26.00	0.11	0.00	0.11
2-Methyl-4,6-dinitrophenol	0	--	26.00	--	NA	0.00
2-Methylphenol	0	44000	--	--	NA	0.00
2-Nitrophenol	0	--	26.00	--	NA	0.00
3-Methylphenol	0	44000	--	--	NA	0.00
4-Chloro-3-methylphenol	0	--	26.00	--	NA	0.00
4-Methylphenol	0	4400	26.00	0.01	0.00	0.01
4-Nitrophenol	0	7000	26.00	0.00	0.00	0.00
Benzene	0	1.5	360.00	240.00	0.01	240.00
Ethylbenzene	0	230	111.00	0.48	0.00	0.48
Pentachlorophenol	0	11	26.00	2.36	0.00	2.36
Phenol	0	100000	26.00	0.00	0.00	0.00
Toluene	0	520	280.00	0.54	0.00	0.54
Xylenes	0	210	289.00	1.38	0.00	1.38
Polyaromatic Compounds						
Acenaphthene	0	38000	1630	0.04	0.00	0.04
Acenaphthylene	0	190	155	0.82	0.00	0.82
Anthracene	0	100000	578	0.01	0.00	0.01
Benzo(a)anthracene	0	2.9	564	194.48	0.01	194.48
Benzo(a)pyrene	0	0.29	942	3248.28	0.10	3248.28
Benzo(b)fluoranthene	0	2.9	752	259.31	0.01	259.31
Benzo(g,h,i)perylene	0	0.29	747	2575.86	0.08	2575.86
Benzo(k)fluoranthene	0	29	238	8.21	0.00	8.21
Chrysene	0	290	811	2.80	0.00	2.80
Dibenzo(a,h)anthracene	0	0.29	4707	16231.03	0.49	16231.03
Fluoranthene	0	30000	2350	0.08	0.00	0.08
Fluorene	0	33000	481	0.01	0.00	0.01
Indeno(1,2,3-cd)pyrene	0	2.9	519	178.97	0.01	178.97
Naphthalene	0	190	13000	68.42	0.00	68.42
Phenanthrene	0	0.29	2950	10172.41	0.31	10172.41
Pyrene	0	54000	3580	0.07	0.00	0.07
Sum of R				33186.8352		

Appendix E Human Health Screening - Detection Limit / PRG Comparison - Koppers Area Subsurface Soil

	(mg/kg) Soil Detection Limit	(mg/kg) Soil Preliminary Remedial Goal	Soil Number of Dectects
Metals and Inorganics			
Antimony	1	820	4
Arsenic	1	27	6
Beryllium	1	2200	0
Cadmium	1	810	0
Chromium	1	64	6
Copper	1	76000	6
Lead	1	1000	6
Mercury	1	88	1
Nickel	1	41000	6
Selenium	1	10000	4
Silver	1	10000	4
Thallium	10	160	4
Zinc	1	100000	6
Cyanide	0.5	4400	2
Monocyclic Aromatic Compounds			
2,3,4,6-Tetrachlorophenol	52	26000	0
2,4,5-Trichlorophenol	52	88000	0
2,4,6-Trichlorophenol	52	220	0
2,4-Dichlorophenol	52	2600	0
2,4-Dimethylphenol	52	18000	0
2,4-Dinitrophenol	92	1800	0
2-Chlorophenol	52	240	0
2-Methyl-4,6-dinitrophenol	52	--	0
2-Methylphenol	NA	44000	0
2-Nitrophenol	52	--	0
3-Methylphenol	NA	44000	0
4-Chloro-3-methylphenol	52	--	0
4-Methylphenol	52	4400	0
4-Nitrophenol	52	7000	0
Benzene	0.3	1.5	6
Ethylbenzene	0.3	230	6
Pentachlorophenol	52	11	1
Phenol	52	100000	0
Toluene	0.3	520	5
Xylenes	0.3	210	6
Polyaromatic Compounds			
Acenaphthene	0.05	38000	13
Acenaphthylene	0.05	190	14
Anthracene	0.05	100000	10
Benzo(a)anthracene	0.05	2.9	16
Benzo(a)pyrene	0.05	0.29	15
Benzo(b)fluoranthene	0.05	2.9	18
Benzo(g,h,i)perylene	0.05	0.29	16
Benzo(k)fluoranthene	0.05	29	16
Chrysene	0.05	290	16
Dibenzo(a,h)anthracene	0.05	0.29	14
Fluoranthene	0.05	30000	17
Fluorene	0.05	33000	13
Indeno(1,2,3-cd)pyrene	0.05	2.9	16
Naphthalene	0.05	190	13
Phenanthrene	0.05	0.29	15
Pyrene	0.05	54000	16

NWT 003026

Appendix E Soil Chemical Data Statistics - Koppers Area Subsurface Soil

	Final EC	*Source Statistic Type*
Metals and Inorganics		
Antimony	1.06	Maximum
Arsenic	7.27	Maximum
Beryllium	0.50	Maximum
Cadmium	0.50	Maximum
Chromium	16.20	Maximum
Copper	46.00	Maximum
Lead	20.60	Maximum
Mercury	2.60	Maximum
Nickel	16.60	Maximum
Selenium	0.50	Maximum
Silver	0.50	Maximum
Thallium	50.00	Maximum
Zinc	64.20	Maximum
Cyanide	518.00	Maximum
Monocyclic Aromatic Compounds		
2,3,4,6-Tetrachlorophenol	26.00	Maximum
2,4,5-Trichlorophenol	26.00	Maximum
2,4,6-Trichlorophenol	26.00	Maximum
2,4-Dichlorophenol	26.00	Maximum
2,4-Dimethylphenol	26.00	Maximum
2,4-Dinitrophenol	46.00	Maximum
2-Chlorophenol	26.00	Maximum
2-Methyl-4,6-dinitrophenol	26.00	Maximum
2-Methylphenol	--	Maximum
2-Nitrophenol	26.00	Maximum
3-Methylphenol	--	Maximum
4-Chloro-3-methylphenol	26.00	Maximum
4-Methylphenol	26.00	Maximum
4-Nitrophenol	26.00	Maximum
Benzene	360	Maximum
Ethylbenzene	111	Maximum
Pentachlorophenol	26.00	Maximum
Phenol	26.00	Maximum
Toluene	280	Maximum
Xylenes	289	Maximum
Polyaromatic Compounds		
Acenaphthene	1630	Maximum
Acenaphthylene	155	Maximum
Anthracene	578	Maximum
Benzo(a)anthracene	564	Maximum
Benzo(a)pyrene	942	Maximum
Benzo(b)fluoranthene	752	Maximum
Benzo(g,h,i)perylene	747	Maximum
Benzo(k)fluoranthene	238	Maximum
Chrysene	811	Maximum
Dibenzo(a,h)anthracene	4707	Maximum
Fluoranthene	2350	Maximum
Fluorene	481	Maximum
Indeno(1,2,3-cd)pyrene	519	Maximum
Naphthalene	13000	Maximum
Phenanthrene	2950	Maximum
Pyrene	3580	Maximum

Koppers Company, Inc.

MEMO ROUTING SLIP

To	Location	Date Received	Initial
Tom Leake			

☐ Note & Forward ?

☐ Prepare Reply for my Signature

☐ Note & Return

☐ Comment & Return

☐ Note & File

☐ Take Appropriate Action

Remarks: Could not find record of "confidential info given EPA" Could it be data from the old still in 1968? Note, EPA contracts 68-01-4602

From Henry E. Rossi Phone Date

K-17 150M 2-80

NWT 003028

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

20 November 1981

OFFICE OF
POLICY AND RESOURCE MANAGEMENT

Plant Manager
Koppers Company, Inc.
7540 NW St. Helens Road
Portland, OR 97229

Gentlemen:

The purpose of this letter is to provide advance notice that information considered by you to be confidential will be made available to Industrial Economics, Inc. (IEc) of Cambridge, Massachusetts in connection with the U.S. Environmental Protection Agency (EPA) Contract No. 68-01-5838. The confidential information at issue was originally obtained by EPA via two requests (questionnaires) made under the authority of Section 308 of the 1972 Clean Water Act. Your responses to these requests were transmitted to Catalytic, Inc., of Philadelphia, Pennsylvania, an organization obligated by two EPA contracts (68-01-4602 and 68-01-4493) to collect and organize this data.

Industrial Economics, Inc. will use this data to analyze typical process and plant configurations as part of a continuing effort to develop regulatory impact assessment models for the chemicals industry. Absolutely no plant or firm-specific data will be released to the public by EPA or IEc as part of this effort. The EPA contract with IEc contains a clause (see enclosure) providing adequate protection for confidential information disclosed to authorized agents of EPA, i.e., contractors. The clause is based on EPA regulations published in 40 CFR, Part 2. IEc has adequate safeguards for the protection of such data.

Although not obligated to do so, Industrial Economics, Inc. is willing to enter into a confidentiality agreement directly with your company. Such an agreement is enclosed. If you desire this additional protection, please complete and sign the enclosed agreement and return it to IEc. An officer of IEc will sign and copy the agreement, returning the original document to you. In order to maintain a viable and uniform confidentiality program, Industrial Economics, Inc. will not execute confidentiality agreements in other forms.

RECEIVED
NOV 30 1981
KOPPERS CO., INC.
INDUSTRIAL PRODUCTS DIV.

If you have further questions on this matter, please contact me (202-382-2770) or Howard Seidler at Industrial Economics, Inc. (617-354-0074). The EPA considers ten working days after your receipt of this letter a reasonable period to wait before proceeding with the data transfer, so prompt attention to this matter is requested.

Sincerely,

Frederick W. Talcott

Frederick W. Talcott
Economic Analysis Division (PM-220)

Enclosures: (two)

The Contracting Officer has determined that during the performance of this contract EPA may furnish confidential business information to the Contractor that EPA obtained under the Clean Air Act (42 U.S.C. 1857 *et seq.*), the Federal Water Pollution Control Act (33 U.S.C. 1251 *et seq.*), the Safe Drinking Water Act (42 U.S.C. 300f *et seq.*), the Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 136 *et seq.*), the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq.*), the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq.*), or the Toxic Substances Control Act (15 U.S.C. 2601 *et seq.*). EPA regulations on confidentiality of business information in 40 CFR Part 2 Subpart B require that the Contractor agree to the Clause entitled "Treatment of Confidential Business Information" before any confidential business information may be furnished to the Contractor.

TREATMENT OF CONFIDENTIAL BUSINESS INFORMATION

(a) The Contracting Officer, after a written determination by the appropriate program office, may disclose confidential business information to the Contractor necessary to carry out the work required under this contract. The Contractor agrees to use the confidential information only under the following conditions:

(1) The Contractor and Contractor's Employees shall: (i) use the confidential information only for the purposes of carrying out the work required by the contract; (ii) not disclose the information to anyone other than EPA employees without the prior written approval of the Deputy Associate General Counsel for Contracts and General Administration; and (iii) return to the Contracting Officer all copies of the information, and any abstracts or excerpts therefrom, upon request by the Contracting Officer, whenever the information is no longer required by the Contractor for the performance of the work required by the contract, or upon completion of the contract.

(2) The Contractor shall obtain a written agreement to honor the above limitations from each of the Contractor's Employees who will have access to the information, before the employee is allowed access.

(3) The Contractor agrees that these contract conditions concerning the use and disclosure of confidential information are included for the benefit of, and shall be enforceable by, both EPA and any affected business having a proprietary interest in the information.

(4) The Contractor shall not use any confidential information supplied by EPA or obtained during performance hereunder to compete with any business to which the confidential information relates.

(b) The Contractor agrees to obtain the written consent of the Contracting Officer, after a written determination by the appropriate program office, prior to entering into any subcontract that will involve the disclosure of confidential business information by the Contractor to the subcontractor. The Contractor agrees to include this clause, including this paragraph (b), in all subcontracts awarded pursuant to this contract that require the furnishing of confidential business information to the subcontractor.

NWT 003031

AGREEMENT

between

Industrial Economics, Inc. ("IEc")
30 Boylston Street
Cambridge, Massachusetts 02138

and

_____ ("the Company")

This Agreement concerns confidential information which the Company furnished to the U.S. Environmental Protection Agency ("EPA") in response to requests made pursuant to Section 308 of the 1972 Clean Water Act and which EPA intends to make available to Industrial Economics, Inc. in connection with EPA Contract No. 68-01-5838 ("the Contract").

Industrial Economics, Inc. hereby agrees with the Company that (as provided in the Contract):

(1) Industrial Economics, Inc. and its employees shall:

(i) use any confidential information of the Company supplied by EPA or obtained during the performance of the Contract only for the purposes of carrying out the work required by the Contract;

(ii) not disclose such information to anyone other than EPA employees without the prior written approval of the EPA Deputy Associate General Counsel for Contracts and General Administration;

(iii) return to EPA all copies of information, and any abstracts or excerpts therefrom, upon request by EPA, whenever the information is no longer required by Industrial Economics, Inc. for the performance of the work required by the Contract, or upon completion of the Contract; and

(iv) clearly mark all copies of any documents containing Company confidential information as confidential.

(2) Industrial Economics, Inc. shall obtain a written agreement to honor the above limitations from each of its employees who will have access to the information before the employee is allowed access.

(3) Industrial Economics, Inc. shall not use any confidential information supplied by EPA or obtained during performance of the Contract to compete with the Company.

(4) Industrial Economics, Inc. shall:

(i) obtain the written consent of EPA prior to entering into any subcontract that will involve the disclosure of any confidential information of the Company by Industrial Economics, Inc. to the subcontractor;

(ii) include these provisions, including paragraph 4, in all subcontracts awarded pursuant to the Contract that require the furnishing to the subcontractor by Industrial Economics, Inc. of any confidential information of the Company; and

(iii) require any subcontractor who will receive any confidential information of the Company to enter into a similar agreement with the Company before the information is transferred.

As you may know, the Contract provides, in effect, that any presentation of statistical or analytical material or reports based on any confidential information of the Company is subject to review by EPA before publication or dissemination in order to determine whether the foregoing provisions regarding confidentiality have been observed.

Accepted:

_____	Industrial Economics, Inc.
Company	
By: _____	By: _____
Title: _____	Title: President
Date: _____	Date: _____

NW-S-2

RECEIVED

MAR 29 1988

Environmental Resources

KEYSTONE ENVIRONMENTAL RESOURCES

Interoffice Correspondence

To	G. Kerr	From	R. Hepner
Location	Monroeville	Location	Monroeville
Subject	Northwest Terminal (462500)	Date	March 28, 1988

Attached are the results of the BAT & BPT samples received on March 8, 1988.

R. Hepner

RDH/pyc

Attachment

cc: ~~M. Helbling~~
J. Dern

CHAIN OF CUSTODY RECORD

PLANT CODE: NW

PROJECT NAME: NORTHWEST TERMINAL - TRANSFORMER, OK

SAMPLERS (Signature): Harold A. Beckler, David Hails

STA. NO.	DATE	TIME	COMP.	GRAB	WELL	STATION LOCATION	NUMBER OF CONTAINERS	PCB	Metals: Cr-T, Cu, Pb, (unpr.) Ni, Zn	CN-T (preserved w/NaOH)	BOD-T, TSS (unpres)					CONDUCTIVITY	pH	REMARKS OR OBSERVATIONS
T-65 Loading Station	1-15-88			X		PORTLAND, OR	1	1										
Outside Boiler House	↓			X		↓	1	1										☆ Metals are
Concrete Build Station				X			1	1										NOT
Reboiler				X			1	1										PRESERVED
Outside Still Room				X			1	1										
5 Track TAR STATION				X			1	1										
INSIDE STILL ROOM				X			1	1										TANK #4 was
INSIDE BOILER HOUSE	↓			X		↓	1	1										agitated prior
TANK #3	3-7-88	0900		X			3		1	1	1						6.41	to sampling
TANK #4	3-7-88	0910		X			3		1	1	1						6.57	Tank #3 was
Field Blank	3-7-88	1100		X					1									not agitated

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Reliquished by: (Signature)	Date	Time	Received by: (Signature)
Harold A. Beckler	3-7-88	0930	David C. Hails				
David C. Hails	3-7-88	1600	Fed X				

Reliquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Ice Chest Temp	Ice Chest	Chain of Custody
			Anthony [illegible]	3-8-88	10:00	NO ICE IN COOLER °C	# 198	~~Tag #~~ TAPED

*DISTRIBUTION: Original accompanies shipment; Copy to Coordinator Field Files.

Rec'd in good condition

PAGE ____ OF ____

KEYSTONE ENVIRONMENTAL RESOURCES, INC
NARRATIVE - INORGANIC ANALYSIS

I GENERAL

A. WORK ORDER M8803038

B. SAMPLE NUMBERS 88030181-183

C. SHIPPING PROBLEMS None

II PREPARATION

A. DIGESTION PROBLEMS None

III ANALYSIS

A. ANALYSIS PROBLEMS None

OTHER PROBLEMS

PREPARATION LABORATORY MANAGER

David Brennan /gf

INORGANIC ANALYSIS MANAGER

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
NARRATIVE - CONVENTIONAL ANALYSIS

I GENERAL

A. WORK ORDER M8803038

B. SAMPLE NUMBERS 88030181-183

C. SHIPPING PROBLEMS None

II ANALYSIS

A. ANALYSIS PROBLEMS None

OTHER PROBLEMS

Andrea Moroney
CONVENTIONAL CHEMISTRIES MANAGER

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

TABLE OF CONTENTS — PRODUCED ON 03/28/88 AT 12:04 — PAGE 1

SAMPLE #	SOURCE	DESCRIPT	DATE-COL	DATE-REC	ORD #
88030181	TANK #3	BAT&BPT	03/07/88	03/08/88	M8803038
88030182	TANK #4	BAT&BPT	03/07/88	03/08/88	M8803038
88030183	FB	BAT&BPT	03/07/88	03/08/88	M8803038

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

TABLE 1: SUMMARY OF ANALYTICAL DATA PRODUCED ON 03/28/88 AT 12:02 PAGE 1

SAMPLE #	RSLT. LNE		SOURCE
BIOCHEMICAL OXYGEN DEMAND (5 DAY, TOTAL)			
88030181	BOD, mg/L.....	21.0	TANK #3
88030182	BOD, mg/L.....	40.5	TANK #4
CYANIDE (TOTAL)			
88030181	Cyanide (Total), mg/L	0.035	TANK #3
88030182	Cyanide (Total), mg/L	0.028	TANK #4
TOTAL SUSPENDED SOLIDS			
88030181	Total SS@103C, mg/L.	48.0	TANK #3
88030182	Total SS@103C, mg/L.	134	TANK #4
pH			
88030181	pH, units.....	6.4	TANK #3
88030182	pH, units.....	6.6	TANK #4

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

TABLE 2: SUMMARY OF METALS DATA — PRODUCED ON 03/28/88 AT 12:03 — PAGE 1

SAMPLE #	RSLT. LNE		SOURCE
CHROMIUM			
88030181	Chromium, ug/L.....	<10.0	TANK #3
88030182	Chromium, ug/L.....	<10.0	TANK #4
88030183	Chromium, ug/L.....	<10.0	FB
COPPER			
88030181	Copper, ug/L.....	<10.0	TANK #3
88030182	Copper, ug/L.....	34.7	TANK #4
88030183	Copper, ug/L.....	<10.0	FB
LEAD			
88030181	Lead, ug/L.....	5.50	TANK #3
88030182	Lead, ug/L.....	19.2	TANK #4
88030183	Lead, ug/L.....	<5.00	FB
NICKEL			
88030181	Nickel, ug/L.....	<10.0	TANK #3
88030182	Nickel, ug/L.....	<10.0	TANK #4
88030183	Nickel, ug/L.....	<10.0	FB
ZINC			
88030181	Zinc, ug/L.....	128	TANK #3
88030182	Zinc, ug/L.....	346	TANK #4
88030183	Zinc, ug/L.....	<10.0	FB

NW-5-2 OMB#: 2050-0024 Expires 12-31-88

BEFORE COPYING FORM, ATTACH SITE IDENTIFICATION LABEL OR ENTER:

SITE NAME KOPPERS COMPANY, INC.
7540 N.W. ST. HELENS RD.
PORTLAND, OR 97210

EPA ID NO. OR|D|0|2|7|7|3|4|3|5|9|

U.S. ENVIRONMENTAL PROTECTION AGENCY

1987 Hazardous Waste Report

FORM **IC**

IDENTIFICATION AND CERTIFICATION

WHO MUST COMPLETE THIS FORM? Form IC must be completed by every site that received this package.

INSTRUCTIONS: Please read the detailed instructions beginning on page 4 of the 1987 Hazardous Waste Report Instruction booklet before completing this form.

Complete Sections I through IV and Sections VI through IX immediately. Complete Section V, certification, after you have finished the full report package.

SEC. I. Site name and physical location which may differ from the mailing address. Complete items A through G.
Mark [X] for items A, B, C, D, F, and G if same as label; if different, enter corrections. If label is absent, enter information.

A. Site/company name — Same as label [X] — or →

B. EPA ID No. — Same as label [X] — or →

C. Address number and street name of physical location - if not known, enter industrial park, building name or other physical location description — Same as label [X] — or →

D. City, town, village, etc. — Same as label [X] — or →

E. County: MULTNOMAH

F. State — Same as label [X] — or →

G. Zip Code — Same as label [X] — or →

SEC. II. Mailing address of site.
Mark [X] for A, B, C, and D if same as label; if different, enter corrections.

A. Number and street name of mailing address — Same as label [X] — or →

B. City, town, village, etc. — Same as label [X] — or →

C. State — Same as label [X] — or →

D. Zip Code — Same as label [X] — or →

SEC. III. Name, title, and telephone number of the person who should be contacted if questions arise regarding this report.

A. Please print: Last name	First name	M.I.	B. Title	C. Telephone
OXFORD	JOHN	A	PLANT MGR.	503 286-8181 Extension

SEC. IV. Enter the Standard Industrial Classification (SIC) Code that describes the principal products, group of products, produced or distributed, or the services rendered at the site's physical location. Enter more than one SIC Code only if no one industry description includes the combined activities of the site. SIC codes are listed beginning on page 1 of the 1987 Hazardous Waste Report Codebook.

A.	B.	C.	D.	E.	F.
2865					

SEC V. I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. Please print: Last name	First name	M.I.	Title
OXFORD	JOHN	A	PLANT MGR.

B. Signature: John A Oxford

Date of signature: 04 (Mo.) 20 (Day) 88 (Yr.)

OVER -->

SEC. VI. Does this site's EPA ID authorize hazardous waste generation?

- ☐ NO ⟶ SKIP TO SECTION VII.
- ☒ YES ⟶ Did this site generate any hazardous waste during 1987? *NO*
  - ☐ YES ⟶ READ DETAILED INSTRUCTION ON PAGE 5 OF THE 1987 HAZARDOUS WASTE REPORT INSTRUCTIONS BOOKLET FOR ACUTE AND ACCUMULATION LIMITS. MARK [X] NEXT TO THE HAZARDOUS WASTE GENERATION QUANTITY CATEGORY THAT APPLIED TO THIS SITE DURING 1987.
    - ☐ Category 1: More than 1000 kg (2,200 lb) in one or more months
    - ☐ Category 2: More than 100 kg (220 lb) but no more than 1000 kg (2,200 lb) in any single month
    - ☐ Category 3: No more than 100 kg (220 lb) in any single month
      - ☐ Mark [X] if this site changed from Category 1 to Category 2 or 3 due to waste minimization activity conducted during 1986 or 1987.
  - ☐ NO ⟶ CONTINUE BELOW, MARK [X] NEXT TO ALL THAT APPLY.
    - ☐ Generated, excluded or delisted wastes
    - ☐ Generated hazardous waste prior to 1987 but do not expect to generate in the future - MARK [X] FOR REASON IN ONE BOX BELOW
      - ☐ Waste was from one-time event(s) (e.g. spills, remedial actions, etc.)
      - ☐ Waste minimization activity undertaken during 1986 or 1987
      - ☐ Out of business
    - ☒ Generated hazardous waste prior to 1987 and expect to generate in the future
    - ☐ Never generated before but expect to generate in the future
    - ☐ Never generated and do not expect to generate in the future - MARK [X] FOR REASON IN ONE BOX BELOW
      - ☐ Protective notifier only
      - ☐ Misunderstood the requirements
      - ☐ Notified to secure transportation services
      - ☐ Other EXPLAIN REASON FOR GENERATOR NOTIFICATION IN COMMENTS

SEC. VII. Does this site have RCRA Interim Status or a RCRA permit to treat, store, or dispose hazardous waste?

- ☒ NO ⟶ SKIP TO SECTION VIII
- ☐ YES ⟶ Did the site treat, store, or dispose (T/S/D) hazardous waste in RCRA-regulated units during 1987?
  - ☐ YES ⟶ SKIP TO SECTION VIII
  - ☐ NO ⟶ CONTINUE BELOW, MARK [X] NEXT TO ALL THAT APPLY
    - ☐ T/S/D excluded waste during 1987
    - ☐ T/S/D hazardous waste in exempt units during 1987
    - ☐ T/S/D hazardous waste prior to 1987 but did not T/S/D waste during 1987. MARK [X] IN ONE BOX BELOW
      - ☐ T/S/D will resume in the future
      - ☐ Have notified of planned closure
      - ☐ Site is in closure or post closure
    - ☐ Never T/S/D hazardous waste prior to 1987 but: MARK [X] IN ONE BOX BELOW
      - ☐ Expect to T/S/D hazardous waste in the future
      - ☐ Do not expect to T/S/D hazardous waste in the future - EXPLAIN REASON FOR INTERIM STATUS OR PERMIT IN COMMENTS

SEC. VIII. Do you wish to withdraw this site's generator notification or EPA Part A permit application?

Withdraw generator notification	☐ Yes	☒ No
Withdraw Part A permit application	☐ Yes	☒ No

SEC. IX. Does this site have an area not requiring a RCRA Part A or Part B permit that is used exclusively for the short term accumulation of hazardous waste?

- ☐ NO
- ☒ YES ⟶ DOES THE AREA HAVE:

Containers	☐ No	☒ Yes	ENTER THE NUMBER OF TANKS AND THEIR TOTAL CAPACITY IN GALLONS.
Tanks	☐ No	☐ Yes ⟶	|___| Number |_____| Gallon capacity

Comments:

NW-J-3

KOPPERS

Interoffice Correspondence

To	J. A. Oxford	**From**	J. E. McFadden
Location	Northwest	**Location**	Monroeville
Subject	Soil Analysis	**Date**	May 1, 1987

Attached are copies of V. Romell's analysis of your soil samples.

J E McFadden
J. E. McFadden

JEM/bjm

Attachments

cc: J. M. Dern
L. F. Flaherty

RECEIVED

MAY 4 1987

Environmental Resources

KOPPERS

Interoffice Correspondence

To	J. E. McFadden	From	Vaughn Romell
Location	Industrial Products	Location	Absorption Spectroscopy
Subject	Portland, Oregon-Soil (4420)	Date	April 27, 1987

Your soil samples 87-23-E and -F (AL-167432 and 167433) from Portland have been examined by solvent extraction-infrared spectral (IR) techniques for identification of organic contaminants.

Both samples were found to contain a small amount of carbon disulfide extractable material identified as creosote components (similar to a "whole" creosote). Also exhibited is a weak 3.4 micron absorption indicating the presence of aliphatic hydrocarbon (petroleum derived) structure (present in both extracts).

The aromaticity index (I_A) and creosote/oil ratio were calculated for both extracts with the following results:

Sample	I_A	Creosote/Oil Ratio*
Soil Sample Test Hole 2 ~~of~~ FT 87-23-E	0.53	83/17
Soil sample Test Hole 4 FT. 87-23-F	0.45	80/20

* The creosote/oil is calculated assuming a mixture of Grade 1 creosote and Nujol mineral oil is present.

Experimental

The samples as received were found to be very heterogeneous mixtures of liquid/solids; sampling was performed from the top of the containers as practical as possible. The samples were then extracted with CS_2. The CS_2 solutions were dehydrated by filtering the solutions through sodium sulfate; the solubles were evaporated and identified by IR.

Vaughn Romell

sjb
cc: D. W. Grandy
R. Obrycki
L. Whiteford
Files
cf

K-5 REV. 2

KOPPERS

Interoffice Correspondence

To	J. E. McFadden	From	Vaughn Romell
Location	Industrial Products	Location	Absorption Spectroscopy
Subject	Portland, Oregon (4420)	Date	April 27, 1987

Your samples of water and soil have been examined by carbon disulfide extraction-infrared spectral (IR) procedures for identification of organic contaminants. The results are as follows:

Your Sample No.	AL No.	Identification of Extracts
87-65-A (Water Sample)	168280	Polynuclear aromatic hydrocarbons (similar to a "whole" creosote) + minor aliphatic hydrocarbon (petroleum derived oil or other aliphatic material). I_A = 0.87. Creosote/oil Ratio* = 91/9.
87-65-B (Soil Sample S-2)	168281	Qualitatively identical to extracts from sample -A. I_A = 0.95. Creosote/oil Ratio* = 93/7.
87-65-C (Soil Sample S-1)	168282	Similar to samples -A and -B but rich in anthracene and carbazole (creosote crystals). I_A = 0.84. Creosote/oil Ratio* = 91/9.

* The creosote/oil ratio, calculated as a mixture of Grade 1 creosote and Nujol mineral oil, is intended to serve only as an estimate of the amount of aromatic (coal tar derived) species versus the non-aromatic (petroleum derived) species, assuming specific coal tar and petroleum sources.

Experimental

Portions of each sample were extracted with carbon disulfide; the carbon disulfide solutions were dehydrated via filtration through sodium sulfate. The CS_2 solubles were collected, evaporated (no heat), and identified by IR techniques.

Vaughn Romell

sjb
cc: D. W. Grandy
R. Obrycki
L. Whiteford
Files
cf

Koppers Company, Inc.
Science and Technology
Pittsburgh, PA 15219, Telephone 41[redacted]-2000

File: NW-5-RRFRCRA

KOPPERS

CERTIFIED MAIL

February 12, 1985

Mr. Richard Reiter, Supervisor
Hazardous Waste Operations
Department of Environmental Quality
Hazardous and Solid Waste Division
P. O. Box 1760
Portland, Oregon 97205

ATTENTION: Mr. Fred Bromfeld

SUBJECT: Koppers Company, Inc.
Portland, Oregon
EPA I.D.#ORD027734359

Dear Mr. Bromfeld:

In regard to our discussion of February 6, 1985, I am sending you a copy of the Part A Permit Application withdrawal dated April 25, 1984, as well as a copy of the letter from the U.S. EPA - Region X dated March 30, 1984, confirming that a hazardous waste facility does not exist in your state. Please forward this information to Mr. Reiter.

I trust that the information provided above will free us of any further written submissions (to include financial assurance documents) in regard to this matter.

Please feel free to contact me if any other problems develop.

Sincerely,

John J. Daskivich

John J. Daskivich
Environmental Resources Department

JJD/mas

Enclosures

JMD ✓

Writer's Direct Dial Number _____

MLP: NW-5-RCRA file

Koppers Company, Inc.
Environmental Resources Department
Pittsburgh, PA 15219, Telephone 412-227-2000

KOPPERS

April 25, 1984

Ms. Alexandra B. Smith, Director
Air & Waste Management Division
U.S. EPA - Region X
1200 Sixth Avenue
Seattle, Washington 98105

ATTN: Ms. Nancy Karanicolas - MS 533

SUBJ: Koppers Co., Inc.
Portland, Oregon
EPA I.D. # ORD 027734359

Dear Ms. Karanicolas:

Thank you for your letter of March 30, 1984 and the return of Part A Permit Application submitted on November 30, 1980.

Please find attached a revised notification of hazardous waste activity for generation only. I understand that if we desire to treat, store, dispose of hazardous waste at the site, we are obliged to file both a Part A and Part B RCRA Permit Application.

Thank you for your assistance in this matter.

Sincerely,

L L Nagel

L. L. Nagel, Vice President

bcc: J. Oxford

Writer's Direct Dial Number _____

Please print or type with ELITE type *(12 characters/inch)* in the unshaded areas only.

Form Approved OMB No. 158-S79016
GSA No. 0246-EPA-OT

EPA — U.S. ENVIRONMENTAL PROTECTION AGENCY
NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

INSTALLATION'S EPA I.D. NO.

I. NAME OF INSTALLATION

II. INSTALLATION MAILING ADDRESS

III. LOCATION OF INSTALLATION

PLEASE PLACE LABEL IN THIS SPACE

INSTRUCTIONS: If you received a preprinted label, affix it in the space at left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave items I, II, and III below blank. If you did not receive a preprinted label, complete all items. "Installation" means a single site where hazardous waste is generated, treated, stored and/or disposed of, or a transporter's principal place of business. Please refer to the INSTRUCTIONS FOR FILING NOTIFICATION before completing this form. The information requested herein is required by law *(Section 3010 of the Resource Conservation and Recovery Act).*

DETACH

FOR OFFICIAL USE ONLY

COMMENTS: C

INSTALLATION'S EPA I.D. NUMBER	APPROVED	DATE RECEIVED (yr., mo., & day)
F O R D 0 2 7 7 3 4 3 5 9 (T/A) C 1		

I. NAME OF INSTALLATION

Koppers Co. Inc.

II. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX: 7540 NW St. Helens Road

CITY OR TOWN	ST.	ZIP CODE
Portland	OR	97229

III. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER: 7540 NW St. Helens Road

CITY OR TOWN	ST.	ZIP CODE
Portland	OR	97229

IV. INSTALLATION CONTACT

NAME AND TITLE *(last, first, & job title)*	PHONE NO. *(area code & no.)*
Oxford, John, Terminal Manager	503-286-3681

V. OWNERSHIP

A. NAME OF INSTALLATION'S LEGAL OWNER

DETACH

B. TYPE OF OWNERSHIP *(enter the appropriate letter into box)*

F = FEDERAL
M = NON-FEDERAL

M

VI. TYPE OF HAZARDOUS WASTE ACTIVITY *(enter "X" in the appropriate box(es))*

- [X] A. GENERATION
- [X] B. TRANSPORTATION *(complete item VII)*
- [ ] C. TREAT/STORE/DISPOSE
- [ ] D. UNDERGROUND INJECTION

VII. MODE OF TRANSPORTATION *(transporters only – enter "X" in the appropriate box(es))*

- [ ] A. AIR
- [ ] B. RAIL
- [X] C. HIGHWAY
- [ ] D. WATER
- [ ] E. OTHER *(specify):*

VIII. FIRST OR SUBSEQUENT NOTIFICATION

Mark "X" in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your installation's EPA I.D. Number in the space provided below.

- [ ] A. FIRST NOTIFICATION
- [X] B. SUBSEQUENT NOTIFICATION *(complete item C)*

C. INSTALLATION'S EPA I.D. NO.: ORD027734359

IX. DESCRIPTION OF HAZARDOUS WASTES

Please go to the reverse of this form and provide the requested information

NWT 003049

I.D. – FOR OFFICIAL USE ONLY		
W O R D 0 2 7 7 3 4 3 5 9		1

IX. DESCRIPTION OF HAZARDOUS WASTES *(continued from front)*

A. HAZARDOUS WASTES FROM NON–SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.31 for each listed hazardous waste from non–specific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	**8**	**9**	**10**	**11**	**12**

B. HAZARDOUS WASTES FROM SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.32 for each listed hazardous waste from specific industrial sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	**20**	**21**	**22**	**23**	**24**
25	**26**	**27**	**28**	**29**	**30**

C. COMMERCIAL CHEMICAL PRODUCT HAZARDOUS WASTES. Enter the four–digit number from 40 CFR Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
U 05 1					
37	**38**	**39**	**40**	**41**	**42**
43	**44**	**45**	**46**	**47**	**48**

D. LISTED INFECTIOUS WASTES. Enter the four–digit number from 40 CFR Part 261.34 for each listed hazardous waste from hospitals, veterinary hospitals, medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. CHARACTERISTICS OF NON–LISTED HAZARDOUS WASTES. Mark "X" in the boxes corresponding to the characteristics of non–listed hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 – 261.24.)*

☐ 1. IGNITABLE (D001) ☐ 2. CORROSIVE (D002) ☐ 3. REACTIVE (D003) ☐ 4. TOXIC (D000)

DETACH

X. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

SIGNATURE	NAME & OFFICIAL TITLE *(type or print)*	DATE SIGNED
L L Nagel	L. L. Nagel, Vice President	4/25/84

DETACH

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

my copy
2/8/85

REPLY TO ATTN OF: M/S 533

cc: CPB
John Oxford

Judson
please
handle
FLM 4/5/84

MAR 30 1984

L. Nagel, Vice President
Koppers Company, Incorporated
The Koppers Building
Pittsburg, Pennsylvania 15219

Re: Facility No. ORD027734359

Dear Mr. Nagel:

This letter is written in response to your February 22, 1984 letter certifying that hazardous waste had never been treated, stored, or disposed of at your Portland, Oregon facility.

Based upon an inspection conducted by the Environmental Protection Agency (EPA) personnel at the facility on March 21, 1984, as well as the certification in your letter, we have no reason to believe that hazardous waste was ever stored, treated, or disposed of on your site. We are accordingly returning the hazardous waste Part A permit application for your facility, as you never qualified for interim status, and you are relieved from submitting a Part B application.

I am enclosing a hazardous waste notification form, which should be amended to include "generation only" under Item VI, Type of Hazardous Waste Activity. This will delete your treat, store, or dispose status and will allow the facility to maintain its status as a potential generator of hazardous waste. Please complete the form and return it to this office.

Before any change in operation can occur at the facility that would cause it to become subject to the 40 CFR Part 270 permit requirements, a complete (Part A and Part B) permit application would have to be submitted.

Should you have any questions regarding the Federal regulations, please contact Nancy Karanicolas at this office at (206) 442-2806.

Sincerely,

Charles Findley
for Alexandra B. Smith, Director
Air & Waste Management Division

Enclosures

file PORTLAND PLANT

NWT 003051

File: NW-S- RCRA

Department of Environmental Quality

VICTOR ATIYEH
Governor

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE: (503) 229-5696

TO: Hazardous Waste Generators DATE: August 10, 1984

cc: J. Orford 9/4

FROM: Steve Sander, DEQ Hazardous Waste Operations

SUBJECT: Quarterly Reporting Requirements

As you may be aware, this Department's new hazardous waste regulations (OAR 340 Divisions 100-110) were recently adopted (4/26/84). Copies were mailed to all generators registered as of the time of adoption. As a result of these new regulations, some changes in the quarterly reporting requirements have occurred.

OAR 340 Division 102-041 (page 8) of the rules states that a generator who ships his hazardous waste off-site must submit quarterly reports to the Department. This refers to fully regulated generators who are generating 2,000 lbs. or more of hazardous waste per month (not small quantity generators) and requires that the fully regulated generator use a manifest regardless of the individual shipment size.

As in the past, the quarterly report will preferably consist of xeroxed copies of the individual manifests. There is a new requirement, however, of a signed certification statement (340-102-041(1B) which must accompany the quarterly report.

Finally, the time period for submission of the quarterly report has been extended to 45 days following the end of each calendar quarter. This changes the quarterly reporting dates to August 15, 1984; November 15, 1984; February 15, 1985 and May 15, 1985 respectively for the next year.

As an additional note, the Department is anticipating the required use of the new uniform national manifest form (EPA 8700-22) which becomes effective September 20, 1984. As in the past, DEQ will not provide these manifest forms but will require their use by generators in Oregon.

Please send quarterly reports to:

Steve Sander
DEQ Hazardous Waste Operations
P.O. Box 1760
Portland, OR 97207

If you have any questions, please call me at (503) 229-6242 or toll-free at 1-800-452-4011.

Thank you.

SRS:b
ZB3705

9/4/84
Called Steve Sander.
If no waste is generated or shipped, no need to send in quarterly report
JAM

RECEIVED
AUG 20 1984
KOPPERS CO., INC.
INDUSTRIAL PRODUCTS DIV.
PORTLAND, OREGON

UNITED STATES POSTAL SERVICE

OFFICIAL BUSINESS

SENDER INSTRUCTIONS

Print your name, address, and ZIP Code in the space below.

- Complete items 1, 2, and 3 on the reverse.
- Attach to front of article if space permits, otherwise affix to back of article.
- Endorse article "Return Receipt Requested" adjacent to number.

RETURN TO

PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE, $300

RECEIVED

MAY 14 1984

ENVIRONMENTAL RESOURCES
OMG

U.S.MAIL

Mr. Jordan M. Dern
(Name of Sender)

Koppers Company, Inc.
1201 Koppers Bldg.
(Street or P.O. Box)

Pittsburgh, Pa. 15219
(City, State, and ZIP Code)

PS Form 3811, Jan. 1979

RETURN RECEIPT, REGISTERED, INSURED AND CERTIFIED MAIL

NW Cancel RCR

SENDER: Complete items 1, 2, and 3.
Add your address in the "RETURN TO" space on reverse.

1. The following service is requested (check one.)
   - ☒ Show to whom and date delivered.....60¢
   - ☐ Show to whom, date and address of delivery...___ ¢
   - ☐ RESTRICTED DELIVERY
     Show to whom and date delivered.....___ ¢
   - ☐ RESTRICTED DELIVERY.
     Show to whom, date, and address of delivery.$___

   (CONSULT POSTMASTER FOR FEES)

2. ARTICLE ADDRESSED TO:
Ms. Alexandra B. Smith, Dir.
U.S. EPA - Region X
1200 Sixth Avenue
Seattle, Washington 98105

3. ARTICLE DESCRIPTION: X

REGISTERED NO.	CERTIFIED NO.	INSURED NO.
	5000491	

(Always obtain signature of addressee or agent)

I have received the article described above.
SIGNATURE ☐Addressee ☐Authorized agent

4. Claudio S. Bano

DATE OF DELIVERY	POSTMARK
MAY 11 1984	

5. ADDRESS (Complete only if requested)

6. UNABLE TO DELIVER BECAUSE: CLERK'S INITIALS

☆GPO : 1979-288-848

NWT 003054

File: NW-5-RCRA

Koppers Company, Inc.
Environmental Resources Department
Pittsburgh, PA 15219, Telephone 412-227-2000

KOPPERS

April 25, 1984

Ms. Alexandra B. Smith, Director
Air & Waste Management Division
U.S. EPA - Region X
1200 Sixth Avenue
Seattle, Washington 98105

ATTN: Ms. Nancy Karanicolas - MS 533

SUBJ: Koppers Co., Inc.
Portland, Oregon
EPA I.D. # ORD 027734359

Dear Ms. Karanicolas:

Thank you for your letter of March 30, 1984 and the return of Part A Permit Application submitted on November 30, 1980.

Please find attached a revised notification of hazardous waste activity for generation only. I understand that if we desire to treat, store, dispose of hazardous waste at the site, we are obliged to file both a Part A and Part B RCRA Permit Application.

Thank you for your assistance in this matter.

Sincerely,

L L Nagel

L. L. Nagel, Vice President

bcc: J. Oxford

Writer's Direct Dial Number _____

Please print or type with ELITE type *(12 characters/inch)* in the unshaded areas only.

Form Approved OMB No. 158-S79016
GSA No. 0246-EPA-OT

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

INSTALLATION'S EPA I.D. NO.

I. NAME OF INSTALLATION

II. INSTALLATION MAILING ADDRESS

III. LOCATION OF INSTALLATION

PLEASE PLACE LABEL IN THIS SPACE

INSTRUCTIONS: If you received a preprinted label, affix it in the space at left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave Items I, II, and III below blank. If you did not receive a preprinted label, complete all items. "Installation" means a single site where hazardous waste is generated, treated, stored and/or disposed of, or a transporter's principal place of business. Please refer to the INSTRUCTIONS FOR FILING NOTIFICATION before completing this form. The information requested herein is required by law *(Section 3010 of the Resource Conservation and Recovery Act)*.

DETACH

FOR OFFICIAL USE ONLY

COMMENTS: C

INSTALLATION'S EPA I.D. NUMBER	APPROVED	DATE RECEIVED (yr., mo., & day)
F O R D 0 2 7 7 3 4 3 5 9 T/A C 1		

I. NAME OF INSTALLATION

K o p p e r s C o. I n c.

II. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX: 3 7 5 4 0 NW St. Helens Road

CITY OR TOWN: 4 P o r t l a n d | ST.: O R | ZIP CODE: 9 7 2 2 9

III. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER: 5 7 5 4 0 NW St. Helens Road

CITY OR TOWN: 6 P o r t l a n d | ST.: O R | ZIP CODE: 9 7 2 2 9

IV. INSTALLATION CONTACT

NAME AND TITLE *(last, first, & job title)*: 2 O x f o r d, J o h n, Terminal Manager

PHONE NO. *(area code & no.)*: 5 0 3 - 2 8 6 - 3 6 8 1

DETACH

V. OWNERSHIP

A. NAME OF INSTALLATION'S LEGAL OWNER: 8

B. TYPE OF OWNERSHIP *(enter the appropriate letter into box)*: M

F = FEDERAL
M = NON-FEDERAL

VI. TYPE OF HAZARDOUS WASTE ACTIVITY *(enter "X" in the appropriate box(es))*

- [X] A. GENERATION
- [X] B. TRANSPORTATION *(complete item VII)*
- [ ] C. TREAT/STORE/DISPOSE
- [ ] D. UNDERGROUND INJECTION

VII. MODE OF TRANSPORTATION *(transporters only – enter "X" in the appropriate box(es))*

- [ ] A. AIR
- [ ] B. RAIL
- [X] C. HIGHWAY
- [ ] D. WATER
- [ ] E. OTHER *(specify)*:

VIII. FIRST OR SUBSEQUENT NOTIFICATION

Mark "X" in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your Installation's EPA I.D. Number in the space provided below.

- [ ] A. FIRST NOTIFICATION
- [X] B. SUBSEQUENT NOTIFICATION *(complete item C)*

C. INSTALLATION'S EPA I.D. NO.: O R D 0 2 7 7 3 4 3 5 9

IX. DESCRIPTION OF HAZARDOUS WASTES

Please go to the reverse of this form and provide the requested information.

EPA Form 8700-12 (2-85)

NWT 003056

I.D. – FOR OFFICIAL USE ONLY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W	O	R	D	0	2	7	7	3	4	3	5	9		I

IX. DESCRIPTION OF HAZARDOUS WASTES *(continued from front)*

A. HAZARDOUS WASTES FROM NON–SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.31 for each listed hazardous waste from non–specific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B. HAZARDOUS WASTES FROM SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.32 for each listed hazardous waste from specific industrial sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. COMMERCIAL CHEMICAL PRODUCT HAZARDOUS WASTES. Enter the four–digit number from 40 CFR Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
U 05 1					
37	38	39	40	41	42
43	44	45	46	47	48

D. LISTED INFECTIOUS WASTES. Enter the four–digit number from 40 CFR Part 261.34 for each listed hazardous waste from hospitals, veterinary hospitals, medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. CHARACTERISTICS OF NON–LISTED HAZARDOUS WASTES. Mark "X" in the boxes corresponding to the characteristics of non–listed hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 – 261.24.)*

☐ 1. IGNITABLE (D001) ☐ 2. CORROSIVE (D002) ☐ 3. REACTIVE (D003) ☐ 4. TOXIC (D000)

X. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

SIGNATURE	NAME & OFFICIAL TITLE *(type or print)*	DATE SIGNED
L L Nagel	L. L. Nagel, Vice President	4/25/84

EPA Form 8700-12 (6-80) REVERSE

NWT 003057

File: NW-S-RCRA

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 533

cc: CPB
John Oxford

Jordan
Please handle
LLN 4/5/84

MAR 30 1984

L. Nagel, Vice President
Koppers Company, Incorporated
The Koppers Building
Pittsburg, Pennsylvania 15219

Re: Facility No. ORD027734359

Dear Mr. Nagel:

This letter is written in response to your February 22, 1984 letter certifying that hazardous waste had never been treated, stored, or disposed of at your Portland, Oregon facility.

Based upon an inspection conducted by the Environmental Protection Agency (EPA) personnel at the facility on March 21, 1984, as well as the certification in your letter, we have no reason to believe that hazardous waste was ever stored, treated, or disposed of on your site. We are accordingly returning the hazardous waste Part A permit application for your facility, as you never qualified for interim status, and you are relieved from submitting a Part B application.

I am enclosing a hazardous waste notification form, which should be amended to include "generation only" under Item VI, Type of Hazardous Waste Activity. This will delete your treat, store, or dispose status and will allow the facility to maintain its status as a potential generator of hazardous waste. Please complete the form and return it to this office.

Before any change in operation can occur at the facility that would cause it to become subject to the 40 CFR Part 270 permit requirements, a complete (Part A and Part B) permit application would have to be submitted.

Should you have any questions regarding the Federal regulations, please contact Nancy Karanicolas at this office at (206) 442-2806.

Sincerely,

Charles Findley

Alexandra B. Smith, Director
Air & Waste Management Division

Enclosures

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

EPA

U[illegible]IRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER: F ORD 027734359 D

LABEL ITEMS

I. EPA I.D. NUMBER: ORD027734359

III. FACILITY NAME

V. FACILITY MAILING ADDRESS: KOPPERS CO INC
7540 NW ST HELENS
PORTLAND, OR 97229

VI. FACILITY LOCATION: 7540 NW ST HELENS
PORTLAND, OR 97229

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area*(s)* below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold—faced terms.**

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)		X	
B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge to waters of the U.S.**? (FORM 2B)		X	
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	X		
D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)			
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	X		X
F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X	
H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)			
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)		X	
J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)			X

III. NAME OF FACILITY

1 SKIP

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2 GUTH PAUL W PLT SUPT	503 286 3681

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX			
3 7540 NW ST HELENS RD			
B. CITY OR TOWN	**C. STATE**	**D. ZIP CODE**	
4 PORTLAND	OR	97229	

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER			
5 7540 NW ST HELENS RD			
B. COUNTY NAME			
MULTNOMAH			
C. CITY OR TOWN	**D. STATE**	**E. ZIP CODE**	**F. COUNTY CODE (if known)**
6 PORTLAND	OR	97229	051

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CONTINUE ON REVERSE

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CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
2865 (specify) COAL TAR PRODUCTS	(specify)
C. THIRD	**D. FOURTH**
(specify)	(specify)

VIII. OPERATOR INFORMATION

A. NAME

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☑ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL; S = STATE; P = PRIVATE; M = PUBLIC (other than federal or state); O = OTHER (specify)
P (specify)

D. PHONE (area code & no.) 412 227 2000

E. STREET OR P.O. BOX
KOPPERS BLDG

F. CITY OR TOWN PITTSBURGH

G. STATE PA

H. ZIP CODE 15219

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☑ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)
9 N 2,180J	9 P
B. UIC (Underground Injection of Fluids)	**E. OTHER** (specify)
9 U	9 2,129,30 (specify) AIR OPERATING
C. RCRA (Hazardous Wastes)	**E. OTHER** (specify)
9 R	9 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements. A

XII. NATURE OF BUSINESS (provide a brief description)

A

TERMINAL FOR COAL TAR PRODUCTS

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
L. L. NAGEL Vice PRES.	Lawrence L. Nagel	11/19/80.

COMMENTS FOR OFFICIAL USE ONLY

EPA Form 3510-1 (6-80) REVERSE

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Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER: S F 0 A D 0 2 7 7 3 4 3 5 9 T/A C 1

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS
	80 11 19	

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☒ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

☐ 2. NEW FACILITY *(Complete item below.)*

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*: C 8 | YR. 77 | MO. 00 | DAY 00

FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN: YR. | MO. | DAY

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☐ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

S C DUP T/A C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S02	600	G		5				
X-2	T03	20	E		6				
1	S03	100	Y		7				
2					8				
3					9				
4					10				

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Continued from the front.

III. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES — FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

IV. DESCRIPTION OF HAZARDOUS WASTES

A. **EPA HAZARDOUS WASTE NUMBER** – Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. **ESTIMATED ANNUAL QUANTITY** – For each **listed** waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each **characteristic** or **toxic contaminant** entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. **UNIT OF MEASURE** – For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. **PROCESSES**

1. PROCESS CODES:
   For listed hazardous waste: For each **listed** hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate **all** the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* – A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2				*included with above*

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Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

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EPA I.D. NUMBER (enter from page 1)															FOR OFFICIAL USE ONLY													
S													T/A	C	S											T/A	C	
W	A	R	0	0	2	7	7	3	4	3	5	7		1	W	D	U	P									2	DUP
1	2											13	14	15	1	2								13	14	15	23	-	26

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
	23 - 26	27 - 35	36	27 - 29	27 - 29	27 - 29	27 - 29	
1	U051	10	T	S03				
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
	23 - 26	27 - 35	36	27 - 29	27 - 29	27 - 29	27 - 29	

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Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTE (continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. (enter from page 1)

S											T/A	C
F	O	R	D	0	2	7	7	3	4	3	5	9		6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)
75 34 350	122 45 360

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)
E NORTH WEST NATURAL GAS	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F 123 NW FLANDERS ST	G PORTLAND OREGON	OR	97209

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
JOHN VAN BLADEREN	by John Bladeren VICE president	11-7-80

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
L.L NAGEL VICE PRES.	Lawrence L. Nagel	11/19/80.

CONTINUE ON PAGE 5

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GENERAL INSTRUCTIONS

Who Must File

The Resource Conservation and Recovery Act of 1976 *(RCRA)* requires anyone who generates or transports hazardous waste, or who owns or operates a facility for treating, storing, or disposing of hazardous waste to notify EPA of their activity. This includes individuals, trusts, firms, joint stock companies, corporations *(including government corporations)*, partnerships, associations, States, municipalities, commissions, interstate bodies and Federal Agencies. If you transport, treat, store, or dispose of hazardous waste without filing a notification, you may be subject to civil and criminal penalties.

Hazardous waste generators and owners and operators of facilities for treating, storing, or disposing of hazardous waste who operate underground injection wells must notify EPA using the Notification Form under RCRA. You do not have to submit a separate Notification Form under the Safe Drinking Water Act, however, you are still required to fill out inventory and other forms required under the Safe Drinking Water Act. For further information, owners and operators of underground injection wells should consult the Chief, Water Supply Branch at the nearest EPA Regional Office.

What Information Should Be Filed

When filing a notification, you must identify the hazardous wastes that you handle and give a general description of your activity including its location. You can submit all this information by completing the enclosed EPA Form 8700-12, Notification of Hazardous Waste Activity.

How Many Forms Should Be Filed

You need submit only one Notification Form per site or location, provided that you describe all the activities at that site or location. If you conduct hazardous waste activity at more than one site or location, you must submit a separate form for each site or location.

If you transport hazardous waste, and do not generate, treat, store, or dispose of hazardous waste, you may submit one form which covers all the transportation activities your company conducts. This form should be submitted to the EPA Regional Office that serves the area where your company has its headquarters or principal place of business. However, if you are a transporter who generates, treats, stores or disposes of hazardous waste, you will have to complete and submit separate Notification Forms to cover each installation.

When To File

1. WITHIN 90 DAYS OF PUBLICATION OF REGULATIONS UNDER SECTION 3001 OF RCRA: Anyone who conducts hazardous waste activity must file a notification within 90 days after EPA publishes regulations under Section 3001 of RCRA. These regulations define which solid wastes are hazardous wastes and are published under Title 40 of the Code of Federal Regulations, Part 261.

Owners or operators of facilities that treat, store, or dispose of hazardous waste must submit a notification within 90 days after the 3001 regulations are published in order to qualify for "Interim Status" — that is, temporary authority to continue their operations until a final permit is issued.

2. WITHIN 90 DAYS OF ANY AMENDMENTS TO THE SECTION 3001 REGULATIONS: From time to time, EPA may change its procedures for identifying hazardous waste, or may revise the list of hazardous waste which it has published. If you handle any wastes which are identified or listed as hazardous by an amendment to the Section 3001 regulations, you must file a notification covering these wastes within 90 days after the amendment is published.

3. NEW GENERATORS AND TRANSPORTERS: If you begin to generate hazardous waste and have not previously filed a notification, you must comply with the regulations for obtaining an EPA Identification Number published under Section 3002 of RCRA *(40 CFR Part 262)* before you transport hazardous waste or offer your hazardous waste to a transporter.

Similarly, if you desire to transport hazardous waste and have not previously filed a notification, you must comply with the regulations for obtaining an EPA Identification Number published under Section 3003 of RCRA *(40 CFR Part 263)* before you move any hazardous waste.

Persons applying for an EPA Identification Number under Section 3003 of RCRA need not complete the reverse side of the Notification Form as they may not know which wastes they will be handling.

4. TREATMENT, STORAGE, AND DISPOSAL FACILITIES: If you own or operate a facility where hazardous waste is treated, stored, or disposed, and you do not file a notification during the 90 day period following the initial publication of the Section 3001 regulations, you will not be allowed to continue your hazardous waste activities until you obtain a hazardous waste permit. Similarly, if you plan to open a new hazardous waste treatment, storage, or disposal facility, you must obtain a hazardous waste permit before commencing operations. Owners or operators of new facilities need not submit a notification, since your permit application will fulfill your notification requirements.

Confidential Information

All information you submit in a notification can be disclosed to the public, according to the Freedom of Information Act and EPA Freedom of Information Regulations. Because notification information is very general, EPA believes that it is unlikely that any information in your notification could qualify to be protected from disclosure.

However, if you wish, you may make a claim of confidentiality by printing the word "confidential" on both sides of the Notification Form and on any attachments. In addition, at the time of notification, you must submit written answers to each of the following questions:

1. Which portions of the information do you claim are entitled to confidential treatment?
2. How long do you want this information treated confidential?
3. What measures have you taken to guard against undesired disclosure of the information to others?
4. To what extent has the information been disclosed to others, and what precautions have you taken in connection with that disclosure?
5. Has EPA or any other Federal Agency made a pertinent confidentiality determination? *(If so, include a copy of this determination or reference to it, if available)*.
6. Will disclosure of the information be likely to substantially harm your competitive position? If so, what would the harm be, and why should it be viewed as substantial? What is the relationship between disclosure and the harm?

Where To File

Notification should be sent to the EPA Regional Office that serves the area where your hazardous waste activity is located. If you received a notification packet from EPA that contains two preaddressed mailing labels, you should use one of the envelopes *(included in this packet)* and one of the mailing labels to send your notification to EPA *(the other envelope and mailing label should be used if you submit a permit application to EPA)*. If you do not have a preaddressed mailing label, mail your notification to the EPA Regional Office that serves the area where your hazardous waste activity is located. The mailing addresses for the EPA Regional Offices are listed below:

EPA REGION	AREA SERVED	NOTIFICATION MAILING ADDRESS
I	Connecticut, Maine, Massachusetts, Rhode Island, Vermont, New Hampshire	EPA Region I Permits Branch P.O. Box 8748 Boston, MA 02114
II	New Jersey, New York, Virgin Islands, Puerto Rico	EPA Region II Information Service Center 26 Federal Plaza New York, NY 10007

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Where To File *(continued)*

EPA REGION	AREA SERVED	NOTIFICATION MAILING ADDRESS
III	Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia	EPA Region III P.O. Box 1480 Philadelphia, PA 19107
IV	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee	EPA Region IV RCRA Activities 345 Courtland, N.E. Atlanta, GA 30308
V	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin	EPA Region V RCRA Activities P.O. Box 7861 Chicago, IL 60680
VI	Arkansas, Louisiana, New Mexico, Oklahoma, Texas	EPA Region VI Attn: 6 AEP 1201 Elm Street First International Bldg. Dallas, TX 75270

Where To File *(continued)*

EPA REGION	AREA SERVED	NOTIFICATION MAILING ADDRESS
VII	Iowa, Kansas, Missouri, Nebraska	EPA Region VII P.O. Box 15606 Kansas City, MO 64106
VIII	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming	EPA Region VIII 8AH–WM (ON) 1860 Lincoln Street Denver, CO 80295
IX	Arizona, California, Hawaii, Nevada, Guam, American Samoa, Commonwealth of the Northern Marianas	EPA Region IX Attn: A–3–2 215 Fremont Street San Francisco, CA 94105
X	Alaska, Idaho, Oregon, Washington	EPA Region X M/S 530–A 1200 Sixth Avenue Seattle, WA 98101

LINE – BY – LINE INSTRUCTIONS FOR EPA Form 8700-12

How To Complete This Form

Type using ELITE type or print in ink all items except X*(A)*, "Signature", leaving a blank box between words. When typing *(with elite type)*, hit the space bar **once** between characters and **three** times between words. If you must use additional sheets, indicate clearly the number of the item on the form to which the information on the separate sheet applies.

EXAMPLE:

I. NAME OF INSTALLATION
Smith Manufacturing Company

II. INSTALLATION MAILING ADDRESS
STREET OR P.O. BOX
3 PO Box 8719

CITY OR TOWN | ST. | ZIP CODE
4 Urbana | IL | 61801

III. LOCATION OF INSTALLATION
STREET OR ROUTE NUMBER
5 1201 6th Street

CITY OR TOWN | ST. | ZIP CODE
6 Urbana | IL | 61801

Items I Through III

NAME, MAILING ADDRESS, AND LOCATION OF INSTALLATION: If you received a preprinted label from EPA, attach it in the space provided and leave items I, II, and III blank. If there is an error or omission on the label, cross out the incorrect information and fill in the appropriate item*(s)*. If you did not receive a preprinted label, complete items I, II, and III. If the mailing address and location of the installation are the same, print "SAME" in the "Street or Route No." boxes of item III.

Item IV

INSTALLATION CONTACT: Enter the name, title, and business telephone number of the person who should be contacted regarding information submitted on this form.

Item V

OWNERSHIP: (A) Enter the name of the legal owner of the installation. Use additional sheets if necessary to list more than one owner.
(B) Enter an "F" in the box if the installation is owned by a Federal Agency. Enter an "M" if the installation is not owned by a Federal Agency. An installation is Federally owned if the owner is the Federal Government, even if it is operated by a private contractor.

Item VI

TYPE OF HAZARDOUS WASTE ACTIVITY: Mark "X" in the appropriate box*(es)* to indicate the hazardous waste activity or activities at the installation. If you mark item C, you are reminded that you should mail the enclosed postcard to request a RCRA Permit Application. Hazardous waste generators and owners and operators of facilities for treating, storing, or disposing of hazardous waste must mark item D if an injection well is located at their installation. An injection well is defined as any hole in the ground that is deeper than it is wide and that is used for the subsurface placement of fluid, **including septic tanks.**

Item VII

MODE OF TRANSPORTATION: Complete this item only if you are a transporter of hazardous waste to indicate the mode*(s)* of transportation you use.

NWT 003066

Item VIII

FIRST OR SUBSEQUENT NOTIFICATION: If you handle any hazardous waste that is identified in an amendment to Part 261 you will have to file a notification on that waste within 90 days after the amendment is published. Place an "X" in the appropriate box to indicate whether this is your first or a subsequent notification. If you have filed a previous notification, enter your EPA Identification Number in the boxes provided.

NOTE: If you have filed a notification before, you only need enter the four–digit numbers of those wastes that were identified in the amendment to Part 261.

Item IX

DESCRIPTION OF HAZARDOUS WASTE: You need to read Title 40, Code of Federal Regulations Part 261 in order to complete this item. Part 261 identifies those solid wastes that EPA defines to be hazardous wastes. Part 261 identifies hazardous wastes in two ways:

(1) A number of hazardous wastes are listed by name in various tables and appendices. EPA has assigned a four–digit number to each waste that is listed to make it easier to identify the wastes.

(2) Part 261 also lists the general characteristics of hazardous wastes. EPA has also assigned a four–digit number to these characteristics.

As you will note, item IX on the form is divided into five sections. You should use Sections A through D to identify any listed hazardous wastes which you handle; use Section E to identify those characteristics of the non–listed hazardous wastes which you handle.

You should include in Sections A through E all hazardous wastes you handled during the three–month period preceding the date of notification. If you occasionally handle a hazardous waste but did not handle that waste during the three–month period preceding the date of notification, you may also include that waste *(or wastes)* in Section A through E.

If you are a new generator applying for an EPA Identification Number under the provisions of 40 CFR Part 262, you should describe the wastes which you believe you will be generating.

If you are a new transporter applying for an EPA Identification Number under the provisions of 40 CFR Part 263, you are not required to complete item IX.

The specific instructions for Sections A through E are:

SECTION A: If you handle hazardous wastes from the non–specific sources listed in Part 261.31, enter the appropriate four–digit numbers in the boxes provided.

SECTION B: If you handle hazardous wastes from the specific industrial sources listed in Part 261.32, enter the appropriate four–digit numbers in the boxes provided.

SECTION C: If you handle any of the commercial chemical products or manufacturing intermediate or material listed in Part 261.33 as wastes, enter the appropriate four–digit numbers in the boxes provided. Manufacturers may include the products or raw materials that can be reasonably anticipated to require treatment, storage, or disposal as wastes from time to time even though you may not have handled them in the past three months.

SECTION D: If you handle any of the hazardous wastes from hospitals, veterinary hospitals, or medical and research laboratories listed in Part 261.34, enter the appropriate four–digit numbers in the boxes provided.

SECTION E: If you handle hazardous wastes which are not listed in Subpart D of Part 261, you should describe these wastes by the characteristics in Subpart C of Part 261. For purposes of notification, it is not necessary to use the four–digit numbers for each characteristic. Rather, you should place an "X" in the box next to the characteristic of those non–listed wastes which you handle.

Item X

CERTIFICATION: This certification must be signed by the owner or operator or an authorized representative of your installation. An "authorized representative" is a person responsible for the overall operation of the facility – for example – a plant manager or superintendent, or a person of equivalent responsibility.

DEFINITIONS

The following definitions are provided to help clarify the notification requirements and to assist you in completing the Notification Form. If you need a more detailed discussion of the definitions you should obtain a copy of 40 CFR Part 260 from the EPA Region Office serving your area.

DISPOSAL means the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

DISPOSAL FACILITY means a facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

EXISTING HAZARDOUS WASTE MANAGEMENT FACILITY or EXISTING FACILITY means a facility which was in operation or for which construction had commenced, as of October 21, 1976. Construction had commenced if:

(1) The owner or operator had obtained all necessary Federal, State, and local preconstruction approvals or permits; and

(2)
(i) A continuous physical, on–site construction program had begun, or
(ii) The owner or operator had entered into contractual obligations – which cannot be cancelled or modified without substantial loss – for construction of the facility to be completed within a reasonable time.

Note: This definition reflects the literal language of the statute. However, EPA believes that amendments to RCRA now in conference will shortly be enacted and will change the date for determining when a facility is an "existing facility". EPA has received a letter indicating that the Conferees are considering establishing October 30, 1980 as the date for determining when a facility is an "existing facility". Accordingly, EPA encourges every owner or operator of a facility which was built or under physical construction as of the promulgation date of these regulations to file a notification and Part A of its permit application so that it can be quickly processed for interim status when the change in the law takes effect. When those amendments are enacted, EPA will amend this definition.

FACILITY means all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units *(e.g., one or more landfills, surface impoundments, or combinations of them)*.

GENERATOR means any person, by site, whose act or process produces hazardous waste identified or listed in Part 261 of this Chapter.

NWT 003067

INSTALLATION'S EPA IDENTIFICATION *(I.D.)* NUMBER means the number assigned by EPA to each generator, transporter, and treatment, storage, or disposal facility.

OPERATOR means the person responsible for the overall operation of a facility.

OWNER means the person who owns a facility or part of a facility.

RCRA or ACT means the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended, 42 U.S.C. §6901 *et seq.*

STORAGE means the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere.

TRANSPORTATION means the movement of hazardous waste by air, rail, highway, or water.

TRANSPORTER means a person engaged in the off—site transportation of hazardous waste by air, rail, highway, or water.

TREATMENT means any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render such waste non—hazardous, or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduced in volume.

NWT 003068

Please print or type with ELITE type *(12 characters/inch)* in the unshaded areas only.

Form Approved OMB No. 158-S79016
GSA No. 0246-EPA-OT

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

INSTALLATION'S EPA I.D. NO.

I. NAME OF INSTALLATION

II. INSTALLATION MAILING ADDRESS

III. LOCATION OF INSTALLATION

PLEASE PLACE LABEL IN THIS SPACE

INSTRUCTIONS: If you received a preprinted label, affix it in the space at left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave Items I, II, and III below blank. If you did not receive a preprinted label, complete all items. "Installation" means a single site where hazardous waste is generated, treated, stored and/or disposed of, or a transporter's principal place of business. Please refer to the INSTRUCTIONS FOR FILING NOTIFICATION before completing this form. The information requested herein is required by law *(Section 3010 of the Resource Conservation and Recovery Act).*

DETACH

FOR OFFICIAL USE ONLY

COMMENTS

C

INSTALLATION'S EPA I.D. NUMBER | APPROVED | DATE RECEIVED (yr., mo., & day)

F | T/A | C | 1

I. NAME OF INSTALLATION

II. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX

3

CITY OR TOWN | ST. | ZIP CODE

4

III. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER

5

CITY OR TOWN | ST. | ZIP CODE

6

IV. INSTALLATION CONTACT

NAME AND TITLE *(last, first, & job title)* | PHONE NO. *(area code & no.)*

2

V. OWNERSHIP

A. NAME OF INSTALLATION'S LEGAL OWNER

8

B. TYPE OF OWNERSHIP *(enter the appropriate letter into box)*

F = FEDERAL
M = NON-FEDERAL

VI. TYPE OF HAZARDOUS WASTE ACTIVITY *(enter "X" in the appropriate box(es))*

☐ A. GENERATION ☐ B. TRANSPORTATION *(complete item VII)*

☐ C. TREAT/STORE/DISPOSE ☐ D. UNDERGROUND INJECTION

VII. MODE OF TRANSPORTATION *(transporters only – enter "X" in the appropriate box(es))*

☐ A. AIR ☐ B. RAIL ☐ C. HIGHWAY ☐ D. WATER ☐ E. OTHER *(specify):*

VIII. FIRST OR SUBSEQUENT NOTIFICATION

Mark "X" in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your Installation's EPA I.D. Number in the space provided below.

C. INSTALLATION'S EPA I.D. NO.

☐ A. FIRST NOTIFICATION ☐ B. SUBSEQUENT NOTIFICATION *(complete item C)*

IX. DESCRIPTION OF HAZARDOUS WASTES

Please go to the reverse of this form and provide the requested information.

EPA Form 8700-12 (6-80)

CONTINUE ON REVERSE

NWT 003069

I.D. – FOR OFFICIAL USE ONLY

1	2											13	T/A 14	C 15
W														1

IX. DESCRIPTION OF HAZARDOUS WASTES *(continued from front)*

A. HAZARDOUS WASTES FROM NON–SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.31 for each listed hazardous waste from non–specific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B. HAZARDOUS WASTES FROM SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.32 for each listed hazardous waste from specific industrial sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. COMMERCIAL CHEMICAL PRODUCT HAZARDOUS WASTES. Enter the four–digit number from 40 CFR Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48

D. LISTED INFECTIOUS WASTES. Enter the four–digit number from 40 CFR Part 261.34 for each listed hazardous waste from hospitals, veterinary hospitals, medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. CHARACTERISTICS OF NON–LISTED HAZARDOUS WASTES. Mark "X" in the boxes corresponding to the characteristics of non–listed hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 – 261.24.)*

☐ 1. IGNITABLE (D001) ☐ 2. CORROSIVE (D002) ☐ 3. REACTIVE (D003) ☐ 4. TOXIC (D000)

X. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

SIGNATURE	NAME & OFFICIAL TITLE *(type or print)*	DATE SIGNED

EPA Form 8700-12 (6-80) REVERSE

DETACH

DETACH

NWT 003070

File: NW-S-RCRA

Koppers Company, Inc., Environmental Resources
Pittsburgh, PA 15219, Telephone 412-227-2000

Organic Materials Group

KOPPERS

February 22, 1984

Ms. Alexandra B. Smith, Director
Air & Waste Management Division
United States EPA
Region X
1200 Sixth Avenue
Seattle, Washington 98101

ATTN: M/S 533

SUBJ: Koppers Company, Inc.
Portland, Oregon
EPA I.D. No. ORD 027734359
EPA I.D. No. ORD 050955848

Dear Ms. Smith:

This letter is written in response to your request for a Part B RCRA Permit Application for the subject facility. The EPA I.D. Number which appears on our records is ORD02773435. In your request for application dated February 6, 1984, the EPA I.D. Number is shown as ORD 050955848.

We have determined that it is not necessary to store hazardous waste at this location. In point of fact, none has been stored at this site to date. We feel assured that any hazardous waste which is generated can be properly disposed of within 90 days.

While we recognize that the history of hazardous waste generation at this site would qualify it as a small quantity generator, we would prefer to maintain our status as a generator of hazardous waste in the event such status is needed in the future for the disposal of a large quantity of hazardous waste. We understand that an emergency permit can be obtained if disposal becomes necessary but we feel that maintaining generator status would simplify future disposal. Our choice then would be to store any hazardous waste which is generated in containers; if the quantity is small we will store in drums and if large, in roll-out boxes. This storage would, of course, be for less than 90 days.

I hope this information satisfies your requirements. If you have any further questions, you may contact Mr. Jordan M. Dern, our environmental coordinator for this facility at (412) 227-2207.

continued

Writer's Direct Dial Number _____

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Sincerely yours,

L. L. Nagel
Vice President

cc: R. Reiter - Oregon DEQ
J. Oxford
J. M. Dern

bcc: C. P. Brush

File NW-S-RCRA Act

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 533

CERTIFIED MAIL--RETURN RECEIPT REQUESTED

FEB 6 1984

L. L. Nagel, Vice President
Koppers Company, Incorporated
The Koppers Building
Pittsburg, Pennsylvania 15219

Re: Facility No. ORD050955848

Dear Mr. Nagel:

On November 19, 1980, you submitted a Part A Resource Conservation and Recovery Act (RCRA) permit application specifying that there was hazardous waste storage in waste piles at the Kopper's facility in Portland, Oregon. On June 22, 1983, you requested that your Part A be withdrawn and that your facility be considered as only a generator of hazardous waste.

To resolve these matters and to comply with your request we are formally requesting submission of the Part B portion of the application. This request is made under authority of 40 CFR Part 270.10(e)(4). Should your formal response to this request remain as you stated on June 22, 1983, we would proceed to process your termination of interim status and ensure that any applicable closure requirements are met in lieu of Part B issuance.

You will be contacted during the next 2 weeks for the purpose of setting up a meeting regarding the Part B application. At that time, we can discuss the permit program in detail and can answer specific questions that pertain to your facility. Should you still desire to withdraw your Part A, we can also discuss the ramifications of this decision as well as what information will be necessary to verify: that hazardous wastes were never treated or disposed of at this site; that any hazardous waste storage complied with the applicable exemption rules specified in 40 CFR Parts 262.34 and 270.1; and that, therefore, formal closure would not be necessary.

Since this letter constitutes a formal request for your Part B application, I am obligated to include some information in case you should decide to remain in the RCRA system and receive a Part B permit. The Part B application requirements specified in 40 CFR Parts 270.14 through 270.21 reference other regulations such as Part 264. I have enclosed commercial reprints of 40 CFR Parts 264 and 270. This is the current available form of consolidated information. If copies of other regulations are needed, please make a specific request to this office.

The complete Part B portion of the application must be submitted to this office within 6 months of your receipt of this letter. Failure to comply with this time limit could result in the loss of interim status for existing hazardous waste management facilities and penalties under Section 3008 of RCRA up to $25,000 a day. While the regulations allow 6 months to complete the Part B portion of the application process we urge you to submit your application earlier if possible. If you submit any information under a claim of confidentiality please indicate this fact. Such claims must be substantiated as outlined in 40 CFR Part 2.

Both the Department of Environmental Quality (DEQ) and the Environmental Protection Agency (EPA) require permits for hazardous waste management facilities according to their respective regulations. In order to minimize the amount of paperwork for you, both agencies will work together to issue a joint permit. As you may already know, DEQ has expressed their intent to apply for authorization to administer a hazardous waste permit program in the State of Oregon in lieu of federally issued permits. When they recieve this authorization, they will be responsible for issuing all hazardous waste permits in the State. DEQ has indicated that the information required by EPA in 40 CFR 270.14 through 270.21 should satisfy all of the information requirements of the State except for completion of the DEQ land use compatibility form (Form DEQ 12-81). A copy of Form DEQ 12-81 is enclosed for completion and submittal with the Part B application to EPA.

Due to the wide variety of the types of hazardous waste recognized by EPA and the many unique treatment, storage, and disposal methods utilized, EPA has elected not to develop a Part B application form. We believe the reporting burden will be minimized by allowing the applicant to tailor the Part B application to the specific needs and requirements of the facility.

Since there is no rigid format for the Part B application, we are very willing to provide whatever assistance is necessary, both verbal and written, in order to ensure the submission of a complete and accurate document.

Through a joint effort we are confident that we can resolve this issue in a timely manner. We are looking forward to working with you.

Sincerely,

Alexandra B. Smith

Alexandra B. Smith, Director
Air & Waste Management Division

Enclosures

cc: Richard Reiter, DEQ
Al Goodman, OOO

Koppers Company, Inc., Environmental Resources
Pittsburgh, PA 15219, Telephone 4[redacted]27-2000

File: NW-S-RCRA

Organic Materials Group

KOPPERS

December 6, 1983

Mr. Tobias A. Hegdahl
RCRA Program Development Section
U.S. EPA - Region X
1200 6th Avenue
Seattle, Washington 98101

ATTN: Ms. Marianne Olczak
M/S 530

SUBJ: Koppers Co., Inc.
Portland, Oregon
EPA I.D. #ORD027734359

Dear Ms. Olczak:

This is written in response to your letter of November 8, 1983 in which you asked some specific questions concerning waste storage at the subject site, with regard to our request to cancel our interim status as a storer of hazardous waste. Essentially, your letter offers us two alternatives. Either we seek an exemption from RCRA as a small quantity generator, or that future storage of hazardous waste for less than 90 days be in containers or tanks.

While we recognize that the history of hazardous waste generation at this site would qualify it as a small quantity generator, we would prefer to maintain our status as a generator of hazardous waste in the event such status is needed in the future for the disposal of a large quantity of hazardous waste. We understand that a emergency permit can be obtained if disposal becomes necessary but we feel that maintaining generator status would simplify future disposal. Our choice then would be to store any hazardous waste which is generated in containers; if the quantity is small we will store in drums and if large, in either tanks or roll-out boxes. This storage would, of course, be for less than 90 days.

I hope this information satisfies your requirements. If you have any further questions, you may contact Mr. Jordan M. Dern, our environmental coordinator for this facility at (412) 227-2207.

Sincerely yours,

L. L. Nagel

L. L. Nagel, Vice President

cc: J. Oxford - Koppers, Portland
R. Reiter - Oregon DEQ
J. M. Dern

Writer's Direct Dial Number _____

File: HNW-5- RCRA Act

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 530

cc: J. Oxford-NW

JHO 11/15

NOV 8 - 1983

L. L. Nagel, Vice President
Koppers Company, Incorporated
The Koppers Building
Pittsburgh, Pennsylvania 15219

Re: Koppers Company, Inc., Portland, Oregon, EPA Identification No. ORD027734359

Dear Mr. Nagel:

In your letter dated June 22, 1983, you indicated that because storage of hazardous waste at the Portland site would not occur for longer than 90 days, Koppers would not have to submit a Part B permit application.

However, the original Part A permit application from Koppers indicated that the U051 waste generated at the site is stored in a waste pile. Unlike storage in tanks or containers, storage in waste piles is not exempt from the permit requirement even if storage occurs for less than 90 days. (See 40 CFR 262.34.)

Based on recent visits by Environmental Protection Agency and Oregon Department of Environmental Quality inspectors, it appears that activities carried out at the Portland site would not need to be permitted under the Resource Conservation and Recovery Act. However, before we can formally reach this conclusion, we will need verification from Koppers that either (a) the waste is generated in quantities of less than 1,000 kilograms per month and taken offsite before 1,000 kilograms are accumulated, or (b) the waste is stored in containers or tanks rather than in a waste pile, for less than 90 days.

Please contact Marianne Olczak at (206) 442-1262 if you have any further questions.

Sincerely,

Tobias A. Hegdahl

Tobias A. Hegdahl, Chief
RCRA Program Development Section

cc: Richard Reiter, Department of Environmental Quality, Portland
Al Goodman, Oregon Operations Office, EPA, Portland

Koppers Company, Inc., Environmental Resources
Pittsburgh, PA 15219, Telephone 412-227-2000

File: NW-S-RCRA

Organic Materials Group

KOPPERS

June 22, 1983

RCRA Permits Branch
U.S. Environmental Protection Agency
Region X
1200 6th Avenue
Seattle, Washington 98101

SUBJ: Koppers Co., Inc.
Portland, Oregon
EPA I.D. No.

Gentlemen:

Please find attached a revised Part A RCRA Permit Application for the subject facility. Specific changes include the following:

1. Delete "treat/store/dispose" from Sec. VI of "Notification of Hazardous Waste Activity."

2. Delete Line 1 from Sec. III.C. of Form 3.

3. Delete Line 1 from Sec. IV. of Form C.

The revised application reflects our intention not to store hazardous waste at this location. In point of fact, none has been stored at this site to date. By this action, we are cancelling our interim status and advising you of our intention not to file a Part B RCRA Permit Application. This action is being taken because we feel assured that any hazardous waste which is generated can be properly disposed of within 90 days.

This action has no bearing on our status as a generator of hazardous waste which we wish to maintain.

If you have any questions on this matter, please contact Mr. Jordan M. Dern, our Environmental Coordinator in Pittsburgh, Pa. at 412-227-2207.

Thank you for your assistance.

Sincerely yours,

L. L. Nagel, Vice President

cc: R. Reiter - Oregon DEQ
J. Oxford - Terminal Manager
C. P. Brush

Writer's Direct Dial Number _____

EPA

NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

INSTRUCTIONS: If you received a preprinted label, affix it in the space at left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave items I, II, and III below blank. If you did not receive a preprinted label, complete all items. "Installation" means a single site where hazardous waste is generated, treated, stored and/or disposed of, or a transporter's principal place of business. Please refer to the INSTRUCTIONS FOR FILING NOTIFICATION before completing this form. The information requested herein is required by law *(Section 3010 of the Resource Conservation and Recovery Act)*.

INSTALLATION'S EPA I.D. NO.	ORD027734359
I. NAME OF INSTALLATION	KOFFERS CO INC
II. INSTALLATION MAILING ADDRESS	7540 NW ST HELENS PORTLAND, OR 97229
III. LOCATION OF INSTALLATION	7540 NW ST HELENS PORTLAND, OR 97229

DETACH

FOR OFFICIAL USE ONLY

COMMENTS: C

INSTALLATION'S EPA I.D. NUMBER: F | APPROVED | DATE RECEIVED (yr., mo., & day) | T/C: C 1

I. NAME OF INSTALLATION

II. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX: 3

CITY OR TOWN: 4 | ST. | ZIP CODE

III. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER: 5 7540 NW ST HELENS RD

CITY OR TOWN: 6 PORTLAND | ST. OR | ZIP CODE 97229

IV. INSTALLATION CONTACT

NAME AND TITLE *(last, first, & job title)*: 2 GUTH PAUL PLT SUPT | PHONE NO. *(area code & no.)*: 503-286-3681

V. OWNERSHIP

A. NAME OF INSTALLATION'S LEGAL OWNER: 8 KOFFERS CO INC

DETACH

B. TYPE OF OWNERSHIP *(enter the appropriate letter into box)*

F = FEDERAL
M = NON-FEDERAL

M

VI. TYPE OF HAZARDOUS WASTE ACTIVITY *(enter "X" in the appropriate box(es))*

- [X] A. GENERATION
- [X] B. TRANSPORTATION *(complete item VII)*
- [ ] C. TREAT/STORE/DISPOSE
- [ ] D. UNDERGROUND INJECTION

VII. MODE OF TRANSPORTATION *(transporters only – enter "X" in the appropriate box(es))*

- [ ] A. AIR
- [ ] B. RAIL
- [X] C. HIGHWAY
- [ ] D. WATER
- [ ] E. OTHER *(specify)*:

VIII. FIRST OR SUBSEQUENT NOTIFICATION

Mark "X" in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your installation's EPA I.D. Number in the space provided below.

- [X] A. FIRST NOTIFICATION
- [ ] B. SUBSEQUENT NOTIFICATION *(complete item C)*

C. INSTALLATION'S EPA I.D. NO.: ORD027734359

IX. DESCRIPTION OF HAZARDOUS WASTES

Please go to the reverse of this form and provide the requested information.

EPA Form 8700-12 (6-80)

CONTINUE ON REVERSE

NWT 003078

IX. DESCRIPTION OF HAZARDOUS WASTES *(continued from front)*

A. HAZARDOUS WASTES FROM NON–SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.31 for each listed hazardous waste from non–specific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B. HAZARDOUS WASTES FROM SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.32 for each listed hazardous waste from specific industrial sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. COMMERCIAL CHEMICAL PRODUCT HAZARDOUS WASTES. Enter the four–digit number from 40 CFR Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31 U051	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48

D. LISTED INFECTIOUS WASTES. Enter the four–digit number from 40 CFR Part 261.34 for each listed hazardous waste from hospitals, veterinary hospitals, medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. CHARACTERISTICS OF NON–LISTED HAZARDOUS WASTES. Mark "X" in the boxes corresponding to the characteristics of non–listed hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 – 261.24.)*

☐ 1. IGNITABLE (D001) ☐ 2. CORROSIVE (D002) ☐ 3. REACTIVE (D003) ☐ 4. TOXIC (D000)

X. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

SIGNATURE	NAME & OFFICIAL TITLE *(type or print)*	DATE SIGNED
Paul W. Guth	PAUL W. GUTH PLT SUPT	7-15-80

EPA Form 8700-12 (6-80) REVERSE

(Fill-in areas are spaced for elite type, i.e., 12 ch[illegible]ers/inch)

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F ORD027734359

LABEL ITEMS

I. EPA I.D. NUMBER	ORD027734359
III. FACILITY NAME	KOPPERS CO INC
V. FACILITY MAILING ADDRESS	7540 NW ST HELENS PORTLAND, OR 97229
VI. FACILITY LOCATION	7540 NW ST HELENS PORTLAND, OR 97229

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area on the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.

SPECIFIC QUESTIONS	MARK "X" YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK "X" YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		✓		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		✓	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	✓			D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)			
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	✓		✓	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		✓	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		✓		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		✓	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		✓		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		✓	

III. NAME OF FACILITY

1 SKIP

IV. FACILITY CONTACT

A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)
2 [illegible] PAUL W PLT SUPT	503 286 3681

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 7540 NW ST HELENS RD

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 PORTLAND	OR	97229

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 7540 NW ST HELENS RD

B. COUNTY NAME

MULTNOMAH

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
6 PORTLAND	OR	97729	

EPA Form 3510-1 (6-80)

CONTINUE ON REVERSE

NWT 003080

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
2865 (specify) COAL TAR PRODUCTS	(specify)
C. THIRD	**D. FOURTH**
(specify)	(specify)

VIII. OPERATOR INFORMATION

A. NAME

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☒ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL M = PUBLIC (other than federal or state) S = STATE O = OTHER (specify) P = PRIVATE — P (specify)

D. PHONE (area code & no.) A: 412 227 2000

E. STREET OR P.O. BOX
1 OPPER'S BLDG

F. CITY OR TOWN PITTSBURGH

G. STATE PA

H. ZIP CODE 15219

IX. INDIAN LAND
Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)
9 N 2 1 5 0 3	9 P
B. UIC (Underground Injection of Fluids)	**E. OTHER (specify)**
9 U	9 2 6 2 9 3 0 (specify) AIR OPERATING
C. RCRA (Hazardous Wastes)	**F. OTHER (specify)**
9 R	9 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

TERMINAL FOR COAL TAR PRODUCTS

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
L. L NAGEL VICE PRES	Lawrence L. Nagel	11/19/80.

COMMENTS FOR OFFICIAL USE ONLY

EPA Form 3510-1 (6-80) REVERSE

NWT 003081

(All—in areas are spaced for elite type, i.e., 12 characters/inch). Form Approved OMB No. 158-S80004

FORM 3 RCRA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

1	2	3	4	5	6	7	8	9	10	11	12
F	O	R	D	0	2	7	7	3	4	5	9

13	14
	1

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS
15	16 17 18 19 20 21	

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)* 15

[ ] 2. NEW FACILITY *(Complete item below.)* 16

FOR EXISTING FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

C	YR.	MO.	DAY
8	8 4		
17	18 19	20 21	22 23

FOR NEW FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR IS EXPECTED TO BEGIN

YR.	MO.	DAY
24 25	26 27	28 29

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

[ ] 1. FACILITY HAS INTERIM STATUS 15

[ ] 2. FACILITY HAS A RCRA PERMIT 16

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR, GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

26	27	28	29	30
C	DUP		T/A	C
				1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G	
X-2	T 0 3	20	E	
1				
2				
3				
4				

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
5				
6				
7				
8				
9				
10				

NWT 003082

Continued from the front.

III. PROCESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER – Enter the four-digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four-digit number(s) from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY – For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE – For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in column A select the code(s) from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code(s) from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "Included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV (shown in line numbers X-1, X-2, X-3, and X-4 below) – A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2				Included with above

NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	FOR OFFICIAL USE ONLY
W A K D 2 7 7 3 4 3 5 7	W DUP 2 DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
1			T	S03	
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. (enter from page 1)													
F	O	R	0	8	2	7	7	3	5	9			6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility (see instructions for more detail).

VI. PHOTOGRAPHS

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)						LONGITUDE (degrees, minutes, & seconds)					
45	34	35	0			122	45	36	0		

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items.

	1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)
B	NORTHWEST NATURAL GAS	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
220 NW Broadacres St.	Portland	OR	97209

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
JOHN VAN BLADEREN	Asst. Vice President	11-7-80

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
L.L NAGEL Vice Pres.	Lawrence L. Nagel	11/19/80.

NWT 003085

Fle: NW-S-RCRA

DATA FOR RCRA COMPLIANCE MANUAL

PLANT NAME: N.W. Terminal LOCATION: 121 Portland, Ore.

CONTINGENCY PLAN

General - Map

Attach a plant map or plant layout (either 8½ x 11 or 8½ x 14). The map must contain the following information.

1. Production Areas
2. Tank Storage Areas -
3. Product and/or Raw Material Storage Areas
4. Hazardous Waste Areas
5. Fire Pump and Fire Hydrant Locations -
6. Fire Alarm Locations -
7. Telephones which can call outside the plant -
8. Evacuation points, routes and muster areas -

II. Responsibilities

A. What are your normal working hours? 8AM To 4:30 pm

B. Who has been designated as Emergency Coordinator during normal working hours? Henry E. Rassi

C. Who has been designated as Emergency Coordinator during evenings, night shifts, holidays and weekends? George Hoffman or Harold Beehler

attached

III. A. Emergency Equipment

Provide a separate list of emergency equipment including quantity and location where stored to deal with fires and spills. Your plant may not have the same equipment and capabilities as Bridgeville or Woodward Tar. You should only report the capabilities you presently have. We do not represent any list as being adequate or inadequate for the purposes of RCRA Compliance so they should not be the basis to acquire new equipment.

III. B. Outside Resources

a. The name and phone number of the fire department which would respond to an emergency. Phone 911

b. The name and all phone numbers of physicians who normally would treat plant personnel either for accidents or physicals. Dr. Wolf 286 5805

c. Name and phone number of the ambulance service which would be used in an emergency. Phone 911

d. Name and phone number of medical evacuation services if available. Life Flight Helicopter 2804128

e. Name and phone number of the local hospital that will treat victims of a plant mishap. Emanuel phone 2804128

Copies of applicable portions of the RCRA Compliance Plans must be reviewed with each of these agencies. We also have an obligation to familiarize them with the physical layout of our facility (applicable to those who could work at the site).

III. C. Communication System

a. A description of the plants walkie-talkie communication system if applicable. (A listing of individuals with the equipment should be included). N.A.

b. The internal phone number(s) to call in case of emergency. These numbers should be posted at each phone. LAb # 8
office # 21

c. Phones with outside call capability should have emergency phone numbers for plant personnel and outside agencies posted.

IV. A. II. Immediate Response

a. The name and phone number (both work and home) of the primary emergency coordinator. The titles, names and phone numbers (both work and home) of the chain of command for dealing with emergencies. H. Rassi 253 1962
Hoffman 760 5236, Beehler 206 646 9652

b. The phone number where the emergency coordinator during off-hours can be reached. If this individual is away from the phone for extended periods, an alternate number which will always answer (e.g. boilerhouse or guardhouse) as well as instructions to these personnel detailing how to contact the emergency coordinator.

IV. A. V.

a. The name and phone number of the local law enforcement agency. Phone 911

b. The name and phone number of the state law enforcement agency. Phone 911

Phone D.E.Q 2296092

c. The name and phone number of the local air pollution control agency (emergency phone number preferred).

D.E.Q. 2296474

d. Name and phone number of the local water pollution control agency (emergency phone number preferred).

(1-800-452-0311 emergency)

e. U.S. EPA Regional Office phone number (emergency phone number preferred).

IV. B. First Aid Lab. #8

The location of the plant's first aid facilities including phone number.

IV. C. Evacuation Plan

What are your evacuation signals, evacuation points, (at least 2) and mustering areas. Repeated short signals from steam whistle - muster at whistle, main gate, back gate, go south through Wacker Siltronic and out on front ave.

IV. D. Hazardous Waste Release

Explain how a discharge of hazardous waste would be controlled at your plant. A separate strategy is required for each hazardous waste on your RCRA Permit Application. The same strategy may apply to more than one hazardous waste.

IV. E. Oil or Hazardous Materials Spill

Forward a copy of your facility's SPCC Plan which has been up-dated to reflect changes in storage capability and usage and facility changes which affect other parts of the plant including spill history.

Waste Analysis Plan

Forward all copies of Waste Analysis which have been performed by your plant.

Operating Record

Identify each hazardous waste for which an operating record will be maintained including 1) waste type and hazardous waste code, 2) the process generating the hazardous waste 3) the reason it is a hazardous waste, 4) how it is treated, stored, disposed and 5) the inventory on November 19, 1980.

INSPECTION LOG

A. RCRA Regulations require daily inspections for all potential sources of hazardous waste release including evidence of spills, leaks, corrosions, cracks, and/or ruptures. You should identify each piece of equipment which has the potential to discharge hazardous waste including tanks, pumps, pipelines and dikes. Storage Tanks, Tank Cars, Hose and fittings, Truck Tanks, Creo Pumps(4), Terminal effluent to river ditch.

B. Include check lists which you use for emergency equipment, e.g. fire extinguishers. These should be incorporated as part of this plan and show as a separate inspection log. extinguisher list attached.

PERSONNEL TRAINING PROGRAM

Provide a list, by job title, of all individuals who require RCRA training. The list must include all individuals who potentially could come into personal contact with hazardous waste (both salaried and hourly).

If you have any questions concerning the information being requested, the following individuals should be contacted immediately.

Mark Urbassik - 227-2870

Jordan Dern - 227-2207

Robert Honstein - 227-2885

Charles Brush - 227-2877

III

Emergency Spill

35A Tractor Shovel — Storage location outside shop

hand shovels — one at each track, locker in shop

Extera Labor — Call Barry Service → 243-2444

Vacuum truck To pick up liquid — Call → 283-1150

Plan To prevent spill from going into storm drain by diking around it with dirt.

Fire Equipment

There are 5 hose houses (see map) each with 150' of 2½" hose.

23 Fire extinguishers (see attached list & location)

one Foam cart for close range → Boiler room

N.W. Terminal 121 Portland, Oregon

(Phone numbers for emergency)

Coordinator:

Henry Rassi 286 3681 Work
253 1962 Home

Terminal Personnel:

George Hoffman 760 5236
Harold Beehler 206 696 9652
Mitch Allen 644 1124

Extera labor Berry Service 243 2444

Liquid Spill Vacuum Truck 283 1150

Fire, Police, Medical, Sheriff 911

Emanuel Hopital
OR
Life Flight Helicopter } 280 4128

D.E.Q. [emergency] 1-800-452-0311

D.E.Q. (Air, Water, Land,) day phone 229 5696

Dr. Wolf St. Johns office 286 5805

RECEIVED

RECEIVED
MAR 15 1982
ENVIRONMENTAL RESOURCES
OMG

KOPPERS

Interoffice Correspondence

To JORDAN M. DERN

Location K-1201

Subject CONTINGENCY PLAN (ENVIRONMENTAL)

From HENRY E. RASSI

Location NORTHWEST TERMINAL

Date JANUARY 7, 1982

EMERGENCY COORDINATOR:
HENRY E. RASSI
WORK PHONE 286-3681
HOME PHONE 253-1962

TERMINAL PERSONNEL EXPERIENCED IN EMERGENCY ACTION:

MITCHELL L. ALLEN 644-1124
HAROLD, R. BEEHLER 206-696-9652
GEORGE E. HOFFMAN 760-5236

EMERGENCY PHONE:
FIRE 911
POLICE 911
MEDICAL 911
D.E.Q. 229-5696

THE ENVIRONMENTAL HAZARD AT THIS TERMINAL WOULD BE FROM OIL SPILLAGE, SUCH AS OVER-FLOW OF STORAGE TANK, R.R. TANK CAR, OR TANK TRUCK.

ACTION TO CONTROLL DAMAGE AND PROTECT ENVIRONMENT:
MONTHHY SAFETY MEETINGS ARE HELD TO KEEP "ALIVE" RULES SUCH AS-

1. DO NOT FILL ANY TANK TO MORE THAN TWO FOOT OUTAGE.
2. NEVER LEAVE THE JOB OF TRANSFERRING OIL FROM TANK TO TANK UNTIL TRANSFER PUMPS ARE OFF AND STORAGE TANK VALVES CLOSED.
3. TRUCK DRIVERS MUST REMAIN ON THE TRUCK TO SEE AND CONTROL THE LOADING.
4. PUMP MAN REMAINS AT THE PUMP CONTROL SWITCH AND SHUT OFF VALVE.

SHOULD THERE BE A SPILL IT MUST BE CONTROLLED RROM GOING INTO THE STORM DRAIN. ANY SPILL MUST BE REPORTED TO COORDINATOR AND PLANT MANAGER.

SHOVEL AND DRY SAND ARE STORED IN BOILER ROOM TO USE ON SPILL CONTROL.

KOPPERS

Interoffice Correspondence

To JORDAN M. DERN

From HENRY E. RASSI

Location K-1201

Location NORTHWEST TERMINAL

Subject CONTINGENCY PLAN (ENVIRONMENTAL)

Date JANUARY 7, 1982

THE NEAREST STORM DRAIN IS LOCATED IN FRONT OF THE OFFICE, THIS IS 500 FEET FROM THE TRUCK LOADING AREA, AND 300 FEET FROM TANK CAR LOADING AREA. ALL STORAGE TANKS ARE IN DIKE AREA. STORM WATER IS PUMPED FROM DIKE AREA ONLY DURING WORK HOURS SO WATER MONITORING CAN INSURE ENVIRONMENTAL COMPLIANCE.

SHOULD THERE BE A LARGE SPILL WE HAVE A 3/4 YARD BUCKET LOADER FOR MOVING DIRT TO DIKE AREA OF SPILL.

CROSBY AND OVERTON (VACUUM TRUCK) COULD BE CALLED TO PICK UP ANY LARGE LIQUID SPILL. PHONE - 289-5749.

Henry E. Rassi

HE NRY E. RASSI

HER:up

U.S. ENVIRONMENTAL PROTECTION AGENCY

NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

INSTRUCTIONS: If you received a preprinted label, affix it in the space at left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave Items I, II, and III below blank. If you did not receive a preprinted label, complete all items. "Installation" means a single site where hazardous waste is generated, treated, stored and/or disposed of, or a transporter's principal place of business. Please refer to the INSTRUCTIONS FOR FILING NOTIFICATION before completing this form. The information requested herein is required by law *(Section 3010 of the Resource Conservation and Recovery Act).*

INSTALLATION'S EPA I.D. NO.	ORD027734359
I. NAME OF INSTALLATION	KOPPERS CO INC
II. INSTALLATION MAILING ADDRESS	7540 NW ST HELENS PORTLAND, OR 97229
III. LOCATION OF INSTALLATION	7540 NW ST HELENS PORTLAND, OR 97229

DETACH

FOR OFFICIAL USE ONLY

COMMENTS: C

INSTALLATION'S EPA I.D. NUMBER: F | T/A: C = 1 | APPROVED | DATE RECEIVED (yr., mo., & day)

I. NAME OF INSTALLATION

II. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX: 3

CITY OR TOWN: 4 | ST. | ZIP CODE

III. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER: 5 7540 NW ST HELENS RD

CITY OR TOWN: 6 PORTLAND | ST.: OR | ZIP CODE: 97229

IV. INSTALLATION CONTACT

NAME AND TITLE *(last, first, & job title)*: 2 GUTH PAUL PLT SUPT

PHONE NO. *(area code & no.)*: 503-286-3681

V. OWNERSHIP

A. NAME OF INSTALLATION'S LEGAL OWNER: 8 KOPPERS CO INC

DETACH

B. TYPE OF OWNERSHIP *(enter the appropriate letter into box)*: M

F = FEDERAL
M = NON-FEDERAL

VI. TYPE OF HAZARDOUS WASTE ACTIVITY *(enter "X" in the appropriate box(es))*

- [X] A. GENERATION
- [X] B. TRANSPORTATION *(complete Item VII)*
- [X] C. TREAT/STORE/DISPOSE
- [ ] D. UNDERGROUND INJECTION

VII. MODE OF TRANSPORTATION *(transporters only – enter "X" in the appropriate box(es))*

- [ ] A. AIR
- [ ] B. RAIL
- [X] C. HIGHWAY
- [ ] D. WATER
- [ ] E. OTHER *(specify)*:

VIII. FIRST OR SUBSEQUENT NOTIFICATION

Mark "X" in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your installation's EPA I.D. Number in the space provided below.

- [X] A. FIRST NOTIFICATION
- [ ] B. SUBSEQUENT NOTIFICATION *(complete Item C)*

C. INSTALLATION'S EPA I.D. NO.: ORD027734359

IX. DESCRIPTION OF HAZARDOUS WASTES

Please go to the reverse of this form and provide the requested information.

I.D. – FOR OFFICIAL USE ONLY

IX. DESCRIPTION OF HAZARDOUS WASTES *(continued from front)*

A. HAZARDOUS WASTES FROM NON–SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.31 for each listed hazardous waste from non–specific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
7	8	9	10	11	12

B. HAZARDOUS WASTES FROM SPECIFIC SOURCES. Enter the four–digit number from 40 CFR Part 261.32 for each listed hazardous waste from specific industrial sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

C. COMMERCIAL CHEMICAL PRODUCT HAZARDOUS WASTES. Enter the four–digit number from 40 CFR Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
U051					
37	38	39	40	41	42
43	44	45	46	47	48

D. LISTED INFECTIOUS WASTES. Enter the four–digit number from 40 CFR Part 261.34 for each listed hazardous waste from hospitals, veterinary hospitals, medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. CHARACTERISTICS OF NON–LISTED HAZARDOUS WASTES. Mark "X" in the boxes corresponding to the characteristics of non–listed hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 – 261.24.)*

☐ 1. IGNITABLE (D001) ☐ 2. CORROSIVE (D002) ☐ 3. REACTIVE (D003) ☐ 4. TOXIC (D000)

X. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

SIGNATURE	NAME & OFFICIAL TITLE *(type or print)*	DATE SIGNED
Paul W. Guth	PAUL W. GUTH PLT SUPT	7-15-80

EPA Form 8700-12 (6-80) REVERSE

DETACH

DETACH

NWT 003096

RECEIVED
JUL 19 1982
ENVIRONMENTAL RESOURCES
OMG

File: NW-S-general

TO: Jordan Der, 1
cc: Tom, Key, Shannon

FROM: N.W Terminal
7540 N.W. St. Helens rd.
Portland, Oregon

SUBJECT: D.E.Q. site inspection 7-9-82

DATE: 7-13-82

FOLD— MESSAGE

Attached is the D.E.Q information we talked about on the phone 7-9-82

The water in the old wells appears clean and using a model P-12 CHEMets Test Kit. Phenol = trace

ORIGINATOR-DO NOT WRITE BELOW THIS LINE — REPLY TO → SIGNED Henry E. Rossi

REPLY

DATE

SIGNED

SEND WHITE AND PINK COPIES WITH CARBONS INTACT. PINK COPY IS RETURNED WITH REPLY.

Multi. Co
KOPPERS

DEPARTMENT OF ENVIRONMENTAL QUALITY
SITE INSPECTION REPORT
HAZARDOUS WASTE GENERATOR

Facility Name: KOPPERS Co. Inc.

Address: 7540 NW ST HELENS RD
PORTLAND, OR 97229

Phone: 503-286-3681 I.D. No.: ORD 027734359

Company Contact: HENRY RASSI Visited on: 7/9/82

By: ED BAESLER, DEQ
ASSADDMAN, EPA

BACKGROUND

1. Is generator familiar with DEQ and EPA hazardous waste rules? Are rules available? COPIES OF DEQ RULES LEFT AT FACILITY. HW ACTIVITIES COORDINATED AT CORPORATE HEADQUARTERS.

2. Type of business? Principal products/amount produced? Facility employment 7

CREOSOTE FORMULATOR*

≈ 200,000 GAL/MO

* CARBONIZATION OF BITUMINOUS COAL

How registered with DEQ? EPA?

DEQ ⇨ Ø

EPA ⇨ TSDF

4. Are following plans and procedures adequate (if TSD facility)?

   a. Waste analysis procedures

   b. Site security

   c. Inspection plan and records

   d. Preparedness and prevention

   e. Contingency plan and emergency procedures

   f. Personnel training procedures and records

   g. Closure plan

   h. Post-closure plan

5. Fill out WASTE GENERATION AND MANAGEMENT sheet for each hazardous or suspected hazardous waste generated. Similar wastes may be combined onto a single sheet.

6. Conclusion and Recommended Action:

MR RASSI ADVISED THAT THIS FACILITY DOES NOT CURRENTLY PRODUCE WASTE. DRIP PANS ARE UTILIZED TO COLLECT DRIPPINGS FROM RAILROAD CARS AND OUT OF SPEC. CREOSOTE IS DELT WITH BY PUTTING THE DRIPPINGS INTO THE FORMULATION SYSTEM AND BY ADJUSTING OFF SPECIFICATION CREOSOTE TO SPECIFICATION.

SINCE IT APPEARS KOPPERS CO. INC. DOES NOT PRODUCE HAZARDOUS WASTE, NOTIFICATION THROUGH DEQ WOULD NOT BE REQUIRED. THIS COMPANY SHOULD RECONSIDER ITS STATUS WITH EPA AS A TSDF ALSO AND WITHDRAW ITS APPLICATION IF SUCH ACTIVITY IS NOT CONDUCTED AT THE FACILITY.

SAMPLES TO BE TAKEN FROM MONITORING WELLS AROUND OLD EFFLUENT POND. THIS IMPOUNDMENT RECEIVED WATER FROM A DISTILLATION PROCESS AND CONTAINED SOME PHENOL.

HAZARDOUS WASTE GENERATION AND MANAGEMENT

Waste No. _____

1. Waste name:

NONE

2. Hazard classification:

3. Process producing waste:

4. Rate of waste production:

5. Waste handling prior to disposal:

6. Waste disposal practice and manifest:

7. Reporting and recordkeeping:

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

RECEIVED
AUG 12 1982
ENVIRONMENTAL RESOURCES
OMG

REPLY TO ATTN OF: M/S 530

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

AUG 09 1982

Lawrence L. Nagel, Vice President
Kopper Company, Incorporated
1250 Koppers Building
Pittsburgh, Pennsylvania 15219

RE: Facility #ORD027734359

Dear Mr. Nagel:

This is to acknowledge that the Environmental Protection Agency has completed processing the information submitted in your Part A Hazardous Waste Permit Application. It is the Agency's opinion, based on the assumption that the information submitted is complete and accurate, you as an owner or operator of a hazardous waste management facility have met the requirements of Section 3005(e) of the Resource Conservation and Recovery Act (RCRA) for Interim Status. EPA has not verified the information submitted. If it is determined that the information is incomplete or inaccurate, you may be asked to provide additional information or in certain circumstances it may be determined that you do not qualify for interim status.

On July 16, 1981, Oregon received interim authorization under Section 3006 of RCRA to manage Phase I of the Federal hazardous waste program in lieu of EPA. Therefore, as an owner or operator of a hazardous waste management facility in Oregon, you are required to comply with all applicable State and local requirements, including State rules and, where appropriate, State permit or license conditions.

Nonetheless, until Oregon receives Phase II interim authorization or final authorization, you must comply with 40 CFR Sections 122.22 and 122.23 if you wish to handle new wastes, change processes, increase the design capacity, or change ownership or operational control of the facility. The information in the enclosure to this letter, obtained from your Part A Permit Application, identifies the processes your facility may use, their design capacities, and the types of waste your facility may accept during interim status. Please refer to the above referenced Federal Regulations for requirements which apply if you wish to change the operation of your facility. Please also be aware that in complying with the Section 122.22 and 122.23 requirements, you must continue to use the Federal definition of hazardous waste found in 40 CFR Part 261.

If you have any questions concerning this letter, please call Mike Bussell (206) 442-2859.

Sincerely,

Kenneth D. Feigner, Chief
Waste Management Branch

Enclosure

cc: Richard Reiter, Oregon Department of Environmental Quality
Al Goodman, Oregon Operations Office, EPA
Henry Rassi, Koppers, Portland, Oregon
John VanBladeren, Northwest Natural Gas

cc: gm dsm
8/12/82 jfc

CONDITIONS OF OPERATION DURING
INTERIM STATUS

Date Prepared:

The information shown below is based solely on the information that the owner and operator of this facility submitted in Part A of the Hazardous Waste Permit Application. This is not a determination by EPA that this facility is an environmentally acceptable facility for treating, storing or disposing of the hazardous wastes listed below. This notice does not preclude a citizen from taking legal action under the provisions of Section 7002 of RCRA.

I. Facility Name: Koppers Co. Inc.

Location: 7540 N.W. ST. Helens

Portland, Oregon 97229

EPA ID No: ORD-027734359

II. EPA considers the following to be the owner or operator of the facility and therefore the person(s) who must comply with the requirements set forth in 40 CFR Part 122 and existing State regulations:

Owner's Name: Northwest Natural Gas

Operator's Name: Koppers Co. Inc.

III. During the period of interim status, the facility may use only the following processes for treating, storing or disposing of hazardous waste, up to the design capacities that are indicated:

PROCESS	DESIGN CAPACITY
S03	100 cubic yards

IV. During the period of interim status, the facility may handle only the hazardous wastes with the following EPA Hazardous Waste Numbers, and/or solid wastes exhibiting hazardous characteristics with the following EPA Hazardous Waste Numbers (This does not preclude the handling of other wastes defined as hazardous by Oregon State regulations):

U051				

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER: F ORD 027734359 D

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

LABEL ITEMS

I. EPA I.D. NUMBER: ORD027734359

III. FACILITY NAME: KOFFERS CO INC

V. FACILITY MAILING ADDRESS: 7540 NW ST HELENS
PORTLAND, OR 97229

VI. FACILITY LOCATION: 7540 NW ST HELENS
PORTLAND, OR 97229

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X	
B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	X		
D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)			
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		X
F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X	
H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)			
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	
J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*: 2 SAME AS PLT SUPT

B. PHONE *(area code & no.)*: 503 286 3681

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX: 3 7540 NW ST HELENS RD

B. CITY OR TOWN: 4 PORTLAND

C. STATE: OR

D. ZIP CODE: 97229

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER: 5 7540 NW ST HELENS RD

B. COUNTY NAME: MULTNOMAH

C. CITY OR TOWN: 6 PORTLAND

D. STATE: OR

E. ZIP CODE: 97229

F. COUNTY CODE *(if known)*:

EPA Form 3510-1 (6-80)

CONTINUE ON REVERSE

NWT 003104

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST	B. SECOND
7 2865 (specify) COAL TAR PRODUCTS	7 (specify)
C. THIRD	**D. FOURTH**
7 (specify)	7 (specify)

VIII. OPERATOR INFORMATION

A. NAME: 8

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☑ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other", specify.)*
F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC *(other than federal or state)*
O = OTHER *(specify)*
P (specify)

D. PHONE *(area code & no.)*: A 412 227 2000

E. STREET OR P.O. BOX: HOPPERS BLDG

F. CITY OR TOWN	G. STATE	H. ZIP CODE
B PITTSBURGH	PA	15219

IX. INDIAN LAND
Is the facility located on Indian lands? ☐ YES ☑ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*	D. PSD *(Air Emissions from Proposed Sources)*
9 N 2180J	9 P
B. UIC *(Underground Injection of Fluids)*	**E. OTHER** *(specify)*
9 U	9 262930 (specify) AIR OPERATING
C. RCRA *(Hazardous Wastes)*	**E. OTHER** *(specify)*
9 R	9 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

TERMINAL FOR COAL TAR PRODUCTS

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED
L. L. NAGEL VIC PRES	Lawrence L. Nagel	11/19/80

COMMENTS FOR OFFICIAL USE ONLY

C

EPA Form 3510-1 (6-80) REVERSE

NWT 003105

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

														T/A	C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
F	0	R	D	0	2	7	7	3	4	3	5	9			1

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS
23	24 - 29	

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☒ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)* (71)

☐ 2. NEW FACILITY *(Complete item below.)* (71)

C 8 (15)

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR.	MO.	DAY
7 6 (73 74)	(75 76)	(77 78)

FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

YR.	MO.	DAY
(73 74)	(75 76)	(77 78)

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☐ 1. FACILITY HAS INTERIM STATUS (72)

☐ 2. FACILITY HAS A RCRA PERMIT (73)

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

														T/A	C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
C	D	U	P												1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
	(16 - 18)	(19 - 27)	(28)	(29 - 32)
X-1	S 0 2	600	G	
X-2	T 0 3	20	E	
1	S 0 3	100	Y	
2				
3				
4				

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. PROCESS DESIGN CAPACITY 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
	(16 - 18)	(19 - 27)	(28)	(29 - 32)
5				
6				
7				
8				
9				
10				

NWT 003106

Continued from the front.

III. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

IV. DESCRIPTION OF HAZARDOUS WASTES

A. **EPA HAZARDOUS WASTE NUMBER** – Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. **ESTIMATED ANNUAL QUANTITY** – For each **listed waste** entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each **characteristic** or **toxic contaminant** entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. **UNIT OF MEASURE** – For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. **PROCESSES**

1. PROCESS CODES:
   For listed hazardous waste: For each **listed** hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate **all** the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* – A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2				included with above

NWT 003107

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)																FOR OFFICIAL USE ONLY															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
W	2	R	0	2	7	7	3	4	3	5	7		T/A	C	1	W													T/A	C	2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
	23 - 26	27 - 35	36	27 - 28	27 - 28	27 - 28	27 - 28	
1	D 0 5 1	20	T	S 0 3				
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
	23 - 26	27 - 35	36	27 - 28	27 - 28	27 - 28	27 - 28	

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE

(enter "A", "B", "C", etc. behind the "3" to identify photocopied pages)

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTE (continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. (enter from page 1)

F	O	R	D	0	2	7	7	3	4	3	5	9	T/A	C
														6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground–level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)
45 34 35 0	122 45 36 0

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)
E NORTH WEST NATURAL GAS	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F 123 NW FLANDERS ST.	G PORTLAND OREGON	OR	97209

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
JOHN VAN BLADEREN	By John Bladeren Vice President	11-7-80

X. OPERATOR CERTIFICATION

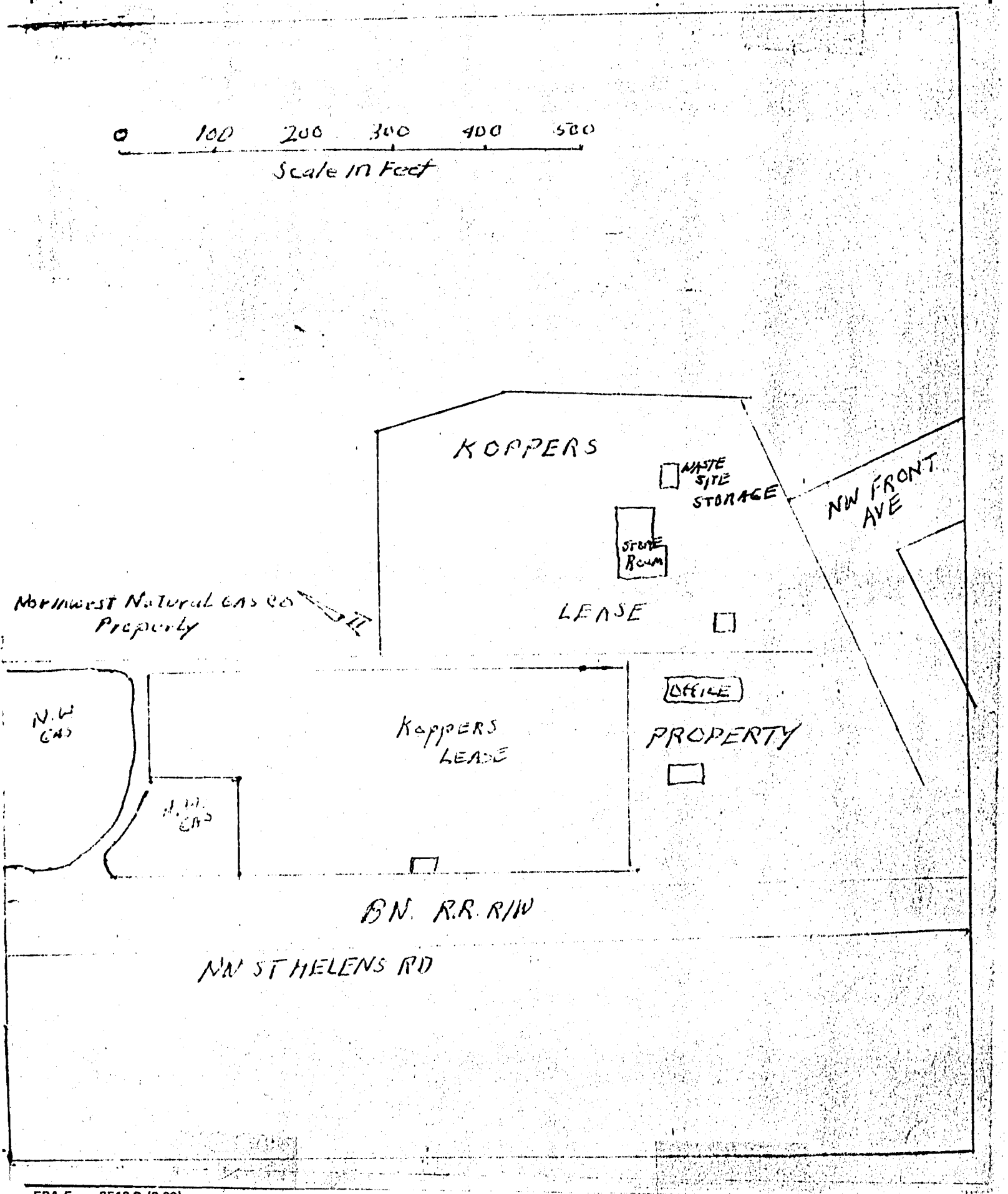
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
L. L NAGEL VICE PRES.	Lawrence L. Nagel	11/19/80.

NWT 003109

Form Approved OMB No. 158-S80004

V. FACILITY DRAWING *(see page 4)*



NWT 003110

ACKNOWLEDGEMENT OF NOTIFICATION OF HAZARDOUS WASTE ACTIVITY

This is to acknowledge that you have filed a Notification of Hazardous Waste Activity for the installation listed at the address shown in the box below to comply with Section 3010 of the Resource Conservation and Recovery Act *(RCRA)*. Your EPA Identification Number for that installation appears in the box below. The EPA Identification Number must be included on all shipping manifests for transporting hazardous wastes; on all Annual Reports that generators of hazardous waste and owners and operators of hazardous waste treatment, storage and disposal facilities must file with EPA; on all applications for a Federal Hazardous Waste Permit; and other hazardous waste management reports and documents required under Subtitle C of RCRA.

EPA I.D. NUMBER:

ORD027734359

ROPPERS CO INC
7540 NW ST HELENS
PORTLAND OR 97229

INSTALLATION ADDRESS:

7540 NW ST HELENS
PORTLAND OR 97229

EPA Form 8700-12A (4-80)

ORD 027734359
Koppers Company, Inc.
Portland, Ore.

File: NW-5-general

Tom Leak
Jordan Perry
Key Caldwell

RECEIVED
JUL 26 1982
ENVIRONMENTAL RESOURCES MNG

NW Terminal

7-21-82-

Subject: Preliminary Inspection by DEQ and EPA reguarding Waste sTorage permit.

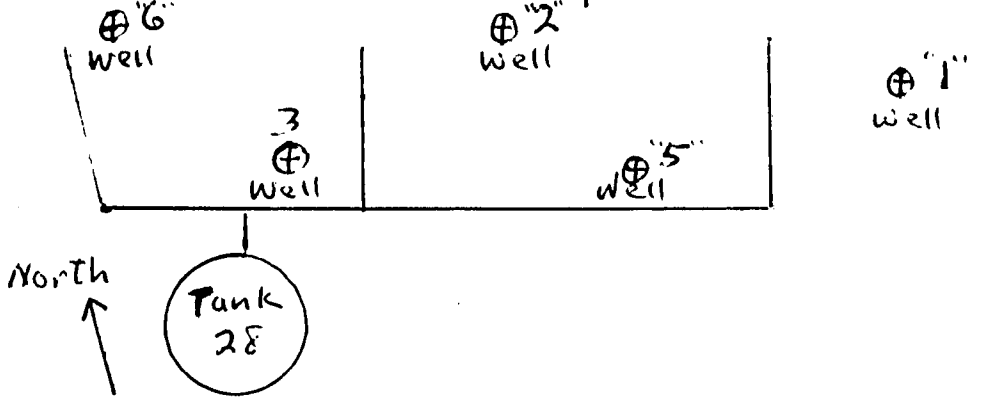
The old wells located in the eftluent pond were sampled by D.E.Q. and EPA July 19, 1982

Samples of about 300 Mls each were taken and placed in Quart canning jars and covered with aluminum foil. No fixers were added to the samples. About 100mls of each sample were retained by N.W. Terminal. Had planned to have Charlton Testing lab analyse the samples. Charlton Lab, Andy Held informed me that we should have taken a gallon or more from each Well and treated samples as required by method. If more samples are

taken Charlton Lab will analyse them.

The EPA – DEQ plan To analyse for Phenol, pH, Oil & Grease, Led.

Of the four samples only one had oil and phenol. See map below.



Well "DEQ #2" had a black heavy fuel oil like substance under about 6" of water.

This substance may be draining into the well area from a pond on the N.W. Gas Co. property just about 75 feet on the other side of the fence, North of well #2.

After talking to Tom Leake about the possibility of oil comming from Gas Co. pond, a phone call was made to Mr. Ed Bollen - N.W. Gas Co. "Mr. Bollen, will have the pond checked over A.S.A.P."

We will continue to work with EPA and DEQ according To Koppers guide lines.

Henry E. Kasi

EPA
UNITED STATES
ENVIRONMENTAL PROTECTION
AGENCY REGION 10

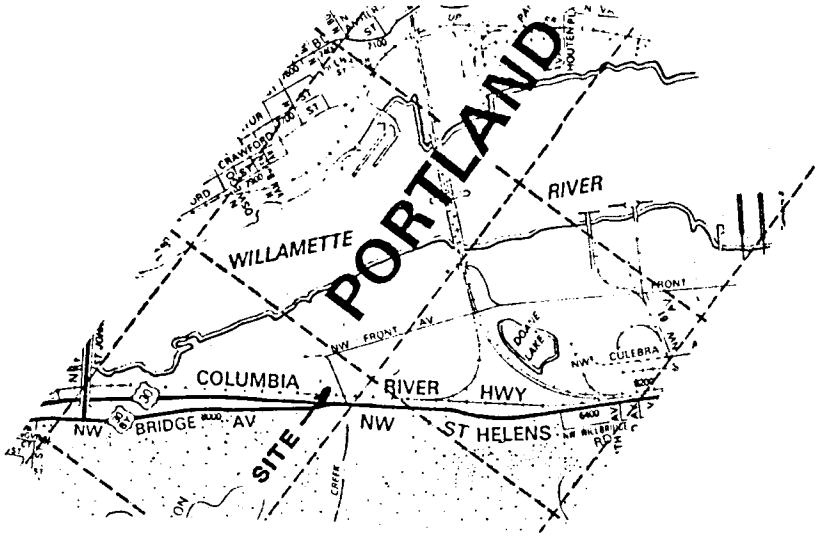
ALAN S. GOODMAN
SANITARY ENGINEER

OREGON OPERATIONS OFFICE
522 S.W. FIFTH, 2nd FLOOR
PORTLAND, OREGON 97204

(503) 221-3250
FTS 423-3250

GREGORY D. BAESLER, R.S.
Environmental Analyst
NORTHWEST REGION

Department of Environmental Quality
Mailing Address: P.O. Box 1760, Portland, Oregon 97207
522 S.W. 5th Avenue
Portland 97204
Phone 229-5296



TANK

WALL

B-1 B-2 B-3 B-4 B-5 B-6 B-7 B-8 B-9 B-10 B-11 B-12 B-13 B-14 B-15

B-9 Approximate Boring Locations Borings Spaced Approximately 30 Feet Apart

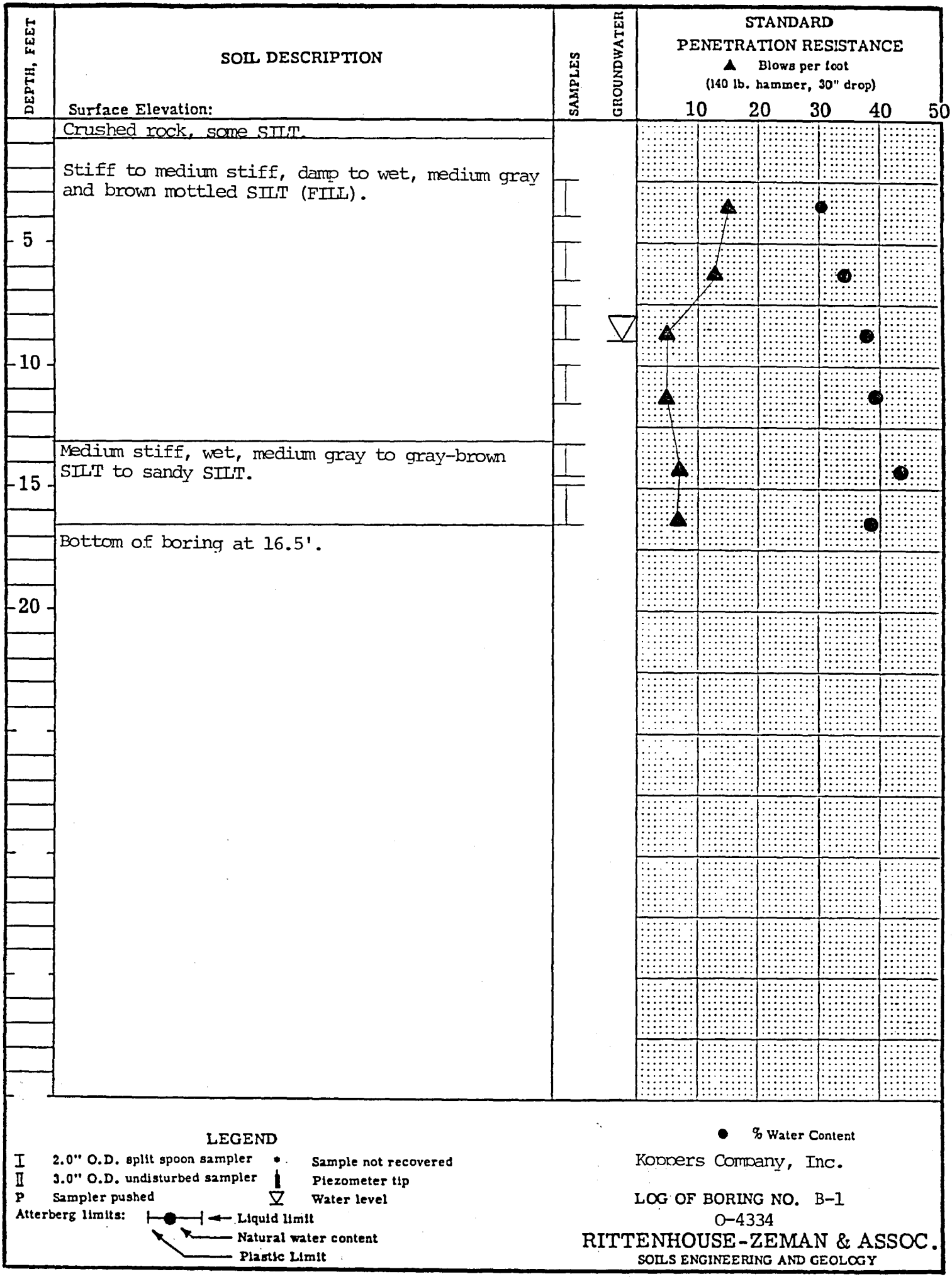
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical Consultants
8050 S.W. Cirrus Drive
Beaverton, Oregon 97005

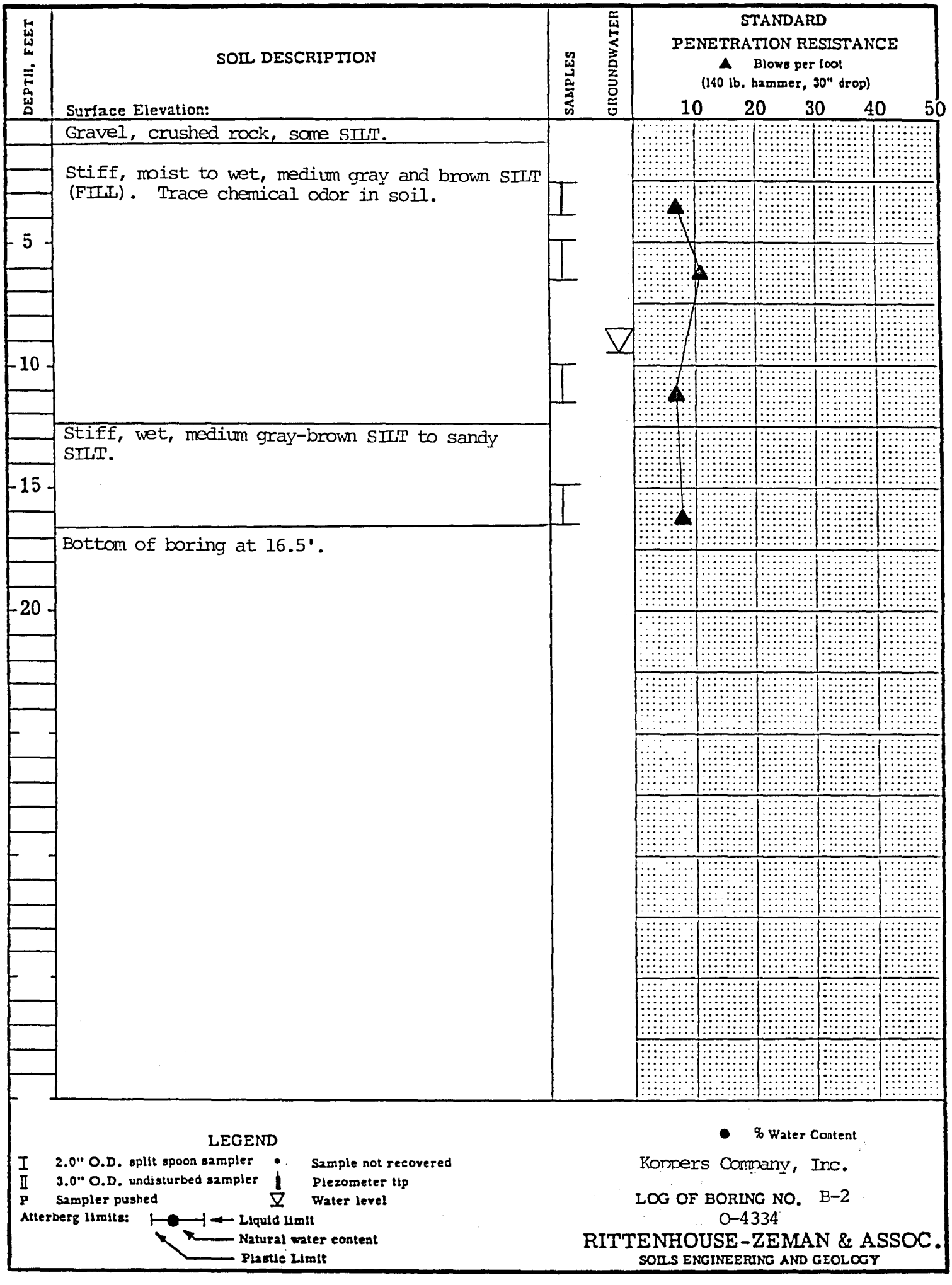
RZA

KOPPERS CHEMICAL

SITE PLAN PLATE 1

W.O. O-4334
By SA
Date APRIL 1987
Scale NTS


DEPTH, FEET
SOIL DESCRIPTION
Surface Elevation:
SAMPLES
GROUNDWATER
STANDARD
PENETRATION RESISTANCE
▲ Blows per foot
(140 lb. hammer, 30" drop)
10
20
30
40
50
5
10
15
20
Crushed rock, some SILT.
Stiff to medium stiff, damp to wet, medium gray and brown mottled SILT (FILL).
Medium stiff, wet, medium gray to gray-brown SILT to sandy SILT.
Bottom of boring at 16.5'.
LEGEND
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Sample not recovered
Piezometer tip
Water level
Atterberg limits:
Liquid limit
Natural water content
Plastic Limit
● % Water Content
Koppers Company, Inc.
LOG OF BORING NO. B-1
O-4334
RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY


DEPTH, FEET
SOIL DESCRIPTION
Surface Elevation:
SAMPLES
GROUNDWATER
STANDARD
PENETRATION RESISTANCE
▲ Blows per foot
(140 lb. hammer, 30" drop)
10
20
30
40
50
Gravel, crushed rock, some SILT.
Stiff, moist to wet, medium gray and brown SILT (FILL). Trace chemical odor in soil.
Stiff, wet, medium gray-brown SILT to sandy SILT.
Bottom of boring at 16.5'.
5
10
15
20
LEGEND
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Sample not recovered
Piezometer tip
Water level
Atterberg limits:
Liquid limit
Natural water content
Plastic Limit
● % Water Content
Koppers Company, Inc.
LOG OF BORING NO. B-2
O-4334
RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003118

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel railroad ballast.			
	Stiff, damp to wet, medium gray and gray-brown SILT (FILL). Some organics present.			
5				
10			▽	
	Stiff, wet, medium brown, medium gray, sandy SILTS, silty SANDS.			
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit

● % Water Content

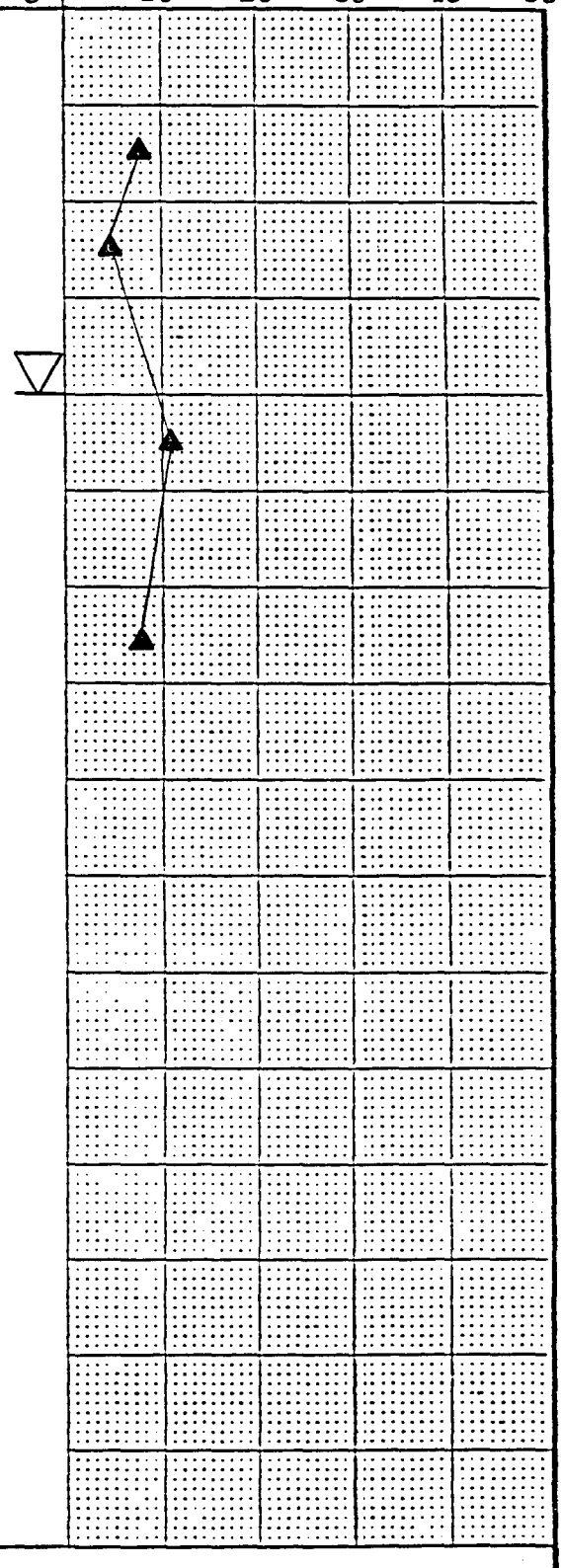
Koppers Company, Inc.

LOG OF BORING NO. B-3
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003119

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel ballast, some organic SILTS.			
5	Stiff, moist to wet, medium gray, medium brown SILT (FILL). Wood debris between 5-10'. Voids of about 1' encountered at 7.0'.			
10				
15	Stiff, wet, medium brown mottled SILT and sandy SILT.			
20	Bottom of boring at 16.5'.			



LEGEND

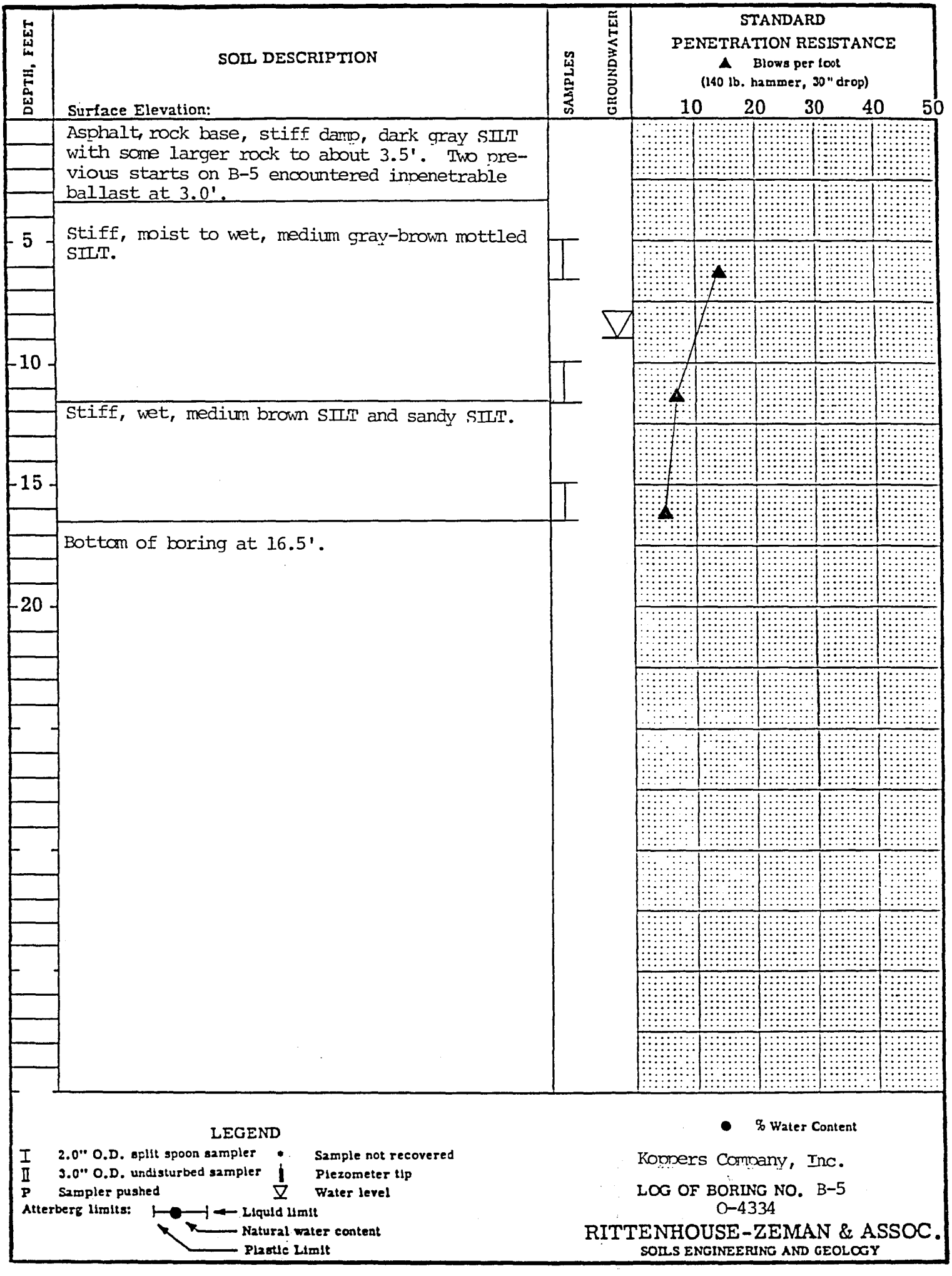
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Atterberg limits: Liquid limit; Natural water content; Plastic Limit
• Sample not recovered
Piezometer tip
Water level
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-4
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003120


DEPTH, FEET
SOIL DESCRIPTION
Surface Elevation:
SAMPLES
GROUNDWATER
STANDARD
PENETRATION RESISTANCE
▲ Blows per foot
(140 lb. hammer, 30" drop)
10 20 30 40 50
Asphalt, rock base, stiff damp, dark gray SILT with some larger rock to about 3.5'. Two previous starts on B-5 encountered inpenetrable ballast at 3.0'.
5
Stiff, moist to wet, medium gray-brown mottled SILT.
10
Stiff, wet, medium brown SILT and sandy SILT.
15
Bottom of boring at 16.5'.
20
LEGEND
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Sample not recovered
Piezometer tip
Water level
Atterberg limits:
Liquid limit
Natural water content
Plastic Limit
● % Water Content
Koppers Company, Inc.
LOG OF BORING NO. B-5
O-4334
RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003121

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravels. Below 1.5' dark gray SILT with some gravels.			
5	Medium stiff to stiff, wet, medium gray and brown mottled SILT, sandy SILT.		▽	
10				
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit

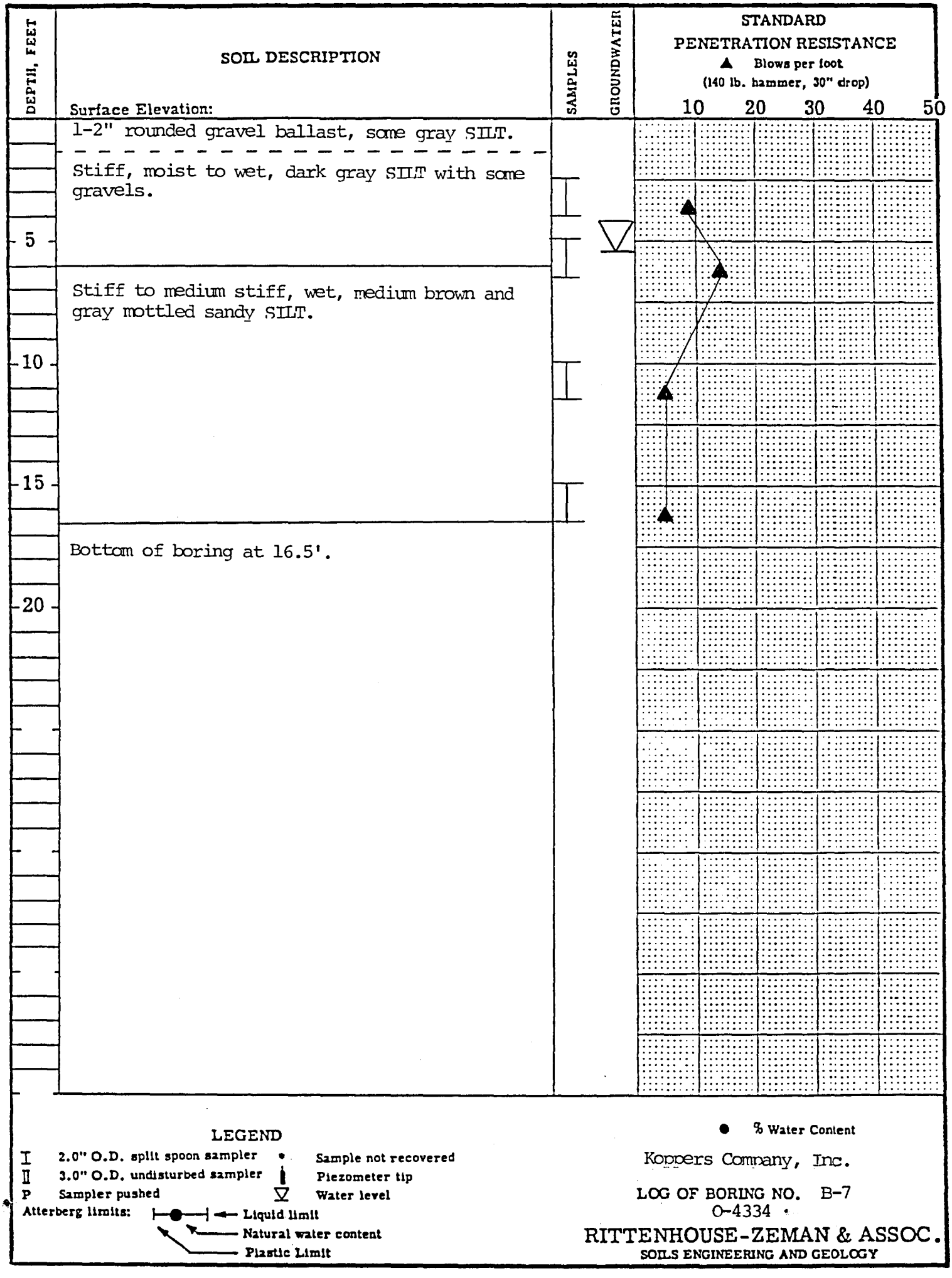
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-6
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003122


DEPTH, FEET
SOIL DESCRIPTION
Surface Elevation:
SAMPLES
GROUNDWATER
STANDARD
PENETRATION RESISTANCE
▲ Blows per foot
(140 lb. hammer, 30" drop)
10 20 30 40 50
1-2" rounded gravel ballast, some gray SILT.
Stiff, moist to wet, dark gray SILT with some gravels.
Stiff to medium stiff, wet, medium brown and gray mottled sandy SILT.
Bottom of boring at 16.5'.
5
10
15
20
LEGEND
I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Sample not recovered
Piezometer tip
Water level
Atterberg limits:
Liquid limit
Natural water content
Plastic Limit
● % Water Content
Koppers Company, Inc.
LOG OF BORING NO. B-7
O-4334
RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003123

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel ballast some dark gray SILT.			
	Medium stiff, damp, dark gray organic clayey SILT with some rock to 3.5'.			
5	Stiff, damp to wet, gray-brown-rust mottled SILT, sandy SILT, some lenses of sand. Cleaner sand lenses contain chemical residue. Oil product appears to float on ground water.		▽	
10				
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-8
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003124

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	1-2" rounded gravel railroad ballast some black SILT.			
	Medium stiff, moist to wet, dark gray, black sandy SILT. Some gravels. Petroleum product saturated below 3.5'.		▽	
5				
	Stiff, wet, medium gray sandy SILT. Oily substance visible on all samples and auguer flights.			
10				
15				
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Atterberg limits: ⊢●⊣ ← Liquid limit; Natural water content; Plastic Limit
• Sample not recovered
Piezometer tip
▽ Water level
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-9
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003125

DEPTH, FEET	SOIL DESCRIPTION Surface Elevation:	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	1-2" rounded gravel ballast, some dark gray SILT some larger diced rock present below 1.5'.			
5	Stiff, wet, dark gray and brown SILT and gray silty SAND.		▽	
	Petroleum product visible on samples and auger flights below about 3.5'.			
10		I		▲
15		I		▲
	Bottom of boring at 16.5'.			
20				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-10

O-4334

RITTENHOUSE-ZEMAN & ASSOC.

SOILS ENGINEERING AND GEOLOGY

NWT 003126

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	1-2" rounded gravel ballast with some dark gray to black sandy SILT matrix, some larger diced rock present below 1.5'.			
	Loose, wet, silver gray, oily, silty SAND (FILL) Petroleum/creosote odor. Ground water at 4'.		▽	
5	Soft, wet, black organic SILT, some roots (TOPSOIL).	I		Water sample obtained after drilling at 3.8' depth.
	Medium stiff to stiff, moist to wet, greenish-brown to dark gray SILT to sandy SILT.			
	Note: Oily sheen and slight petroleum/creosote odor noted on samples.	I		
15		I		
	End of boring at 16.5'.			
20				
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: Liquid limit, Natural water content, Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-11

O-4334

RITTENHOUSE-ZEMAN & ASSOC.

SOILS ENGINEERING AND GEOLOGY

NWT 003127

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	1-1 1/2" rounded gravel ballast			
	2" rounded to diced gravel ballast with silty sandy matrix. Ground water encountered at 3'.		▽	
5	Soft, wet, gray-black (with silver gray sheen) oily organic SILT. Petroleum/creosote odor (FILL?).	I		
	Stiff, moist, mottled greenish-gray with brown SILT, some sand.			
	Note: Creosote odor and oily sheen on samples.			
10		I		▲
15		I		
	End of boring at 16.5'.			
20				
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
Atterberg limits: ⊢●⊣ Liquid limit; Natural water content; Plastic Limit
• Sample not recovered
Piezometer tip
▽ Water level
● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-12
O-4334

RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	2" rounded river-run gravel ballast with sandy silt matrix. 2" diced reject rock noted to 2'.			
	Moist to wet, black, oily, silty fine to medium SAND. Petroleum/creosote odor (FILL). Water table encountered at 3.5'.		▽	
5	Stiff to medium stiff, wet to moist, mottled dark gray and brown SILT to sandy SILT.	I		▲
	Note: Creosote odor and oily sheen on samples.			
10				
15		I		▲
	Bottom of boring at 16.5'.			
20				
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
* Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit; Natural water content; Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-13

O-4334

RITTENHOUSE-ZEMAN & ASSOC.

SOILS ENGINEERING AND GEOLOGY

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	2" rounded (river-run) gravel ballast with oily black silty matrix to 2" diced rock ballast. Water table encountered at 3.5'.		▽	
5	Wet, black to silver-gray oily, silty fine to medium SAND (FILL). Creosote odor.	I		
	Medium stiff, moist to very moist, mottled greenish-gray with brown SILT to sandy SILT.			
	Note: Oily splotches or seams evident in sandy lenses of samples and petroleum/creosote odor.			
10		I		▲
15		I		▲
20		I		▲
	Bottom of boring at 21.5'.			
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

Koppers Company, Inc.

LOG OF BORING NO. B-14

O-4334

RITTENHOUSE-ZEMAN & ASSOC.

SOILS ENGINEERING AND GEOLOGY

NWT 003130

DEPTH, FEET	SOIL DESCRIPTION	SAMPLES	GROUNDWATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot (140 lb. hammer, 30" drop) 10 20 30 40 50
	Surface Elevation:			
	1-2" rounded river-run gravel ballast with oily black, sandy SILT.			
	4" diced rock ballast with oily black, fine to medium SAND (FILL).			
5	Bottom of boring at 3.5' due to inpenetrable conditions caused by large ballast clast size and caving conditions. Note: Four attempts to penetrate ballast in this area were unsuccessful.			
10				
15				
20				
25				
30				
35				
40				

LEGEND

I 2.0" O.D. split spoon sampler
II 3.0" O.D. undisturbed sampler
P Sampler pushed
• Sample not recovered
Piezometer tip
▽ Water level
Atterberg limits: ⊢●⊣ Liquid limit
Natural water content
Plastic Limit

● % Water Content

Koppers Company, Inc.
LOG OF BORING NO. B-15
O-4334
RITTENHOUSE-ZEMAN & ASSOC.
SOILS ENGINEERING AND GEOLOGY

NWT 003131

NW-S-general

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

Interoffice Correspondence

To	Distribution	From	S. Hartley
Location	Various	Location	K-1928
Subject	Exception Reporting	Date	November 1, 1988

J. Nash
J. Oxford
J. P. Johnson
K. Fitzgerald
R. J. Morris
S. Tuggle
W. Swearingen

In response to the RCRA self inspection checklists which you have sent in, the one deficiency that appeared consistently was lack of an exception reporting procedure. this exception reporting procedure is to be utilized when a hazardous waste manifest is not received back from the disposal company within 35 days. Please review this procedure to become familiar with it. This may be asked for during a RCRA inspection.

As always, if you have any questions, please call at x2374.

Suzanne Hartley

Suzanne Hartley

SH/mrw

CC: L. F. Flaherty

PROCEDURE FOR EXCEPTION REPORTING

This procedure is to be used when a copy of a hazardous waste manifest is not received with a signature within 35 days of when shipment was accepted by the inital transporter.

After 35 Days

1. Place a call to both the transporter and the designated disposal facility to determine the status of the hazardous waste. (To ensure consistent documentation, utilize the enclosed form).

At 45 Days

2. An official report consisting of the following must be submitted to the EPA Regional Administrator and your state, both listed below, within 45 days of acceptance by initial transporter.

a) A legible copy of the mainfest in question.

b) A cover letter signed by the generator explaining the steps taken to remedy the situation and the results thereof.

c) A legible copy of the enclosed form.

Oregon DEQ
811 SW 6th Avenue
Portland, OR 97204
Attn: Edna Mays

Robie G. Russel
Regional Administrator, Region X
1200 Sixth Avenue
Seattle, WA 98101

DOCUMENTATION OF EXCEPTION REPORTING INQUIRIES

Caller's Name _____ Date _____ Time _____

Transportation Company _____

Address _____

Telephone ( )_____

Individual Contacted _____

Title/Position _____

Response: _____

_____

_____

_____

Disposal Company _____

Address _____

Telephone ( )_____

Individual Contacted _____

Title/Position_____

Response: _____

_____

_____

NW-S-1

KOPPERS

Interoffice Correspondence

To L. F. Flaherty

Location K-1750

Subject Visit to Northwest Terminal

From J. M. Nash

Location Chicago Plant

Date August 28, 1986

On August 20-21, 1986, John Nash visited Koppers Company Northwest Terminal operation in Portland, Oregon to conduct an environmental review.

With the present operations, the appearance of the facility is acceptable. The 55 gallon drums and 5 gallon pails of scrap oil and grease (some of the containers are in poor physical condition) that belong to Koppers or other companies working on the property could present a problem. The clean-up of all this material was discussed with Mr. Oxford.

The major problems, both physical and financial, are removal and disposal of tank residues and the drain area clean-up. The tanks that should be cleaned are 1, 2, 101, 28 and 42. Tanks 28 and 42 should be dismantled after cleaning.

Other items reviewed are as follows:

1. Storm Water Handling

   Being held in surge tanks and analyzed before being discharged to Willimette River.

2. Fire Protection System

   Operates off city water supply pressure. Three new hydrants have been installed.

3. Contingency Spill Plan

4. Right to Know Training

   The manual has to be updated with the latest Material Safety Data Sheets.

5. Disposal of Creosote Waste and Unused Asbestos Insulation

   The actual disposal of both materials took place earlier in August. The importance of maintaining the records and manifests of such items was stressed.

6. Problem of Soil Contamination in Adjacent Property

   Letter coming from Oregon Department of Environmental Quality (DEQ) requesting action in clean-up. This letter will be sent to all parties involved.

John M. Nash

JMN/pk

cc: F. M. Spinola
J. Dern K-901
J. Oxford - Portland

NW-S-1

CHEM-SECURITY SYSTEMS, INC.
CSSI
200 S.W. Market Street, Suite 925 • Portland, Oregon 97201 • (503) 223-1912

RECEIVED
JUL 27 1987
Environmental Resources

June 30, 1987

Mr. Richard Ireland
Koppers Company, Inc.
7540 N.W. St. Helens Rd.
Portland, Oregon 97229

Re: Waste Profile Sheet (s): # D23753 Expires: 8-29-87

Dear Mr. Ireland:

As part of our periodic reexamination of waste received at the Arlington Facility, we need your help in order to recertify the Waste Profile Sheet(s) listed above. Please complete the steps below:

1. Complete the Recertification Profile Enclosed:

   Enclosed is a copy of your original Waste Profile and a blank Recertification Profile Sheet with the same number as the original. Please look over the old copy making changes where necessary, then complete the new form for the waste as it currently is.

   a. Please note any changes to the old profile on the Recert profile. In Section B of the old profile "odor" information is now required.

   b. To Section B of the Recert profile add the following information from Sections F and G of the existing profile: Proper shipping Name; Hazard Class; ID #; R.Q. value; and EPA and/or State Codes.

   c. Make sure that all blanks are completed. Failure to complete a section may result in delays in waste acceptance.

2. Unless the waste stream is profiled as a "Special Miscellaneous Waste" and requires no sample. Please obtain a 1-quart representative sample of the waste and complete the enclosed Certification of Representative Sample.

3. Send a copy of the existing profile, the Recertification form, a sample and the Certification of Representative Sample directly to the Arlington Facility. You can ship via UPS if the package is marked Lab Sample. To the Portland Sales office send a copy of the Recert profile only.

JUL 6

The recertification process must be completed before the profile expiration date to ensure uninterrupted acceptance of the waste stream.

Please call me if you have any questions.

Sincerely,

CHEM-SECURITY SYSTEMS, INC.

Sherin Bennette RJ

Sherin Bennette
Customer Service Representative

SB:rj

Enclosures: Copy of Current Profile
Recertification Blank Profile
Certification of Representative Sample

To: Jordon Dunn

NW-S-1

Koppers Company, Inc., Organic Materials Group
7540 N.W. St. Helens Road, Portland, OR 97229
Telephone 503-286-3681

KOPPERS

June 17, 1986

Chem-Security Systems Inc.
% Cheryl Saylea
Star Toute
Arlington, Or. 97812

Dear Cheryl:

This letter is to inform you that the D.O.T. Proper Shipping name referred to on our Waste Profile Sheet #D23758 is incorrect. The proper shipping name is Hazardous Waste, Solid, N.O.S. ORM-E NA-9189.

All waste sent to your facility for handling from our facility will be classified under the above shipping name.

Thank You,

John A. Oxford
Plant Manager
Koppers Company INc.

RECEIVED
JUN 23 1986
Environmental Resources

NW-S-1

CHEM-SECURITY SYSTEMS, INC.
P.O. Box 1269 • Portland, Oregon 97207-1269 • (503) 223-1912
CSSI

cc: J Uyfnd
Sent 1-29-86

RECEIVED
NOV 26 1985
Environmental Resources

November 20, 1985

Jordan M. Dern
Manager Environmental Reg. Program
Koppers Company, Inc.
901 Koppers Building
Pittsburg, Pennsylvania 15219

Re: Waste Profile Number D23758 (copy attached)

Dear Mr. Dern:

Confirming our conversation of today's date, regarding the referenced profile sheet, phenolics would be up to 10,000 ppm and should be so indicated in Section C and E of the profile. The phenolics are all allkylated phenols. There are no halogenated phenols in the material.

Sincerely,

CHEM-SECURITY SYSTEMS, INC.

William Van Dyke
District Sales Manager

WVD:lh
Enclosure

Waste Management, Inc.

GENERATOR'S WASTE MATERIAL

TSDR D23758

A GENERAL INFORMATION

GENERATOR NAME: Koppers Co Inc
TRANSPORTER: to be determined
FACILITY ADDRESS: 7540 N.W. Saint Helens Rd
Portland Oregon 97229
TRANSPORTER PHONE:
GENERATOR USEPA I.D. ORD027734359
GENERATOR STATE I.D.
TECHNICAL CONTACT: Jordan M. Dern
TITLE: Mgr, Env Reg. Program
PHONE: 412-227-2207
NAME OF WASTE: Creosote
PROCESS GENERATING WASTE: terminal operations

B PHYSICAL CHARACTERISTICS OF WASTE

COLOR: brown-black

ODOR: ☐ NONE ☒ MILD ☐ STRONG
DESCRIBE: Creosote

PHYSICAL STATE @ 70°F: ☐ SOLID ☒ SEMI-SOLID ☐ LIQUID ☐ POWDER

LAYERS: ☐ MULTILAYERED ☐ BI-LAYERED ☒ SINGLE PHASED

FREE LIQUIDS: ☐ YES ☒ NO
VOLUME: %

pH: ☐ <2 ☐ 2-4 ☐ 4.1-6.9 ☒ 7 ☐ 7.1-10 ☐ 10.1-12.5 ☐ >12.5 ☐ EXACT ☐ N/A

SPECIFIC GRAVITY: ☐ <.8 ☐ .8-1.0 ☒ 1.1-1.2 ☐ EXACT ☐ 1.3-1.4 ☐ 1.5-1.7 ☐ >1.7

FLASH POINT: ☐ <70°F ☐ 70°F-100°F ☐ 101°F-139°F ☐ 140°F-200°F ☒ >200°F ☐ NO FLASH ☐ EXACT ☒ CLOSED CUP ☐ OPEN CUP

C CHEMICAL COMPOSITION (TOTALS MUST ADD TO 100%)

Creosote	30-100 %
coal tar	0-0080 %
Soil	0-80 %
	%
	%
	%
	%
	%
	%
	%

D METALS ☒ TOTAL (PPM) ☐ EPA EXTRACTION PROCEDURE (mg/L)

ARSENIC (As)	0.72	SELENIUM (Se)	0.11
BARIUM (Ba)	2.2	SILVER (Ag)	0.13
CADMIUM (Cd)	0.09	COPPER (Cu)	2.8
CHROMIUM (Cr)	0.43	NICKEL (Ni)	24
MERCURY (Hg)	<0.005	ZINC (Zn)	20
LEAD (Pb)	0.19	THALLIUM (Th)	
CHROMIUM-HEX (Cr+6)			

E OTHER COMPONENTS - TOTAL (PPM)

CYANIDES	none	PCB'S	no
SULFIDES	2 mg/L	PHENOLICS	yes

F SHIPPING INFORMATION

D.O.T. HAZARDOUS MATERIAL? ☒ YES ☐ NO
PROPER SHIPPING NAME: Creosote, coal tar
HAZARD CLASS: Combustible I.D. NO. NA 1993 R.Q.
METHOD OF SHIPMENT: ☐ BULK LIQUID ☒ BULK SOLID ☐ DRUM (TYPE/SIZE)
ANTICIPATED VOLUME: 3,000 TONS/YR as needed CUBIC YARDS ☐ OTHER
PER: ☐ ONE TIME ☐ WEEK ☐ MONTH ☐ QUARTER ☑ YEAR ☐

G HAZARDOUS CHARACTERISTICS

REACTIVITY: ☒ NONE ☐ PYROPHORIC ☐ SHOCK SENSITIVE ☐ EXPLOSIVE ☐ WATER REACTIVE ☐ OTHER

RECEIVED MAY 22 1985

OTHER HAZARDOUS CHARACTERISTICS: ☒ NONE ☐ RADIOACTIVE ☐ ETIOLOGICAL ☐ PESTICIDE MANUFACTURING WASTE ☐ OTHER

USEPA HAZARDOUS WASTE? ☒ YES ☐ NO
USEPA HAZARDOUS CODE(S): U051
STATE HAZARDOUS WASTE? ☐ YES ☒ NO
STATE CODE(S): not total phenols, but some components are hazardous

H SPECIAL HANDLING INFORMATION

Fumes from heating are irritating to SKIN, eyes & respiratory tract
photosensitization can occur

☐ ADDITIONAL PAGE(S) ATTACHED

I HEREBY CERTIFY THAT ALL INFORMATION SUBMITTED IN THIS AND ALL ATTACHED DOCUMENTS IS COMPLETE AND ACCURATE, AND THAT ALL KNOWN OR SUSPECTED HAZARDS HAVE BEEN DISCLOSED.

AUTHORIZED SIGNATURE	TITLE	DATE
Jordan M Dern	Mgr. Env. Regulatory Program	2/4/15

 ©1983 WASTE MANAGEMENT, INC.

FINAL

(DO NOT USE) (1-5)

FORM A: GENERAL FACILITY INFORMATION

Company Name: Koppers Company, Inc.
Division/Subsidiary Organic Materials Group
Facility Name: Northwest Terminal

Address: 7540 N W. St. St. Helens Road
No. Street

Portland, Oregon 97229
City State Zip Code

Name of Person Completing Form: Paul W. Guth

Position: Plant Superintendent

Phone Number: (503) 286-3681

1. Year Facility Opened 19 66 (10-11)

2. Primary SIC Code 2818 (12-15)

3. Estimate the total amounts of process wastes (excluding wastes sold for use) generated by this facility during 1978: No waste generated in 1968. USE ONLY TONS IF POSSIBLE - right justify response

thousand gallons ..... (16-24)

hundred tons ..... (25-32)

thousand cubic yards ..... (33-41)

4. Estimate (in whole percents) how these process wastes generated in 1978 were disposed of:

in landfill ..... (42-44)

in pit/pond/lagoon ..... (45-47)

in deep well ..... (48-50)

incinerated ..... (51-53)

reprocessed/recycled ..... (54-56)

evaporated ..... (57-59)

unknown ..... (60-62)

other (Specify_____)..... (63-65)

5. What is the total number of known sites (including disposal on the property where this facility is located as one site) that have been used for the disposal of process wastes from this facility since 1950? 2 (66-68)

COMPLETE ONE FORM "B" FOR EACH OF THE SITES

6. Have any of the process wastes generated at this facility been hauled (removed) from this facility for disposal? (Yes=1; no=2) 2 (69)

IF YES, COMPLETE FORM "C"

7. Do you know the disposal site locations of all of the process waste hauled from your facility since 1950? (Yes=1; no=2) 1 (70)

IF NO, COMPLETE ONE FORM "D" FOR EACH FIRM OR CONTRACTOR WHO TOOK WASTE TO AN UNKNOWN LOCATION

8. Specify the earliest year represented by information from company or facility records supplied on this and other forms 19 66 (71-72)

9. Specify the earliest year represented by information from employee knowledge supplied on this and other forms 19 66 (73-74)

FORM B: DISPOSAL SITE INFORMATION (DO NOT USE)

COMPLETE THIS FORM FOR EVERY SITE (INCLUDING THE LOCATION OF THIS FACILITY AS ONE SITE) USED FOR THE DISPOSAL OF PROCESS WASTES GENERATED BY THIS FACILITY SINCE 1950.

Company Name: Koppers Company, Inc. Division/Subsidiary: Organic Materials Group

Facility Name: Northwest Terminal

Name of Site: Gasco Property

Address of Site: 7540 N.W. St. Helens Road
no. street

Portland, Oregon 97229
city state zip code

Name of Owner (while used by facility): N.W. Natural Gas Co.

Address: 7540 N.W. St. Helens Road
no. street

Portland, Oregon 97229
city state zip code

Current Owner (if different from above): _____

Address: _____
no. street

_____
city state zip code

1. Location (1= the property on which facility is located; 2= off-site)..... [1] (10)
2. Ownership at time of use (1= company ownership; 2=private but not company ownership) 3=public ownership 9=don't know) ..... [2] (11)
3. Current status (1= closed; 2= still in use; 9=don't know) ..... [1] (12)
   IF CLOSED, specify year closed ..... 19[6 6] (13-14)
4. Year first used for process waste from this facility ..... 19[6 6] (15-16)
5. Year last used for process waste from this facility (enter "79" if still in use) ..... 19[6 6] (17-18)
6. Total amount of process waste from this facility disposed at site: See note.
   USE TONS ONLY IF POSSIBLE: Right justify response
   thousand gallons ..... [ ] (19-26)
   hundred tons ..... [ ] [ ] [ ] [ ] [1 0] (27-33)
   thousand cubic yards ..... [ ] [ ] [ ] [ ] [ ] [ ] [ ] (34-41)
7. Specify type(s) of disposal method(s) used at site and whether method is still in use (1=currently in use; 2=no longer in use; 3=never used; 9=don't know)

landfill, mono industrial waste	[3]	(42)
landfill, mixed industrial waste	[2]	(43)
landfill, drummed waste	[3]	(44)
landfill, municipal refuse co-disposed	[3]	(45)
pits/ponds/lagoons	[1]	(46)
deep well injection	[3]	(47)
land farming	[3]	(48)
incineration	[3]	(49)
treatment (eg. neutralizing)	[3]	(50)
reprocessing/recycling	[3]	(51)
other (specify) _____	[3]	(52)

8. Users of this site (1=this facility; 2=this facility and other company facilities only; 3=this company and others; 9=don't know) ..... [3] (53)

LIST NAMES AND ADDRESSES OF OTHER KNOWN USERS BELOW

N.W. Natural Gas Co.
7900 N.W St. Helens Rd.
Portland, Oregon 97229

Note: Most of the waste was the result of excavation during plant construction.

FINAL

FORM B: DISPOSAL SITE INFORMATION

(1-8) (DO NOT USE)

COMPLETE THIS FORM FOR EVERY SITE (INCLUDING THE LOCATION OF THIS FACILITY AS ONE SITE) USED FOR THE DISPOSAL OF PROCESS WASTES GENERATED BY THIS FACILITY SINCE 1950.

Company Name: Koppers Company, Inc. Division/Subsidiary: Organic Materials Group
Facility Name: Northwest Terminal
Name of Site: Gasco Property
Address of Site: 7540 N.W. St. Helens Rd.
no. street

Portland, Oregon 97229
city state zip code

Name of Owner (while used by facility): N.W. Natural Gas Co.
Address: 7900 N.W. St. Helens Road
no. street

Portland, Oregon 97229
city state zip code

Current Owner (if different from above):
Address:
no. street

city state zip code

1. Location (1= the property on which facility is located; 2= off-site) 1 (10)
2. Ownership at time of use (1= company ownership; 2=private but not company ownership) 3=public ownership 9=don't know) 2 (11)
3. Current status (1= closed; 2= still in use; 9=don't know) 1 (12)
   IF CLOSED, specify year closed 19 7 8 (13-14)
4. Year first used for process waste from this facility 19 6 7 (15-16)
5. Year last used for process waste from this facility (enter "79" if still in use) 19 7 8 (17-18)
6. Total amount of process waste from this facility disposed at site:
   USE TONS ONLY IF POSSIBLE: Right justify response
   thousand gallons ..... (19-26)
   hundred tons 1 (27-33)
   thousand cubic yards ..... (34-41)
7. Specify type(s) of disposal method(s) used at site and whether method is still in use (1=currently in use; 2=no longer in use; 3=never used; 9=don't know)

landfill, mono industrial waste	1	(42)
landfill, mixed industrial waste	9	(43)
landfill, drummed waste	9	(44)
landfill, municipal refuse co-disposed	9	(45)
pits/ponds/lagoons	9	(46)
deep well injection	9	(47)
land farming	9	(48)
incineration	9	(49)
treatment (eg. neutralizing)	9	(50)
reprocessing/recycling	9	(51)
other (specify)	9	(52)

8. Users of this site (1=this facility; 2=this facility and other company facilities only; 3=this company and others; 9=don't know) 1 (53)

LIST NAMES AND ADDRESSES OF OTHER KNOWN USERS BELOW

FORM B CONTINUED ON SECOND PAGE

1 (80)

(1-8)
(DO NOT USE)

Company Name: Koppers Company, Inc.
Division/Subsidiary: Organic Materials Group
Facility Name: Northwest Terminal

Site Name: Gasco Property

9. Components (or characteristics) of process waste from this facility disposed at site: (1=present in waste; 2=not present in waste; 9=don't know)

FILL IN EVERY BLOCK SPACE

Acid solutions, with pH<3	2	(10)
pickling liquor	2	(11)
metal plating waste	2	(12)
circuit etchings	2	(13)
inorganic acid manufacture	2	(14)
organic acid manufacture	2	(15)
Base solutions, with pH>12	2	(16)
caustic soda manufacture	2	(17)
nylon and similar polymer generation	2	(18)
scrubber residual	2	(19)
Heavy metals & trace metals (bonded organically & inorganically)	2	(20)
arsenic, selenium, antimony	2	(21)
mercury	2	(22)
iron, manganese, magnesium	2	(23)
zinc, cadmium, copper, chromium (trivalent)	2	(24)
chromium (hexavalent)	2	(25)
lead	2	(26)
Radioactive residues, >50pico curies/gram	2	(27)
uranium residuals & residuals for UF_6 recycling	2	(28)
lathanide series elements and rare earth salts	2	(29)
phosphate slag	2	(30)
thorium	2	(31)
radium	2	(32)
other alpha, beta & gamma emitters	2	(33)
Organics (See over.)	1	(34)
insecticides & intermediates	2	(35)
herbicides & intermediates	2	(36)
fungicides & intermediates	1	(37)
rodenticides & intermediates	2	(38)
halogenated aliphatics	2	(39)
halogenated aromatics	2	(40)
acrylates & latex emulsions	2	(41)
PCB/PBB's	2	(42)
amides, amines, imides	2	(43)
plastizers	2	(44)
resins	2	(45)
elastomers	2	(46)
solvents polar (except water)	2	(47)
carbontetrachloride	2	(48)
trichloroethylene	2	(49)
other solvents nonpolar	2	(50)
solvents halogenated aliphatic	2	(51)
solvents halogenated aromatic	2	(52)
oils and oil sludges	1	(53)
esters and ethers	2	(54)
alcohols	2	(55)
ketones & aldehydes	2	(56)
dioxins	2	(57)
Inorganics	2	(58)
salts	2	(59)
mercaptans	2	(60)
Misc	2	(61)
pharmaceutical wastes	2	(62)
paints & pigments	2	(63)
catalysts (eg. vanadium, platinum, palladium)	2	(64)
asbestos	2	(65)
shock sensitive wastes (eg. nitrated toluenes)	2	(66)
air water reactive wastes (eg. P_4, aluminum chloride)	2	(67)
wastes with flash point below 100° F	2	(68)

One of the principle raw materials for the Northwest Terminal plant of Koppers Company, Organic Materials Group is coal tar and its derivatives. Coal tar is made up of the following constituents:

Naptha
Tar Aicds (phenols, cresol, etc.)
Tar Bases (pyridine picoline, etc.)
Naphthalene
Phenanthrene and Anthracene
Higher Boiling Oils
Pitch

Any or all of the above may be included in the plant waste.

(DO NOT USE)

Company Name: Koppers Company, Inc.
Division/Subsidiary: Organic Materials Group
Facility Name: Northwest Terminal

Site Name: Gasco Property

9. Components (or characteristics) of process waste from this facility disposed at site: (1=present in waste; 2=not present in waste; 9=don't know)

FILL IN EVERY BLOCK SPACE

Acid solutions, with pH<3	2	(10)
pickling liquor	2	(11)
metal plating waste	2	(12)
circuit etchings	2	(13)
inorganic acid manufacture	2	(14)
organic acid manufacture	2	(15)
Base solutions, with pH>12	2	(16)
caustic soda manufacture	2	(17)
nylon and similar polymer generation	2	(18)
scrubber residual	2	(19)
Heavy metals & trace metals (bonded organically & inorganically)	2	(20)
arsenic, selenium, antimony	2	(21)
mercury	2	(22)
iron, manganese, magnesium	2	(23)
zinc, cadmium, copper, chromium (trivalent)	2	(24)
chromium (hexavalent)	2	(25)
lead	2	(26)
Radioactive residues, >50pico curies/gram	2	(27)
uranium residuals & residuals for UF_6 recycling	2	(28)
lathanide series elements and rare earth salts	2	(29)
phosphate slag	2	(30)
thorium	2	(31)
radium	2	(32)
other alpha, beta & gamma emitters	2	(33)
Organics (See over.)	1	(34)
insecticides & intermediates	2	(35)
herbicides & intermediates	2	(36)
fungicides & intermediates (See over.)	1	(37)
rodenticides & intermediates	2	(38)
halogenated aliphatics	2	(39)
halogenated aromatics	2	(40)
acrylates & latex emulsions	2	(41)
PCB/PBB's	2	(42)
amides, amines, imides	2	(43)
plastizers	2	(44)
resins	2	(45)
elastomers	2	(46)
solvents polar (except water)	2	(47)
carbontetrachloride	2	(48)
trichloroethylene	2	(49)
other solvents nonpolar	2	(50)
solvents halogenated aliphatic	2	(51)
solvents halogenated aromatic	2	(52)
oils and oil sludges (See over.)	1	(53)
esters and ethers	2	(54)
alcohols	2	(55)
ketones & aldehydes	2	(56)
dioxins	2	(57)
Inorganics	2	(58)
salts	2	(59)
mercaptans	2	(60)
Misc	2	(61)
pharmaceutical wastes	2	(62)
paints & pigments	2	(63)
catalysts (eg. vanadium, platinum, palladium)	2	(64)
asbestos	2	(65)
shock sensitive wastes (eg. nitrated toluenes)	2	(66)
air water reactive wastes (eg. P_4, aluminum chloride)	2	(67)
wastes with flash point below 100° F	2	(68)

One of the principal raw materials for the Northwest Terminal plant of Koppers Company, Organic Materials Group, is coal tar and its derivatives. Coal tar is made up of the following constituents:

Naptha
Tar Acids (phenols, cresol, etc.)
Tar Bases (pyridine picoline, etc.)
Naphthalene
Phenanthrene and Anthracene
Higher Boiling Oils
Pitch

Any or all of the above may be included in the plant waste.

Uncontrolled (abandoned) Hazardous Waste Disposal Site Survey
--Progress Report--
--February 15, 1980--

--Department of Environmental Quality--

KOPPERS COMPANY, INC.
7540 N. W. ST. HELENS RD.
PORTLAND, OREGON 97229

cc KRC
CPB
DPM
RJO'6
JMC 2/25

Background:

Over the last several years, a number of incidents have been reported across the U.S.A. of sites containing large quantities of uncontrolled hazardous wastes (in drums, barrels, pits, ponds, lagoons, or landfills) posing threats to human health or the environment (Love Canal in New York, Valley of the Drums in Kentucky, etc.). With the exception of Oregon's experience with the abandonment of pesticide manufacturing wastes at Alkali Lake (60 miles north at Lakeview) in the early 1970's, it has been assumed that no such sites exist in Oregon. This assumption is in large part due to Oregon's low level of industrialization; particularly in the petroleum and chemical industries. One also needs to recognize that prior to the late 1960's much industrial waste was discharged to Oregon's public waters, rather than handled in some other manner such as land disposal or treatment for reuse.

Study Outline:

During discussions with Region X staff of the Environmental Protection Agency (EPA) last summer, however, it was concluded that some effort should be devoted toward verifying this assumption. Having to rely primarily on existing manpower to conduct such a study, the following limited efforts were initiated:

1. Internal staff discussions designed to identify defunct and existing industries or disposal sites likely to have generated, or which currently generate or contain hazardous wastes.

2. Selection and evaluation of candidate companies within specific industrial categories based on raw materials used, manufactoring processes employed and likely wastes produced. (During these initial discussions, three major industrial categories were eliminated from further consideration - (1) sawmill and plywood plants; (2) pulp and paper plants; and (3) urea and phenol formaldehyde resin plants - because of the Department's historical knowledge of these industrial categories and the Department's continuing program of routine air, water and/or solid waste compliance inspections).

3. Mailing a questionnaire to each of Oregon's 36 County Health Departments soliciting information from their staffs and/or files on uncontrolled (abandoned) hazardous waste disposal sites (of the seven responses received, no new uncontrolled hazardous waste sites were brought to our attention).

4. Nuclear wastes as a class of wastes were not considered since responsiblity for their proper management rest with the state Health Division, Radiation Control Section, not DEQ.

Results:

This effort has resulted in 38 sites being ivestigated. Appendix 1 contains specific information on 36 investigations including a description of the type of investigation conducted (i.e., file search, site visit, sample collection). Two investigations documented incorrect initial information (Pope & Talbot, Wauna turned out to be Koppers, Wauna: Giles Lake industrial area was combined with Doane Lake Study Area). Please note when reviewing Appendix I that information on quantities was included only when we could document said information.

As stated earlier, the purpose of this survey was to locate any large quantities of uncontrolled hazardous wastes that may pose a threat to public health or to the environment. To date, the survey has not uncovered any large quantities of uncontrolled hazardous wastes that present an immediate threat to public health or the environment. What the survey is providing us with, however, is an opportunity to review some existing and historical disposal practices in the light of today's knowledge of hazardous materials/hazardous wastes. As the survey and evaluations continue, the practical effect will be to improve current management/ disposal practices to avoid any long-term threat to public health or the environment that may otherwise have been allowed to occur.

In evaluating each of the 36 sites, the Department considered things such as types and quantities of waste; degree of hazard; degree of persistence; type of disposal method (i.e., disposal well, evaporative lagoon, disposal trench, landfill, etc.); soils and geology; surface and groundwater conditions; proximity to people and surrounding land uses (existing or potential). Based on the above criteria, the following conclusions have been reached:

Thirteen (13) investigations have been closed. No imminent health hazard or environmental problem identified.

Dant and Russell, North Plains
Chevron Asphalt, Portland
Pacific Carbide and Alloy Co., Portland
Hercules, Inc., Portland
J. H. Baxter and Co., Eugene
L. D. MacFarland, Eugene
John C. Taylor Lumber Sales, Sheridan
Union Pacific Railroad, Hermiston
Koppers, Wauna (Plant Closed)
McCormick and Baxter, Portland
American Timber and Trading Company, Portland (Plant Closed)
Alkali Lake Disposal Site, Lakeview (Site Closed)
J. H. Baxter and Company, The Dalles

Three (3) investigations have been closed but permanent record of information needed. No imminent health hazard or environmental problem identified.

Charles H. Lilly Company, Portland
Nurnburg Scientific Company, Portland (Plant Closed)
Wah Chang, Albany (Old Albany Landfill (Site Closed)
Coffin Butte Landfill and Roche Road Landfill were used for disposal of pyrophoric (self-igniting) materials from Wah-Chang.

Two (2) investigations have been closed but may be reviewed by EPA as part of an industry-wide evaluation.

Martin Marietta Aluminum Company, The Dalles
Chempro, Portland

Two (2) investigations have been closed but current on-site waste management practices need improvement.

Perma Post Products, Hillsboro
Allied Plating, Portland

Nine (9) investigations are continuing. Insufficient information, including lack of existing monitoring data, preclude a final judgement being made.

Nuway Oil, Portland
Widing Transportation, Portland
Stauffer Chemical, Portland
United Chrome Products, Inc., Corvallis
Miller Products, Portland (Plant Closed)
Tektronix, Beaverton
St. Johns Landfill, Portland
Ace Galvanizing, Portland
Crosby and Overton, Portland

Seven (7) investigations are continuing as part of the Doane Lake Area Study.

Rhone-Ponulenc, Portland
Pennwalt, Portland
N L Industries, Portland
Koppers Company, Portland
Industrial Air Products, Portland
Gilmore Steel, Portland
Northwest Natural Gas, Portland

While this study was underway, the House Subcommittee on Oversight and Investigations, (chaired by Bob Eckhardt) published a survey of process waste (all waste-both hazardous and non-hazardous) disposal practices by the 53 largest domestic chemical companies. A review of that report determined that of the 21 sites listed, we were already investigating seven (7). These seven are:

Chempro, Portland
St. Johns Landfill, Portland (listed twice)
Crosby and Overton, Portland
Gasco (Northwest Natural Gas Property), Portland
Hercules, Inc., Portland
Stauffer, Portland (two sites listed)
Pennwalt, Portland.

Of the remaining 11 sites (1 chemical waste disposal site, 5 municipal landfills, 1 fertilizer plant and 4 resin manufacturing plants), the Department was familiar with all eleven and determined no additional effort was needed. With 3 sites being listed twice, the Department was, therefore, either investigating or knowledgeable of all 21 sites listed in the Eckhardt report.

Future Action:

As described, it can be seen that a 100 percent survey/study of Oregon industries or landfills was not completed. Additional effort either on-going or being discussed by DEQ/EPA-Region X are:

1. EPA-Region X has contracted with Battelle Northwest to independently contact companies in Oregon to review their historical disposal practices. The Battelle Study is expected to be released in mid-March, 1980. Depending on information generated, additional DEQ/EPA work may be needed.

2. A public information campaign to solicit information directly from the public regarding knowledge they may have of uncontrolled or abandoned hazardous waste sites will be undertaken by EPA.

3. Additional site visits of all companies within certain industrial categories will be undertaken where earlier only candidate companies were investigated. Industrial categories have not been identified at this time.

4. A progress report to describe additional finding is planned for mid-June, 1980.

For further information, please contact Richard Reiter or Fred Bromfeld at 229-5913 (or 1-800-452-7213 toll free). If anyone has information on a site or sites they believe the Department should be investigating, please contact Richard Reiter or Fred Bromfeld at the numbers above or DEQ, Box 1760, Portland, Oregon 97207.

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APPENDIX I Page 1 of 23

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Burt & Russell, Inc. 7755 W. Hillcrest North Plains, OR Wood Processing	on-site	sludge lagoon	pentachlorophenol; creosote	organic toxic materials	1. No accumulation of uncontrolled chemicals identified. 2. Sludge currently being hauled to Arlington	no imminent health hazard or environmental problems identified. Uncontrolled site investigation closed	File search; telephone contact
	off-site (St.Johns Landfill)	Municipal landfill	Industrial sludge (10 truckloads)				
	off-site (Arlington Disposal Site)	chemical waste landfill	industrial sludge (periodic shipments as needed)				
Chevron Asphalt Inc. Standard Oil of California 6211 NW Front Portland, OR Asphalt manufacturer	off-site (St. Johns landfill)	municipal landfill	process sludge contaminated with oil	industrial sludge contaminated with oil	1. No accumulation of uncontrolled chemicals on-site 2. Process sludge disposed of at St. Johns landfill	No imminent health hazard of environmental problems identified. Uncontrolled site investigation closed	file search; telephone conversation

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Pacific Carbide & Alloys Co. 9901 N. Hurst Av. Portland, OR Manufacturer of quicklime and calcium carbide	on-site	settling pond	calcium hydrate; calcium carbonate; carbon (10,000 cubic yards per year)	corrosive	1. No accumulation of uncontrolled chemicals on-site. 2. Waste lime sludges are marketed as agricultural soil conditioners.	no imminent health hazard or environmental problems identified. Uncontrolled site investigation closed	file search; site visit; sample collection
Hercules, Inc. 3366 NW Yeon Ave. Portland, OR Manufacturer of coating agents for paper industry	off-site	contract with Crosby & Overton	settleable solids containing resins, fatty acids, wax, emulsifiers and starch	industrial sludge	1. No accumulation of uncontrolled chemicals on-site. 2. Industrial sludge disposed of off-site via contract with Crosby & Overton	1. No imminent health hazard or environmental problem identified on-site. 2. Uncontrolled site investigation closed. 3. Evaluation of Crosby and Overton facilities scheduled.	file search; telephone conversation

NWT 003154

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
J.H. Baxter & Co. BS Baxter Street Eugene, OR	off-site Bethel-Danebo landfill	municipal landfill	pentachlorophenol; creosote (up to 25,000 gallons per year)	organic toxic materials	1. No accumulations of uncontrolled chemical on-site 2. Wastes currently disposed of at Arlington Disposal Site	1.No imminent health hazard or environmental problems identified on-site. 2. Uncontrolled site investigation closed. 3. Followup on Bethel-Danebo landfill and Roto-Rooter contract scheduled.	personal interview
	off-site Arlington disposal site	chemical waste landfill					
wood preserving	off-site	contract with Roto-Rooter or other pumper					
L.D. McFarland Company Highway 99N Eugene, OR wood preserving	on-site	land spreading for dust control	pentachlorophenol contaminated sludge (3000 gallons per year)	organic toxic material	1. No accumulation of uncontrolled chemicals on-site. 2. Negligible levels of pentachlorophenol in soil and surface runoff water	1. No imminent hazard or environmental problems identified. 2. Uncontrolled site investigation closed.	personal interview; site visit; sample collection

NWT 003155

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
John C. Taylor Lumber Sales, Inc. (dba Sheridan Pressure Treated Lumber) Rock Creek Rd. off of Business Hwy 18 Sheridan, OR wood preserving	on-site	storage in drums	pentachlorophenol; creosote; arsenic, copper and ammonium salts (15-55 gallon drums per year)	organic and inorganic toxic materials	1. No accumulation of uncontrolled chemicals on-site. 2. Drummed waste shipped to Arlington disposal site or firm in Kelso, Washington.	1. No imminent health hazard or environmental problems identified on-site. 2. Uncontrolled site investigation closed. 3. Reference to Kelso, Washington site referred to EPA.	file search; telephone conversation
	off-site Arlington disposal site	chemical waste landfill	same as above				
	off-site Kelso, Washington	unknown at this time	same as above				
J.H. Baxter & Co. East of City The Dalles, OR wood preserving	on-site	accidental spillage	pentachlorophenol; creosote	organic toxic materials	no accumulation of uncontrolled chemical on-site	No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed.	file search; telephone conversation

NWT 003156

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Union Pacific Railroad Hinkle Rail Yards Hermiston, OR railroad switching and maintenance yard	on-site	land spreading	waste oil (80,000 gallons per year)	industrial sludge	1. No accumulation of uncontrolled chemicals on-site. 2. Land spreading of waste oil discontinued in 1976.	No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed	file search; site visit
Koppers, Wauna Wauna, OR wood preserving	on-site	liquid waste recycled	pentachlorophenol; creosote; copper, chrome, and arsenic salts	organic and inorganic toxic materials	1. Plant permanently closed in 1962. 2. Former site now part of Crown Zellerbach paper mill site.	1. No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed.	telephone conversation

NWT 003157

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
McCormick and Baxter 6900 N. Edgewater Street Portland, OR wood preserving	off-site Arlington disposal site	chemical waste landfill	pentachlorophenol; creosote; copper, chrome and salts; boric acid; isopropyl ether liquid butane	organic and inorganic toxic materials	1. No accumulations of uncontrolled chemicals on-site. 2. Wastes currently hauled to Arlington disposal site.	No health hazard or environmental problem identified. Uncontrolled site investigation closed	file search; telephone conversation
American Timber & Trading Co. (Now Columbia Woodworking Co.) 6450 NE Columbia Blvd. Portland, OR wood preserving	on-site	disposal wells	pentachlorophenol; creosote; copper, chrome and arsenic salts	organic and inorganic toxic materials	1. Plant operated from 1962-1970. 2. Plant disposed of liquid wastes into disposal wells. 3. Former plant site now under warehouse with an address of 6510 Columbia Blvd.	1. No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed	telephone conversation; site visit; sample collection

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Alkali Lake 60 miles north of Lakeview, OR chemical waste landfill	on-site	shallow disposal trenches	residue from the manufacture of pesticides, primarily 2,4-D. (23,500-55 gallon drums)	organic toxic materials	1. All drums were buried under state supervision in Nov-Dec. 1976. 2. Twice a year monitoring on and off-site is continuing by DEQ. 3. Site currently owned by State of Oregon. 4. This was a one time corrective disposal program.	1. Twice a year monitoring on and off-site continuing. 2. No imminent health hazard or environmental problem identified at this time. Uncontrolled site investigation closed.	file search

NWT 003159

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Charles H. Lilly Co. (Miller Products Co.) 7737 N.E. Killingsworth Portland, OR formulator of commercial fertilizer and pesticide products	on-site	concrete pit with approximate dimensions of 150' by 6' by 5' deep	DDT powder (2000 lbs) DDT liquid (200 gallons) miscellaneous quantities of chlordane, lindane, kelthane, etc. as they may have been mixed with DDT product	organic toxic materials	1. One time disposal as a result of the ban on DDT. 2. Department of Agriculture and Department of Environmental Quality had reviewed burial site in 1977. 3. Current pesticide contaminated wastes are hauled to Arlington disposal site.	1. Permanent record of one time disposal needs to be created. 2. No imminent health hazard or environmental problems identified. 3. Uncontrolled site investigation closed.	file search; telephone conversation
	off-site Arlington disposal site	chemical waste landfill	miscellaneous discontinued pesticide products (50,000 pounds)				

NWT 003160

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

...ess Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
...nberg Scien-...fic Company ...37 N. Williams ...rtland, OR ...stributor of ...ecratory ...emicals	on-site	filled in basement	fire damaged laboratory chemicals (unknown quantity of chemicals not salvageable)	miscellaneous acids; bases; oxidizers; flammables; cyanide	following major fire (1967) attempts were made to salvage as many chemicals as possible. Remainder of chemicals were buried in basement along with charred remains of building. Debris leveled & covered with dirt.	1. Permanent record of this information needs to be created. 2. No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed.	file search; telephone conversation; site visit

NWT 003161

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Teledyne Wah Chang Teledyne Industries, Inc. 1600 Old Salem Road Albany, OR manufacturer of non-ferrous metals	off-site Coffin Butte landfill off-site Roche Road landfill off-site Albany landfill off-site Arlington disposal site	municipal landfill demolition landfill municipal landfill (now closed) chemical waste landfill	stainless steel liners and furnace shield with adhering masses of zirconium and magnesium; zirconium fines; metal chlorides, chlorinator residues, filter residues and used carbo-column materials; flammable liquids	pyrophoric materials; reactive materials; flammable materials	1. No accumulation of uncontrolled chemicals on-site. 2. Pyrophoric, reactive and flammable material disposed of in several area landfills. 3. Excavation of previously disposed of material could result in spontaneous combustion or explosion.	1. Permanent record of off-site disposal information needs to be created. 2. No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed.	file search
Martin Marietta Aluminum Co. 3313 West 2nd The Dalles, OR manufacturer of aluminum	on-site	industrial landfill	potliners; carbon blocks; sludge from air scrubbers	industrial sludge	no accumulation of uncontrolled chemicals on-site	1. No health hazard or environmental problem identified on-site. 2. Uncontrolled site investigation closed. 3. The aluminum industry as an industrial category may receive a further evaluation by EPA	file search; telephone conversation

NWT 003162

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Chempro 11535 N. Force St Portland, OR	on-site	sludge lagoon	process sludge contaminated with oil	industrial sludge contaminated with oil	1. No accumulation of uncontrolled chemicals on-site 2. Oily sludge currently being hauled to Arlington disposal site	1. No imminent health hazard or environmental problems identified. 2. Reference to Pasco, Washington site referred to EPA for followup. 3. Uncontrolled site investigation closed. 4. The chemical reprocessing industry as an industrial category may receive further EPA review.	file search; telephone conversation
Reprocessor of waste oil	off-site (Pasco, Washington)	chemical waste landfill	oily sludge				
	off-site (Arlington disposal site)	chemical waste landfill	oily sludge				
Permapost Products Company 25600 SW Tualatin Valley Hwy Hillsboro, OR	on-site	short-term holding/recirculation lagoon and long-term storage/ evaporation lagoon	pentachlorophenol; creosote; copper, chrome and arsenic salts	organic and inorganic toxic materials	1. No accumulation of uncontrolled chemicals identified. 2. Violations of state water pollution control facilities permit occurring.	1. No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed. 2. Enforcement action being initiated to correct permit violations. 3. Reference to Vancouver, WA container recycling firm referred to EPA for followup	
wood preserving	off-site (Vancouver, Washington)	metal container recycling firm	metal containers that contained copper, chrome and arsenic salts				

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Allied Plating 8135 NE Union Portland, OR metal plating	on-site	evaporative/ seepage lagoon	cyanide; copper nickel; chrome; (up to 150 gallons per minute)	inorganic toxic materials	1. No accumulation of uncontrolled chemicals on-site. 2. Because of expanding production capacity of lagoon becoming inadequate. 3. Pretreatment and discharge to city sewer preferred disposal method.	1. No imminent health hazard or environmental problems identified. Uncontrolled site investigation closed. 2. Negotiations toward the installation of a pretreatment systems are ongoing. Following pretreatment discharge to sewer will occur	file search; telephone conversation; site visit

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Nuway Oil 7039 NE 46th Portland, OR rerefiner of used motor oil	on-site	settling lagoon	1. Clay sludge contaminated with oil (up to 70 tons per year) 2. acid sludge contaminated with oil (up to 90,000 gallons per year)	1. Industrial sludge contaminated with oil. 2. Corrosive material	1. No accumulation of uncontrolled chemicals on-site. 2. Clay sludge being disposed of on-site. 3. Acid sludge used for road base in Eastern Oregon and Washington. 4. Clay & acid sludges disposed of at St. Johns landfill.	1. Evaluation of clay sludge continuing to determine chemical contaminants. 2. Uncontrolled site investigation continuing.	file search; telephone conversation; site visit; sample collection
	off-site (St. Johns landfill)	municipal landfill	clay and acid sludges				
	off-site (miscellaneous holes-North Portland)	filling in of depressions in North Portland	clay sludge				
	off-site (Eastern Oregon and Washington)	Used for road base material	acid sludge				

NWT 003165

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Widing Transportation Co., Inc 10145 N. Portland Road Portland, OR - - - - - - - - - transporter of commodities including hazardous materials and hazardous wastes	on-site	6-cell aeration/ gravity settling basin and 4-acre settling pond	liquids and sludges from cleaning inside of bulk carrier transport trucks (50,000 gallons of water contaminated with urea and phenol formaldehyde glue resins, surfactants, oil, black liquor, & defoamer)	1. Organic and inorganic toxic materials 2. Sludges contaminated with oil. 3. Corrosive.	1. No accumulation of uncontrolled chemicals on-site. 2. Following pretreatment some contaminated sludge stored on-site. 3. Following pretreatment some contaminated sludges hauled to Arlington disposal site.	1. Evaluation of water and sediments in 4-acre settling pond continuing to determine chemical contaminants. 2. Uncontrolled site investigation continuing.	file search; telephone conversation; site visit; sample collection
	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -				
	off-site (Arlington disposal site)	chemical waste landfill	liquids and sludges as described above (periodic shipments as needed)				

NWT 003166

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Stauffer Chemical Corporation 4429 N. Suttle Rd. Portland, OR	on-site	settling pond	alum sludge (900 tons per year)	corrosive; organic toxic materials	1. No ground water contamination detected in on-site monitoring wells adjacent to oxidation lagoon 2. Pesticide contaminated wastes currently hauled to Wes-Con disposal site. 3. Alum sludge currently hauled to St. Johns landfill. 4. No good records exist relative to on-site chemical waste landfill.	1. Evaluation of on-site chemical waste landfill continuing. 2. Uncontrolled site investigation continuing.	file search; sample collections; site visit
	on-site	oxidation lagoon	pesticide contaminated wash water (2300 lbs per year)				
manufacturer of aluminum sulfate and formulator of commercial pesticide products	on-site	chemical waste landfill	pesticide contaminated liquids and solids (100-200 tons)				
	off-site St. Johns landfill	municipal landfill	alum sludge				
	off-site Wes-Con disposal site	chemical waste landfill	pesticide contaminated waste (20-30 tons per year)				

NWT 003167

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
United Chrome Products, Inc. Corvallis Airport Industrial Park Corvallis, OR	on-site	dry well	sludge containing chrome (1000 gallons per year)	inorganic toxic material	1. No accumulation of uncontrolled chemicals on-site. 2. Negligible amounts of chrome in surface runoff waters. 3. Sludge now hauled to Coffin Butte landfill	1. No imminent health hazard or environmental problems identified on or off site. 2. Further evaluation of on-site dry well planned. 3. Uncontrolled site investigation continuing.	file search; telephone conversation
metal plating	off-site Coffin Butte landfill	municipal landfill	same as above				
Miller Products Company Foot of SW Caruthers Portland, OR manufacturer of lime-sulfur and formulator of pesticides	on-site	settling pond	lime-sulfur sludge	corrosive industrial sludge	1. No accumulation of uncontrolled chemicals on-site. 2. Plant closed in 1960 at this location. 3. Land where plant was located is now part of freeway system.	1. No imminent health hazard or environmental problem identified. 2. Old aerial photos will be examined to pinpoint location of settling ponds. Uncontrolled site investigation continuing.	file search; site visit

NWT 003168

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Tektronics, Inc. NW Miliken Way Beaverton, OR electronics manufacturing	on-site	evaporation pond/landfill	zinc, cadmium; nickel; copper; chrome; (56,000 gallons of sludge per year)	inorganic toxic material	1. No accumulations of uncontrolled chemicals on-site 2. Two sites have been used for landfilling of industrial sludge containing heavy metals	Evaluation of environmental impacts of land filling continuing. Uncontrolled site investigation continuing	file search; site visit
St. Johns Landfill 9393 N. Columbia Blvd. Portland, OR	on-site	municipal landfill	5000-55 gallon drums of pesticide manufacturing residue Miscellaneous industrial solid waste, industria sludges and oily waste	organic and inorganic toxic materials	1. No accumulation of uncontrolled chemicals on-site 2. Besides household and commercial refuse, site has received miscellaneous industrial solid waste and industrial sludges over the years.	Additonal monitoring and testing of ground water scheduled to attempt detection of pesticide related contaminants. Uncontrolled site investigation continuing.	Industrial file searches; telephone contact; site visit; sample collection scheduled.

NWT 003169

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Ace Galvanizing 805 NW 14th Portland, OR	on-site	disposal well	liquid waste high in zinc & iron. Sludge containing zinc	inorganic toxic material	1. No accumulation of uncontrolled chemicals on-site. 2. Disposal well may have been used for disposal of waste water. 3. Land in Washington may have been used for land spreading of sludge containing zinc.	Evaluation of disposal well and identification of lands in Washington continuing. Uncontrolled site investigation continuing.	file search; site visit
metal plating	off-site farm land in Washington	land spreading					

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Crosby and Overton 5420 N. Lagoon Ave. Portland, OR Industrial tank cleaning and servicing	on-site	temporary storage in steel tanks	ship bilge water (oil-water mixture)	organic and inorganic toxic materials; liquids and sludges contaminated with oil; industrial sludges	1. No accumulation of uncontrolled chemicals on-site. 2. Temporary storage of oil-water mixtures at Tire Oil is practiced. 3. Direct hauling to recycle facilities or authorized disposal sites is practiced for most customer derived wastes.	1. No imminent health hazard or environmental problems identified. 2. Further evaluation of historical disposal practices/ sites continuing. Uncontrolled site investigation continuing.	site visit
	off-site recycle plants	recycling	varies by customer				
	off-site Arlington Disposal Site	chemical waste landfill	varies by customer				
	off-site St. Johns Landfill	municipal landfill	varies by customer				

NWT 003171

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Rhone-Poulenc (formerly Rhoddia or Chipman Chemical) 6200 NW St. Helens Road Portland, OR	on-site	Doane Lake	liquid wastes	organic toxic materials	1. No accumulation of uncontrolled chemicals on site. 2. One municipal landfill and three chemical waste landfill, have been disposal of manufacturing residues.	1. Evaluation continuing as part of Doane Lake area study. 2. Evaluation of St. Johns landfill scheduled. 3. Pasco, Washington reference referred to EPA for followup. 4. Twice a year monitoring of Alkali Lake con- continuing by DEQ	file search; personal interview; site visit; sample collection.
	off-site St. Johns landfill	municipal landfill	manufacturing residues (5000-55 gallon drums)				
manufacturer and formulator of pesticides	off-site Alkali Lake landfill	chemical waste landfill	manufacturing residues (23,500-55 gallon drums)				
	off-site Pasco, Washington	chemical waste landfill	manufacturing residues				
	off-site Arlington disposal	chemical waste landfill	manufacturing residues (200 tons per year)				

NWT 003172

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Pennwalt Chemical 6400 NW Front Av. Portland, OR	on-site	lagoons/landfill	brine purification sludge (1310 pounds per day)	inorganic toxic materials	1. No accumulation of uncontrolled chemical on-site 2. Some industrial sludge disposed of on-site. 3. Some industrial chemicals disposed of at Arlington disposal site.	Evaluation continuing as part of Doane Lake area study	file search; site visit; sample collection
Manufacturer of industrial chemicals - principally chlorine	off-site Arlington disposal site	chemical waste landfill	sodium arsenite; miscellaneous cleaning chemicals				
NL Industries 5009 NW 61st Av. Portland, OR	on-site	landfill	lead; zinc	inorganic toxic material	No accumulation of uncontrolled chemicals on-site	Evaluation continuing as part of Doane Lake area study	file search; site visit; sample collection
Secondary refining of lead and zinc							

NWT 003173

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Koppers Company 2864 NW St. Helens Road Portland, OR manufacturer of pitch and electrobinding products	on-site	landfill	creosote residuals; pitch; phenols; oil and grease	industrial solid waste and sludge	1. No accumulation of uncontrolled chemicals on-site	Evaluation continuing as part of Doane Lake study area	file search; telephone conversation
Industrial Air Products (Division of Liquid Air Inc.) 6600 NW Front Av. Portland, OR manufacturer of acetylene	on-site	landfill	10% lime slurry	corrosive	1. No accumulation of uncontrolled chemicals on-site. 2. Lime slurry currently held in temporary holding pond and reused.	Evaluation continuing as part of Doane Lake area study	file search; site visit; sample collection

NWT 003174

UNCONTROLLED (ABANDONED) HAZARDOUS WASTE DISPOSAL SITE SURVEY

Name/ Business Type	Disposal Site Location	Type of Disposal	Waste Type/ Waste Quantity	Type of Hazard(s)	Finding(s)	Current Status	Type of Investigation
Gilmore Steel 6161 NW 61st Ave. Portland, OR steel fabrication coating and engraving	on-site	landfill	rolling mill scale; melt furnace slag (7500 tons per year)	industrial solid waste	no accumulation of uncontrolled chemicals on-site	evaluation continuing as part of Doane Lake area study	file search; site visit; sample collection
Northwest Natural Gas St. Helens Road Portland, OR manufacturer of oil and gas from petroleum	on-site	landfill	tar bottoms; napthalenes	industrial sludges	1. Gasification plant ceased operation in early 1950's 2. No accumulation of uncontrolled chemicals on-site	Evaluation continuing as part of Doane Lake area study	personal interview; site vist; sample collection

NWT 003175

ROBERT W. STRAUB
GOVERNOR

Department of Environmental Quality

522 S.W. 5th AVENUE, P.O. BOX 1760, PORTLAND, OREGON 97207

November 20, 1978

Mr. Paul W. Guth, Superintendant
Koppers Company, Inc.
7540 N. W. St. Helens Road
Portland, OR 97229

Dear Mr. Guth:

The Department of Environmental Quality, with the concurrence of the Oregon State Legislature, is conducting a state-wide industrial/hazardous waste survey. This study will update previous surveys by the Department in 1972-73 and by the Federal EPA in 1975, and will provide information to implement Oregon's hazardous waste management program.

To aid the collection of information on plant wastes, we have partially completed the enclosed survey form based on data received from your company during the previous surveys. Please complete the form, correcting our information as necessary. Include specific information on all industrial wastes whether they are hauled away for final disposal, reclaimed for reuse, stored or disposed on plant property. However, do not include common trash, domestic garbage or wastewater permitted to be discharged to a municipal sewer or for which you have a wastewater discharge permit.

We will assume that our waste estimates are essentially accurate unless corrected by your written response. Within the next few weeks we will contact you by telephone to discuss the survey information.

The Department will keep strictly confidential all names and specific information obtained during the survey. However, as in the previous survey, a public report will be issued using generalized and composite data (probably grouped by County). We thank you for your cooperation in updating the information for our present use in implementing a waste management program.

Any questions regarding the survey may be directed to Tom Hartman at 229-5913.

Sincerely,

FSB

Fred S. Bromfeld, Supervisor
Hazardous Waste Section
Solid Waste Division

RECEIVED
NOV 27 1978
KOPPERS CO., INC.
TAR & CHEMICAL DIV.
PORTLAND, OREGON

TJH:mm
Enc. (1)

Contains Recycled Materials

DEQ-1

NWT 003176

STATE of OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

INDUSTRIAL WASTE SURVEY FORM - 1973

1. Company Name Koppers Co. Inc

2. Mailing Address 7540 N.W. St. Helens Road Portland 97229

3. Plant Address same

4. Contact Name/Title Plant Mgr.

5. Contact Telephone (area) 286-3681

6. Principal Activity at Plant ~~Coke oven tar distillation~~ ~~TAR DISTILLATION~~ TERMINAL PRODUCT DISTRIBUTION

7. SIC Number (4-digits) 2865

8. Number of Employees (Total & Production) ~~13~~ 17 total

9. NPDES Waste Discharge Permit Number Do we have discharges - why put them on this survey.

10. Federal Tax Identification Number (EIN) ?

USE A SEPARATE FORM FOR EACH PLANT

(continued on next page)

DEQ Industrial Wastes Survey Form (continued)

Company Name: Koppers Co

A. Waste Description (include any chemical analysis, concentrations and whether solid, liquid or sludge). HOUSE KEEPING CLEAN-UP!

① Earth saturated ~~with~~ from creosote and tar spills

② ~~Punctured barrels containing tar residue~~

BROKEN OR LEAKING Containers of product

B. Waste Generation Rate (indicate if in batches and frequency).

① 7 truckloads/yr (15 tons ea.)

1 ~~[illegible]~~

C. Method of Disposal (how packaged/transported/treated/disposal site).

① Stored onsite (approx 40 truckloads now stored) ② cleaned & hauled to scrap dealer

This material has been buried & covered over.

Land filled on site.

D. Production Process Generating the Waste.

This plant does ~~to~~

① Cleanup of spills in loading and unloading operations ② new material containers

Not have a process waste stream

E. Product and Production Rate. N/A - This site is a product distribution terminal.

Roofing pitch, ~~binding pitch~~ creosote ~~from 280,000 lbs/day coke tar~~

F. Comments.

~~This location is a terminal now~~

USE SEPARATE SHEET FOR EACH TYPE OF WASTE

PLEASE INCLUDE WASTES EXPECTED FROM PLANNED OPERATIONS

DEQ Industrial Wastes Survey Form (continued)

Company Name: _____

A. Waste Description (include any chemical analysis, concentrations and whether solid, liquid or sludge).

B. Waste Generation Rate (indicate if in batches and frequency).

C. Method of Disposal (how packaged/transported/treated/disposal site).

D. Production Process Generating the Waste.

E. Product and Production Rate.

F. Comments.

USE SEPARATE SHEET FOR EACH TYPE OF WASTE

PLEASE INCLUDE WASTES EXPECTED FROM PLANNED OPERATIONS

W-W-6

RECEIVED

AUG 31 1987

Environmental Resources

KOPPERS

Interoffice Correspondence

To LARRY FLAHERTY

From JOHN A OXFORD

Location K-1750

Location NORTHWEST PLANT

Subject DEQ INSPECTION

Date 8-28-87

LARRY, ATTACHED YOU WILL FIND A COPY OF THE DEPARTMENT OF ENVIRONMENTAL QUALITY INSPECTION FORM. THE PLANT WAS INSPECTED 8-12-87. THE INSPECTOR REVIEWED OUR N.P.D.E.S. REPORTS THAT WE FILE EACH MONTH WITH THE D.E.Q. HE ASKED HOW WE SAMPLE OUR TANKS OF WASTE WATER, WHO HAS CHAIN OF CUSTODY OF THE SAMPLES, HOW RESULTS OF SAMPLES ARE REPORTED BACK TO US BY COFFEY LABRATORY AND FINALLY OUR PROCEDURE FOR PUMPING THE WATER THRU THE OUTFALL TO THE WILLAMETTE RIVER. ALL OF MY ANSWERS SEEMED TO PLEASE HIM.

HE THEN ASKED IF WE HAD ANY HAZARDOUS WASTE ON SIGHT (WE DON'T). HE INQUIRED HOW WE HANDLE HAZARDOUS WASTES. I SHOWED HIM OUR MANIFESTS FOR PAST SHIPMENTS, HE ASKED HOW THE WASTE WAS GENERATED ETC.

HE THEN ASKED IF HE COULD TOUR THE PLANT. HE LOOKED AT THE WATER TANKS AND PUMPING SYSTEM, THE PENCIL PITCH STORAGE SHED, AND THE CLEANING OPERATION OF TANK #28. HE FOUND NOTHING WRONG AND COMPLIMENTED US ON THE RECORD KEEPING AND THE OPERATION OF THE PLANT.

REGARDS,

John

JOHN

CC: JORDAN DERN K-901
A. DOMANICO K-1750

K-5 REV. 2

DEPARTMENT OF ENVIRONMENTAL QUALITY
SOURCE INSPECTION FORM

☒ WQ ☐ SW ☐ AQ ☐ NC

COUNTY: Multnomah

SOURCE NAME: Koppers

SOURCE ADDRESS: 7540 NW St Helens Rd Portland 97210

OFFICIAL CONTACTED: John Oxford

TABLE A PARA	PREP. TIME	TRANS TIME	INSPECTION TIME	PAPER TIME

PERMIT NUMBER CO.	PERMIT NUMBER SOURCE	POINT	ACTION NO.	ACTION TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
MULT	3077J			7	8 12 87	8 12 87	X	

8 1
8 2
8 3
8 4

COMPLIANCE STATUS *(RESULT CODE)*

	IN COMP.	NOT IN COMPLIANCE	ON SCHEDULE
All permit conditions	☒		
Permit emission limits	R	A	I
Emission standards	S	B	J
Performance reqts.	T	C	K
Monitoring & Reporting	U	D	L
Open burning limits	V	E	M
Procedural Reqts.	W	F	N
Fugitive emissions	X	G	O
Other	Y	H	P

SOURCES IN VIOLATION & LIMITS VIOLATED

NONE

TREATMENT/PROCESS EQUIPMENT – ADDITIONAL REMARKS – OPERATING CONDITIONS

Surface drainage from a portion of the plant area is collected in tanks (four are used depending on volume needed). All runoff and some condensate from steam traps is held in the tanks then sampled. Once water quality is achieved, i.e., meets permit standards, the tanks are discharged through a pipe to an open drainage ditch edge of property. The drainage leads to a creek and to the Willamette River about 3/4 mi distant. The last discharge occurred on August 4, 1987. Tanks #1 and #2 were pumped. These tanks were sampled on July 27, 1987. Sampling is performed by cutting valves. A maximum of 15,000 gallons was discharged over two days.

Koppers water sampling has not recorded a permit violation for the past three years.

Site was inspected - no violations or unusual activity noted.

Dennis Adamczyk Aug 17 1987
SIGNATURE OF INSPECTOR AND DATE

John A Oxford 8-12-87
SIGNATURE OF PERSON INTERVIEWED AND DATE

DEQ/RO-101 (4/80)

SOURCE COPY

NWT 003181

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOURCE INSPECTION FORM

☒ WQ ☐ SW ☐ AQ ☐ NC

COUNTY: MULT

SOURCE NAME: KOPPERS CO. INC

SOURCE ADDRESS: 7540 N.W. ST HELENS RD. PORTLAND

OFFICIAL CONTACTED: HENRY RANSI

FILE 47430

TABLE B PARA.	REQ. TIME	TRANS TIME	INSPECTION TIME	PAPER TIME
	0.5	0.6		

PERMIT NUMBER CO.	PERMIT NUMBER SOURCE	POINT	ACTION NO.	ACTION TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
	3077J		7			10 11 82	X	F04

8 1

8 2

8 3

8 4

COMPLIANCE STATUS *(RESULT CODE)*

	IN COMP.	NOT IN COMPLIANCE	ON SCHEDULE
All permit conditions	☒		
Permit emission limits	R	A	I
Emission standards	S	B	J
Performance reqts.	T	C	K
Monitoring & Reporting	U	D	L
Open burning limits	V	E	M
Procedural Reqts.	W	F	N
Fugitive emissions	X	G	O
Other	Y	H	P

TREATMENT/PROCESS EQUIPMENT – ADDITIONAL REMARKS – OPERATING CONDITIONS

CONDENSATE RETURN LINE IN TANK FARM LEAKS AND SHOULD BE REPAIRED AND ELEVATED.

OUTFALL NO. 2 NOW CONNECTED TO OUTFALL NO. 1

NO FLOW AT OUTFALL NO. 1 DURING INSPECTION

SOURCES IN VIOLATION & LIMITS VIOLATED

Henry M. Ransi
SIGNATURE OF INSPECTOR AND DATE

SOURCE COPY

Henry S. Ransi
SIGNATURE OF PERSON INTERVIEWED AND DATE

DEQ/RO-101 (4/80)

NWT 003182

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOURCE INSPECTION FORM

- [x] WQ
- [ ] SW
- [ ] AQ
- [ ] NC

COUNTY: MULT

SOURCE NAME: KOPPERS CO. INC

SOURCE ADDRESS: 7540 NW ST HELENS RD. PORTLAND

OFFICIAL CONTACTED: HENRY RASSI

FILE 47430

	3077J		7			10 11 82	X	F04

				0	8	0	6						

8 1

8 2

8 3

8 4

COMPLIANCE STATUS *(RESULT CODE)*

	IN COMP.	NOT IN COMPLIANCE	ON SCHEDULE
All permit conditions	[X]		
Permit emission limits	R	A	I
Emission standards	S	B	J
Performance reqts.	T	C	K
Monitoring & Reporting	U	D	L
Open burning limits	V	E	M
Procedural Reqts.	W	F	N
Fugitive emissions	X	G	O
Other	Y	H	P

SOURCES IN VIOLATION & LIMITS VIOLATED

OPERATING CONDITIONS

CONDENSATE RETURN LINE IN TANK FARM LEAKS AND SHOULD BE REPAIRED AND ELEVATED.

OUTFALL NO. 2 NOW CONNECTED TO OUTFALL NO. 1

NO FLOW AT OUTFALL NO. 1 DURING INSPECTION

Henry M. [illegible]

SIGNATURE OF INSPECTOR AND DATE

SOURCE COPY

Henry E. Rassi

SIGNATURE OF PERSON INTERVIEWED AND DATE

DEQ/RO-101 (4/80)

DEPARTMENT OF ENVIRONMENTAL QUALITY
SOURCE INSPECTION FORM

☐ WQ
☐ SW
☒ AQ
☐ NC

COUNTY: Mult.
SOURCE NAME: Koppers Co.
OFFICIAL CONTACTED: Henry Rassi

SOURCE ADDRESS: 7540 NW St Helens Rd

TABLE A PARA	PREP. TIME	TRANS TIME	INSPECTION TIME	PAPER TIME
	2	3	5	2

PERMIT NUMBER CO.	PERMIT NUMBER SOURCE	POINT	ACTION NO.	ACTION	ACTION TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
26	2930	001	99	7	07		12 07 81	Q	B03

81 1-Boiler 75% Opacity
82
83
84

COMPLIANCE STATUS (RESULT CODE)

	IN COMP.	NOT IN COMPLIANCE	ON SCHEDULE
All permit conditions	~~Q~~		
Permit emission limits	R	A	I
Emission standards	S	B	J
Performance reqts.	T	C	K
Monitoring & Reporting	U	D	L
Open burning limits	V	E	M
Procedural Reqts.	W	F	N
Fugitive emissions	X	G	O
Other	Y	H	P

TREATMENT/PROCESS EQUIPMENT — ADDITIONAL REMARKS — OPERATING CONDITIONS

Producing only CREOSOTE
100,000 gal Mo. Production
7 employees

SOURCES IN VIOLATION & LIMITS VIOLATED

[signature] 12/7/81
SIGNATURE OF INSPECTOR AND DATE

SOURCE COPY

SIGNATURE OF PERSON INTERVIEWED AND DATE

DEQ/RO-101 (4/80)

NWT 003184

DEPARTMENT OF ENVIRONMENTAL QUALITY
SOURCE INSPECTION FORM

☐ WQ
☒ SW
☐ AQ
☐ NC

COUNTY: Mult.
SOURCE NAME: Koppers Co
OFFICIAL CONTACTED: Henry Rassin
SOURCE ADDRESS: 7540 NW St Helens Rd

TABLE A PARA	PREP. TIME	TRANS TIME	INSPECTION TIME	PAPER TIME
	.2	.3	.5	.1

PERMIT NUMBER CO.	PERMIT NUMBER SOURCE	POINT	ACTION NO.	ACTION TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
26	30775	000	04 7	07		12 07 81	QX	B03

8 1
8 2
8 3
8 4

COMPLIANCE STATUS *(RESULT CODE)*

	IN COMP.	NOT IN COMPLIANCE	ON SCHEDULE
All permit conditions	~~Q~~		
Permit emission limits	R	A	I
Emission standards	S	B	J
Performance reqts.	T	C	K
Monitoring & Reporting	U	D	L
Open burning limits	V	E	M
Procedural Reqts.	W	F	N
Fugitive emissions	X	G	O
Other	Y	H	P

SOURCES IN VIOLATION & LIMITS VIOLATED

TREATMENT/PROCESS EQUIPMENT — ADDITIONAL REMARKS — OPERATING CONDITIONS

Water sample taken of
001 Discharge 47°F 7.8 PH

002 Discharge Discontinued

Water around plant clean

[signature] 12/7/81
SIGNATURE OF INSPECTOR AND DATE

SOURCE COPY

Henry S. Rassin
SIGNATURE OF PERSON INTERVIEWED AND DATE

DEQ/RO-101 (4/80)

NWT 003185

KOPPERS COMPANY, INC.
7540 N. W. ST. HELENS RD.
PORTLAND, OREGON 97229

DEPARTMENT OF ENVIRONMENTAL QUALITY
SOURCE INSPECTION FORM

COUNTY: Mult

SOURCE NAME: Koppers

SOURCE ADDRESS: 7540 N.W. St Helens Rd.

OFFICIAL CONTACTED: Paul Guth

TABLE A PARA	PREP. TIME	TRANS TIME	INSPECTION TIME	PAPER TIME
	05	05	10	05

PERMIT NUMBER CO.	SOURCE	POINT	ACTION NO.		TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
	0775	001	04	7	49	1 15 80	1 15 80	01	808

81 phenols (1240) 0.24 0.7 @ 0.2 ← LAB
2 TEMP 7°C
3 pH < 6.5

POINT	ACTION NO.		TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
002	04	7	49	1 15 80	1 15 80	01	808

SOURCE DESCRIPTION: Runoff H_2O

81 pH < 6.5
2 TEMP 7°C
3

POINT	ACTION NO.		TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
		7					

SOURCE DESCRIPTION:

81
2
3

POINT	ACTION NO.		TYPE	DATE SCHEDULED MO. DAY YR.	DATE ACHIEVED MO. DAY YR.	RESULT	INSPEC. NO.
		7					

SOURCE DESCRIPTION:

81
2
3

COMPLIANCE STATUS: ☑ IN ☐ OUT

Some coal tar pitch buried on site / ~~[illegible]~~
Only H_2O d/c runoff water & boiler H_2O d/c
Sanitary to city of Ptld. Still utilize separator - use as part of continuing
All tanks concrete bermed - TANKS IN USE bottom normal dirt - some ground H_2O d/c
TANKS - not in use - bottom concrete lined -

Daniel Berger 1-15-80
SIGNATURE OF INSPECTOR AND DATE

Paul Guth 1-15-80
SIGNATURE OF PERSON INTERVIEWED AND DATE

File: NW-W Inspections

DEQ/RO-101 (2/79)

SOURCE COPY

NWT 003186

U. S. ENVIRONMENTAL PROTECTION AGENCY

NOTICE OF INSPECTION

ADDRESS (EPA Regional Office)
Region X
1200 Sixth St.
Seattle Wa.

DATE: 8-24-78 | HOUR: A.M. P.M.

NAME OF INDIVIDUAL	TITLE
PAUL W. GUTH	PLANT SUPERINTENDENT
FIRM NAME	**FIRM ADDRESS** (Number, Street, City, State and Zip Code)
KOPPERS CO. INC.	7540 NW. ST. HELENS Rd Portland, OR 97229
SIGNATURE OF EPA EMPLOYEE	**TITLE**
[signature]	Agronomist

REASON FOR INSPECTION

☒ FOR THE PURPOSE OF INSPECTING AND OBTAINING SAMPLES OF ANY PESTICIDES OR DEVICES PACKAGED, LABELED, AND RELEASED FOR SHIPMENT, AND SAMPLES OF ANY CONTAINERS OR LABELING FOR SUCH PESTICIDES OR DEVICES, IN PLACES WHERE PESTICIDES OR DEVICES ARE HELD FOR DISTRIBUTION OR SALE *(Sec. 9(a) and 12(a)(2)(B))*.

☐ FOR THE PURPOSE OF INSPECTING AND OBTAINING COPIES OF THOSE RECORDS SPECIFIED IN SECTION 8 AND 40 CFR PART 169. *(Sec. 8 and 12(a)(2)(B))*.

VIOLATION SUSPECTED:

None

Section 8, 9(a) and 12(a)(2)(B) of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended *(7 U.S.C. 136 et seq.)* are quoted on the reverse of this form.

EPA Form 3540-2 (Rev. 3-77) PREVIOUS EDITION MAY BE USED UNTIL SUPPLY IS EXHAUSTED

Original- ESTABLISHMENT COPY
1- SAMPLE RECORD COPY
2- REGION COPY
3- INPECTOR'S COPY

NWT 003187

SEC. 8. BOOKS AND RECORDS.

(a) Requirements.—The Administrator may prescribe regulations requiring producers to maintain such records with respect to their operations and the pesticides and devices produced as he determines are necessary for the effective enforcement of this Act. No records required under this subsection shall extend to financial data, sales data other than shipment data, pricing data, personnel data, and research data *(other than data relating to registered pesticides or to a pesticide for which an application for registration has been filed).*

(b) Inspection. — For the purposes of enforcing the provisions of this Act, any producer, distributor, carrier, dealer, or any other person who sells or offers for sale, delivers or offers for delivery any pesticide or device subject to this Act, shall, upon request of any officer or employee of the Environmental Protection Agency or of any State or political subdivision, duly designated by the Administrator, furnish or permit such person at all reasonable times to have access to, and to copy: (1) all records showing the delivery, movement, or holding of such pesticide or device, including the quantity, the date of shipment and receipt, and the name of the consignor and consignee; or (2) in the event of the inability of any person to produce records containing such information, all other records and information relating to such delivery, movement, or holding of the pesticide or device. Any inspection with respect to any records and information referred to in this subsection shall not extend to financial data, sales data other than shipment data, pricing data, personnel data, and research data *(other than data relating to registered pesticides or to a pesticide for which an application for registration has been filed).*

SEC. 9. INSPECTION OF ESTABLISHMENTS, ETC.

(a) In General. — For purposes of enforcing the provisions of this Act, officers or employees duly designated by the Administrator are authorized to enter at reasonable times, any establishment or other place where pesticides or devices are held for distribution or sale for the purpose of inspecting and obtaining samples of any pesticides or devices, packaged, labeled, and released for shipment, and samples of any containers or labeling for such pesticides or devices.

Before undertaking such inspection, the officers or employees must present to the owner, operator, or agent in charge of the establishment or other place where pesticides or devices are held for distribution or sale, appropriate credentials and a written statement as to the reason for the inspection, including a statement as to whether a violation of the law is suspected. If no violation is suspected, an alternate and sufficient reason shall be given in writing. Each such inspection shall be commenced and completed with reasonable promptness. If the officer or employee obtains any samples, prior to leaving the premises, he shall give to the owner, operator, or agent in charge a receipt describing the samples obtained and, if requested, a portion of each such sample equal in volume or weight to the portion retained. If an analysis is made of such samples, a copy of the results of such analysis shall be furnished promptly to the owner, operator, or agent in charge.

SEC. 12. UNLAWFUL ACTS.

(a) In General. —

(2) It shall be unlawful for any person — —

(B) to refuse to keep any records required pursuant to section 8, or to refuse to allow the inspection of any records or establishment pursuant to section 8 or 9, or to refuse to allow an officer or employee of the Environmental Protection Agency to take a sample of any pesticide pursuant to section 9;

NWT 003188

DEPARTMENT OF ENVIRONMENTAL QUALITY

SOURCE INSPECTION FORM

☐ WQ ☐ SW ☒ AQ ☐ NC

COUNTY: MULTNOMAH

SOURCE NAME: KOPPERS

OFFICIAL CONTACTED: HENRY RASSI

SOURCE ADDRESS: 7540 NW ST HELENS RD PORTLAND 97229

TABLE A PART	REP. TIME	TRANS TIME	INSPECTION TIME	PAPER TIME
30	02	04	02	04

CO.					DATE		
26	2930		7		10-82	10 11 82	X FO4

8.1 ACDP SHOULD BE ISSUED FOR PESTICIDE MANUFACTURING

8.2

8.3

8.4

COMPLIANCE STATUS (RESULT CODE)

	IN COMP.	NOT IN COMPLIANCE	ON SCHEDULE
All permit conditions	Q		
Permit emission limits	R	A	I
Emission standards	S	B	J
Performance reqts.	T	C	K
Monitoring & Reporting	U	D	L
Open burning limits	V	E	M
Procedural Reqts.	W	F	N
Fugitive emissions	X	G	O
Other	Y	H	P

SOURCES IN VIOLATION & LIMITS VIOLATED

TREATMENT & CONTROL EQUIPMENT – ADDITIONAL REMARKS – OPERATING CONDITIONS

ACDP EXPIRED 12/31/79 APPARENTLY BECAUSE MANUFACTURING OF COAL TAR PITCH WAS DISCONTINUED. HOWEVER, THE MANUFACTURE OF CREOSOTE BASED PESTICIDES CONTINUED AND SHOULD BE PERMITTED UNDER SIC 2879 WHICH FITS THE CASE NOW.

THE APPLICABLE LISTING IN TABLE 1 OAR 340-20-155 IS ERRONEOUSLY SHOWN AS "HERBICIDE MANUFACTURING" FOR SIC 2879 WHEN IT SHOULD BE "PESTICIDES AND AGRICULTURAL CHEMICALS" HERBICIDES IS JUST ONE OF THE 40+ ITEMS LISTED UNDER SIC 2879. I PROPOSE THE TABLE 1 LISTING BE CHANGED TO FIT THE SIC DESCRIPTION: PESTICIDES AND AG CHEM.

REPORT WRITTEN IN OFFICE FOLLOWING INSPECTION.

H L Demuth 10/11/82
SIGNATURE OF INSPECTOR AND DATE

SOURCE COPY

James E Rassi
SIGNATURE OF PERSON INTERVIEWED AND DATE

To be checked by Jordan Dern

DEQ/RO-101 (4/80)

NWT 003189

DEPARTMENT OF ENVIRONMENTAL QUALITY
SOURCE INSPECTION FORM

COUNTY: M. Hook

PROGRAM AQ

SOURCE NAME: Koppers Co

SOURCE ADDRESS: 75 1/2 N. W. St Helens Rd.

OFFICIAL CONTACTED: Paul Guth

TABLE A PARA	PREP. TIME	TRANS TIME	INSPECTION TIME	PAPER TIME
•	0.5	0.5	1.0	0.5

PERMIT NUMBER CO.	PERMIT NUMBER SOURCE	POINT	ACTION NO.	ACTION	ACTION TYPE	DATE SCHEDULED MO.	DATE SCHEDULED DAY	DATE SCHEDULED YR.	DATE ACHIEVED MO.	DATE ACHIEVED DAY	DATE ACHIEVED YR.	RESULT	INSPEC. NO.
26	0430	001	11	7	04	1	14	80	1	11	80	01	8008

8 1 [redacted]
2 [redacted]
3 [redacted] Boiler opacity 5% or less throughout
All other plumes steam

POINT	ACTION NO.		ACTION TYPE	DATE SCHEDULED MO.	DAY	YR.	DATE ACHIEVED MO.	DAY	YR.	RESULT	INSPEC. NO.
[redacted]		7									

SOURCE DESCRIPTION:

8 1
2
3

POINT	ACTION NO.		ACTION TYPE	DATE SCHEDULED MO.	DAY	YR.	DATE ACHIEVED MO.	DAY	YR.	RESULT	INSPEC. NO.
		7									

SOURCE DESCRIPTION:

8 1
2
3

POINT	ACTION NO.		ACTION TYPE	DATE SCHEDULED MO.	DAY	YR.	DATE ACHIEVED MO.	DAY	YR.	RESULT	INSPEC. NO.
		7									

SOURCE DESCRIPTION:

8 1
2
3

COMPLIANCE STATUS: ☑ IN ☐ OUT

Not producing - unit out - (used to produce tar & carbon pitch - not in use)
No coke or tar producing equipment operating - only boiler.
Fair odor around facility. Flare stack down. Kettle & still only remain
Stacks used as creosote terminal & facilities routing pitch (only creosote) No penta No arsenic

David Boger 1-15-80
SIGNATURE OF INSPECTOR AND DATE

Paul Guth 1-15-80
SIGNATURE OF PERSON INTERVIEWED AND DATE

DEQ/RO-101 (2/79)

SOURCE COPY

NWT 003190

SANDRA K. HART
DIRECTOR OF ENVIRONMENTAL SERVICES

NORTHWEST NATURAL GAS COMPANY
220 N.W. SECOND AVENUE
PORTLAND, OREGON 97209

(503) 226-4211 / EXT. 4322
FAX (503) 273-4815

file Northwest Terminal 1995

NORTHWEST NATURAL GAS COMPANY

220 N.W. SECOND AVENUE PORTLAND, OREGON 97209 - 3991

(503) 226-4211

August 18, 1995 AUG 23 1995

Shannon Craig
Beazer East, Inc.
436 Seventh Avenue, Suite 1101
Pittsburgh PA 15219

Dear Ms. Craig: Work Plan

Please find enclosed the final Remedial Investigation/Feasibility Study for the Northwest Natural Gas property located at 7900 N.W. St. Helens Road, Portland, Oregon.

I apologize for the length of time it has taken to send you this report since our meeting in July, however, the final negotiations with the Oregon Department of Environmental Quality (ODEQ) took longer than anticipated. The ODEQ approved the plan on August 11, 1995.

We are hoping to begin work on the site by August 28, 1995.

Please let me know if you have any questions and need further information. I can be reached at (503) 226-4211, Ex. 4322.

Sincerely,

Sandra K. Hart

Sandra K. Hart, Director
Environmental Management

Enclosure

cc: William F. Giarla, Beazer East, Inc.
Carla L. Kelley
Ronald K. Opitz

SKH656/smj

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E.

Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

January 15, 1997

Ms. Sandra Hart
Senior Engineer
Northwest Natural Gas Company
220 N.W. Second Avenue
Portland, OR 97209

Re: Additional Characterization - Former Gasco Facility

Dear Sandy:

Thank you for submitting your response to our comments on the RI data package and risk assessment conceptual model, the Remedial Investigation Supplement for Land and Water Use and the Conceptual site model for the baseline ecological risk assessment (Montgomery and Watson, October 4, 1996). The Oregon Department of Environmental Quality has review the submitted material; comments are offered below. Comments have been divided into three sections covering each of the above items.

RESPONSE TO COMMENTS:

In general, DEQ agrees with an iterative approach for completion of the remedial investigation. An iterative approach will reduce overall project costs by preventing the collection of unnecessary data, while clarifying additional data needs for site evaluation. Additional site characterization data should be collected for the evaluation of site risks, the evaluation of contaminant fate and transport mechanisms and the delineation of the extent of contamination to evaluate remedial action alternatives for the site. In order to facilitate an iterative approach, DEQ proposes separating the site into operable units based on exposure pathways. If sufficient data have been collected to assess risks for a given operable unit, full delineation of the extent of contamination in support of a feasibility study should proceed only if the acceptable risk has been exceeded.

Although DEQ supports the use of an iterative approach to more efficiently complete the remedial investigation, additional details about how the site risk evaluation will be completed are necessary before DEQ can determine whether sufficient data have been collected. For example, it has been proposed that the site be divided into three exposure units to assess the risk from exposure to surface soils. Without knowing the size and shape of these exposure units, DEQ cannot determine whether sufficient surface soil data have been collected. Similarly, due to the interaction of site groundwater with the Willamette River, contaminant fate and transport analyses will likely be required to assess risk and develop site cleanup levels. Without knowing how the contaminant fate and transport analysis will proceed, DEQ cannot determine whether sufficient groundwater, sediment or surface water data have been collected. Other information such as the results of the beneficial water use determination and proposed site data

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distributions are also necessary for DEQ to determine whether sufficient data have been collected for a given "operable unit."

A summary of the data requirements for each of the proposed operable units is described in detail below:

On-Site and Willamette River Sediments: Three on-site and six Willamette River sediment locations were sampled. Two samples were collected from each Willamette River sediment location at varying depths. This data is considered adequate for the calculation of exposure point concentrations in support of the human health and ecological risk assessments. However, additional sediment sampling may be required for the purposes of conducting bioassays to fully evaluate the risk to the benthic community. It should be noted that the concentrations of polycyclic aromatic hydrocarbons (PAHs) detected in Willamette River sediments far exceed the screening criteria presented in the conceptual model for the ecological risk assessment. This suggests that additional sampling to fully delineate of the extent of Willamette River sediment contamination and determine whether hot spots of contamination are present may be necessary for the purpose of evaluating remedial action alternatives for the site. In addition, additional data may be necessary to evaluate sediment transport mechanisms to fully understand potential risks to human health or the environment. For example, to what extent are contaminated sediments migrating downstream? What was the effect of last years flood event on contaminant distribution?

Surface and Shallow Subsurface Soil: Forty-two soil borings were installed during Phase I of the remedial investigation (RI). Surface samples (0.2 feet) were collected at twenty-one locations. This data should be utilized to evaluate current risks from direct contact exposures (e.g. ingestion, dermal absorption and inhalation) based on industrial and trespasser exposure scenarios. Surface samples and shallow sub-surface soil samples (less than 12-15 feet below ground surface) should be used to evaluate potential future exposures to site workers under both the trenchworker and industrial exposure scenarios. The industrial exposure scenario should assume that excavated soil will become exposed at the surface due excavation activities.

Without knowing the size of the proposed exposure unit, DEQ is unable to determine whether enough soil data have been collected to characterize potential risks from surface and shallow subsurface soil. It is recommended that a discussion of exposure units for soil be initiated in order to determine whether the collection of additional soil data in support of the risk assessment is necessary. Additional data to evaluate the transport of contaminated soil to sediments may also be required. In addition, the use of probabilistic risk assessment techniques may also require the collection of additional data for the calculation of exposure point concentrations.

It should be noted that only four soil borings have failed to reveal the presence of carcinogenic PAHs above the risk-based screening concentration of 1 mg/kg. Consequently, it is likely that additional delineation of the extent of contamination will be necessary in support of the feasibility

study. Although DEQ agrees that the collection of off-site soil data on the adjoining Wacker property is not needed at this time, the collection of off-site data may be required If it is determined that this information is necessary for completion of the feasibility study. In addition, it is not clear whether adequate data have been collected to accurately delineate hot spots of contamination based on the high concentration threshold. This information is considered critical to the feasibility study.

Deep Soil: DEQ assumes that there is no risk from direct contact with deep soil (more than 12-15 feet below ground surface). The primary route of exposure to contaminants in deep soils is through contaminant migration to groundwater and surface water. Because the beneficial use survey has not been completed at this time, it is not possible to determine whether adequate data have been collected to fully evaluate this exposure pathway. Once the full extent of groundwater contamination has been delineated and all potential exposure pathways identified, it can be determined whether additional data are required to complete the risk assessment.

Shallow Groundwater: During Phase I of the RI, twelve shallow monitoring wells were installed and sampled on a quarterly basis. Analysis of groundwater has detected concentrations of benzene up to 120,000 ug/L. However, a full beneficial use determination has not been completed to date. Without this information it is not possible to determine definitively how much additional shallow groundwater data are required. In addition, shallow groundwater is in contact with the Willamette River and in communication with underlying groundwater zones. Contaminant fate and transport analyses will likely be necessary to evaluate impacts to the river and deeper groundwater. Without an understanding of how this analysis will proceed, DEQ cannot determine how much additional groundwater data are required.

Intermediate Groundwater: During Phase I of the RI, four intermediate monitoring wells were installed and sampled on a quarterly basis. Based on preliminary evaluation, intermediate groundwater may be discharging elevated levels of contaminated groundwater directly to the Willamette River. Consequently, DEQ believes that additional data are necessary to evaluate potential effects on beneficial uses of the Willamette River and delineate the full extent of groundwater contamination. This data should include contaminant concentrations as well as information relevant to fate and transport modeling.

Deep Groundwater: Based on results obtained from deep soil borings (B-32 and B-33), deep groundwater is likely impacted. Since deep groundwater may be in communication with the Willamette River and the beneficial use survey has not been completed, additional characterization of deep groundwater is required for completion of the baseline risk assessment and feasibility study.

Surface Water: Based on the concentrations of aromatic volatile organic compounds (VOCs) detected in on-site groundwater, evaluation of adverse impacts on Willamette River surface water are required. This evaluation may include collection of near shore surface water data, collection of

additional groundwater data, extrapolation from groundwater to near shore surface water, or the analysis of sediment pore water.

Air: Personal protection monitoring data was collected during the Phase I RI. However, in the absence of site specific meteorological data, these data are of limited use. Consequently, DEQ reiterates our recommendation that emission modeling be performed to estimate risks to human health from the inhalation of contaminated dust and VOCs released from soil and shallow groundwater.

Recent revisions to the Oregon Environmental Cleanup Law, specify and acceptable risk level of 1 x 10^{-6}. Consequently, OSHA standards are not considered an acceptable measure of protectiveness.

Groundwater Quality and Water Level Monitoring: DEQ agrees that monthly water level monitoring is no longer necessary. Instead, water level measurements may be collected on a quarterly basis beginning with the first quarter of 1997. With respect to quarterly groundwater sampling, DEQ recommends the collection of groundwater quality data in February, 1997. This data can serve as either the high water sampling event for semi-annual monitoring (with a low water sampling event in August) or the first quarter sampling event. Once DEQ has had a chance to review the February 1997 and October 1996 groundwater data, DEQ will determine whether quarterly or semi-annual groundwater monitoring is warranted.

BENEFICIAL USE DETERMINATION:

The response to comments also included a proposal for the identification of current and reasonably likely future land use and beneficial uses of water. The proposal as written is generally acceptable. However, the following modifications are requested:

Beneficial Uses of Surface Water: The beneficial use survey should identify all surface waters to which site related contaminants have migrated to or may reasonably likely migrate to. The determination of whether that contamination may have a significant adverse effect on beneficial uses of surface water should be performed as part of the hot spot identification and risk characterization.

Beneficial Uses of Groundwater: The beneficial use survey should first identify all current and reasonably likely beneficial uses of water in the locality of the facility (may reasonably migrate to). Once those beneficial uses have been identified, it may be determined whether a significant adverse effect has occurred. It is premature to state that no current beneficial uses of groundwater are being significantly affected by GASCO facility-related releases. Contacts with neighboring landowners should include a discussion of future plans for the use of ground and surface water.

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CONCEPTUAL SITE MODEL FOR BASELINE ECOLOGICAL RISK ASSESSMENT:

General Comments:

Although the Conceptual site model for the baseline ecological risk assessment does a good job of identifying potential receptors at the GASCO site, evaluation of these receptors is dismissed without adequate supporting documentation. For example, the US EPA wildlife handbook states that raccoons are found near virtually every aquatic habitat and that raccoons use surface waters for both drinking and foraging. Consequently, evaluation of raccoons, and other terrestrial receptors, appears to be necessary for the baseline ecological risk assessment. In addition, the former GASCO site is a fairly large site (approximately 47 acres) and is adjacent to a significant surface water body between two important ecological habitats (Forest Park and Sauvie Island). Ecological receptors which utilize the Willamette River, Sauvie Island or Forest Park may potentially be at risk as a result of contamination at the former GASCO site. Consequently, the baseline ecological risk assessment should include a site-specific survey to identify habitats and list observed species.

Specific Comments:

Threatened and Endangered Species: The Oregon Natural Heritage Program (ONHP) data base should not be the only source for threatened and endangered plant and animal species. The US Fish and Wildlife and Oregon Department of Fish and Wildlife should also be consulted. Data should be verified through a site specific survey.

Terrestrial Species: A number of terrestrial species such as raccoons, small rodents, plants and invertebrates are potential ecological receptors and require evaluation. Fencing is rarely a deterrent to animal migration.

Riparian Habitat: Riparian habitat should be evaluated. In particular the on-site ponds may provide habitat for avian receptors.

Aquatic Receptors: Although migratory fish are not likely to spend a significant portion of time in the vicinity of the former GASCO site, any resident fish may receive significant exposures especially given the concentration of PAHs detected in Willamette River sediments and should be evaluated.

Conceptual Model: The site conceptual model is developed to identify exposure pathways and potential receptors. The conceptual model (Figure 2) as presented reflects the elimination of exposure pathways and potential receptors, rather than serving as a starting point for the baseline ecological risk assessment. Consequently, the conceptual site model should be revised to include all exposure pathways and potential receptors. An example conceptual site model is attached.

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SUMMARY

DEQ agrees that a significant quantity of data have been collected. For some operable units, sufficient data may be currently available to conduct the baseline risk assessment. However, for many operable units, DEQ has a number of questions which should be addressed before it can be determined what additional data, if any, are required. This is particularly relevant when considering the soil/groundwater/surface water/sediment interaction at the site with respect to contaminant fate and transport mechanisms. In order to facilitate the resolution of the issues identified by DEQ, we recommend a meeting to discuss the best way to proceed with the characterization of the GASCO site. At that time we can reach agreement on areas where we may proceed with risk characterization and what additional data are necessary to complete the risk characterization for the remaining areas. In general, DEQ agrees that full delineation of contamination is not required in those areas which do not present an unacceptable risk to human health and the environment. However, based on the screening level assessment included in Montogomery Watson's letter dated August 16, 1996, many areas of the site do exceed the acceptable risk level and will require additional delineation prior to the identification and evaluation of remedial action alternatives.

Sincerely,

Eric L. Blischke
Project Manager
Voluntary Cleanup and Site Assessment Section

cc: Mike Rosen, NWR/DEQ
Karla Urbanowicz, NWR/DEQ
Rich Sedman, NWR/DEQ
Bruce Hope, WMCD/DEQ

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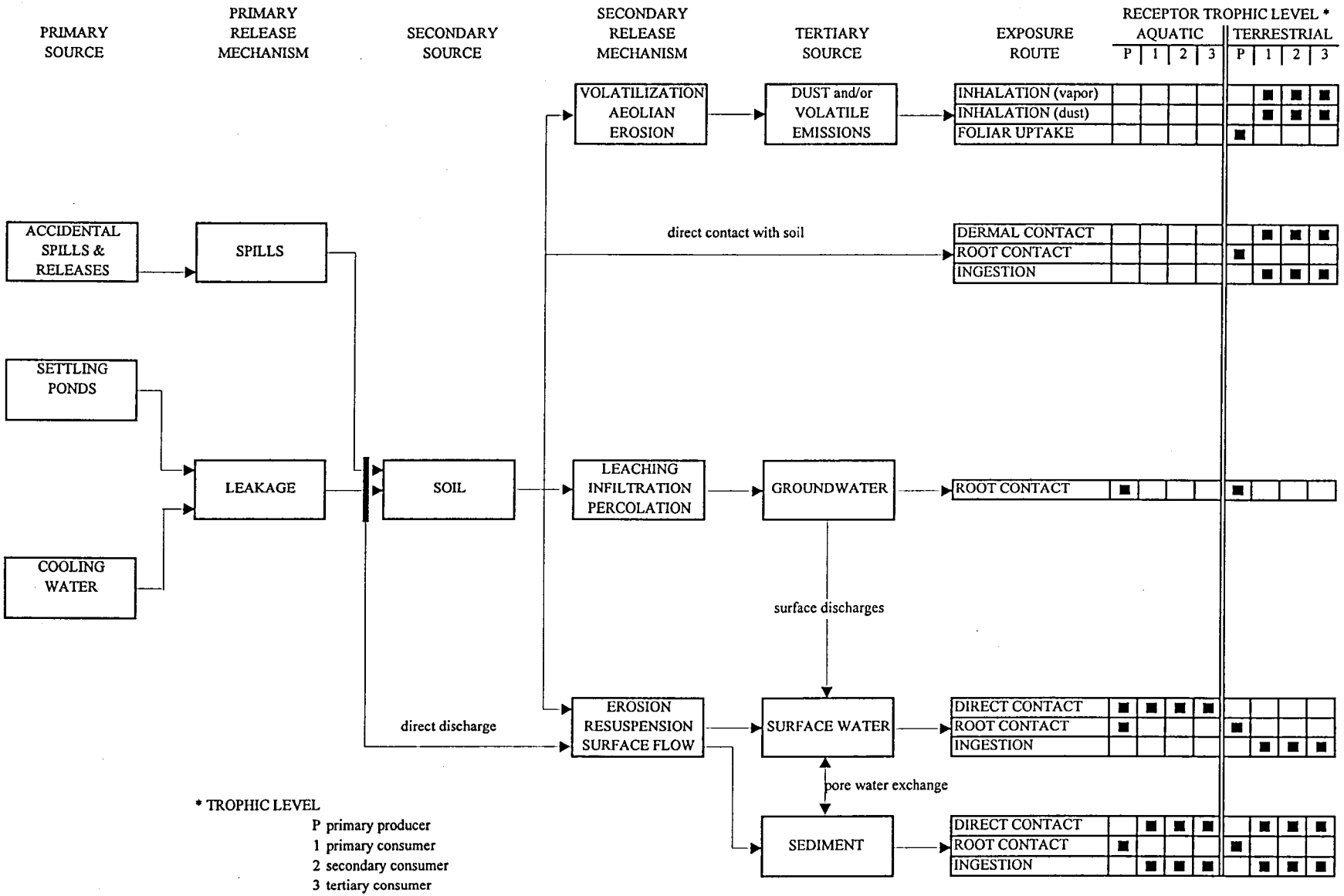
Gasco Site
Exposure Pathway Model (EPM) - Component of the Conceptual Site Model (CSM)



Level II / GASCO_C.XLS

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August 30, 2000

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Ms. Shannon Craig
Beazer East, Inc.
436 Seventh Avenue
Pittsburgh, PA 15219

Re: Koppers Company, Inc. Operations
Gasco Facility, 7900 NW St. Helens Road, Portland, Oregon

Dear Ms. Craig:

This letter provides an update on the ongoing environmental investigations and remedial activities at our Gasco Site in Portland, which includes the facility that you operated for many years as Koppers Company, Inc. Much has happened since our last correspondence with you regarding this project.

We are nearing completion of the remedial investigation phase of the uplands project. Enclosed are copies of the Phase I and Phase II remedial investigations. These reports include comprehensive data packages and findings on the uplands soil and groundwater assessment. We have also started the Ecological and Human Risk Assessment process and we expect to develop a feasibility study in the near future. These activities are being conducted under the Oregon Department of Environmental Quality (DEQ) Voluntary Cleanup Program.

The Environmental Protection Agency (EPA) has proposed that a six-mile reach of the Willamette River be placed on the National Priorities List because of contaminants in the sediments. The Governor of Oregon has concurred with the listing. The Gasco site is located along this reach of the river. DEQ and EPA will work together, with DEQ taking the lead role on investigation of the uplands, and EPA taking the lead role on the sediments.

As presented in the enclosed reports, contaminants of concern with the chemical characteristics of the pencil pitch processed at your facility have been identified in the soils, groundwater and sediments at our property. Given the accelerating pace of activities at the site, and the agencies' enhanced interest in identifying responsible parties, we respectfully suggest that it is time for Beazer East, Inc. to become more involved.

We invite you to join with us as we move into the next phases of investigation and remediation. Specifically, we propose that we enter into an agreement pursuant to which your company would pay its fair share of response costs and participate in the

process. We would be pleased to meet with you to develop a mechanism for determining that fair share.

Please call me at your earliest convenience to discuss how we might best resolve these issues. Best Regards.

Sincerely,

Robert J. Wyatt, R.G.
Environmental Compliance Specialist

Enclosures

cc: Richard D. Bach

86-117(E) E.3

NORTHWEST NATURAL GAS COMPANY

220 N.W. SECOND AVENUE PORTLAND, OREGON 97209 - 3991

(503) 226-4211

January 21, 1997

Shannon Craig
Beazer East, Inc.
436 Seventh Avenue, Suite 1101
Pittsburgh PA 15219

Dear Ms. Craig:

Please find enclosed the data package for the Remedial Investigation/Feasibility Study for the Northwest Natural Gas property located at 7900 N.W. St. Helens Road, Portland, Oregon.

Also enclosed are:

A. The Conceptual Model for the Baseline Human Health Risk Assessment; Dated August 16, 1996

B. The Oregon Department of Environmental Quality's (OEDQ) comments on the data package and conceptual risk assessment model; Dated August 23 ,1996

C. The Baseline Ecological Risk Assessment; Dated October 4, 1996

D. Northwest Natural's response to the ODEQ comments on the data package and conceptual model; Dated November 15, 1996

E. ODEQ's response to Northwest Natural's November 15, 1996 comments; Dated January 15, 1997/

We are in the process of reviewing the last set of comments from ODEQ. Northwest Natural and its consultants will be meeting the week of February 3, 1997 to discuss the next steps with the ODEQ.

Please let me know if you have any questions, comments or need further information. I can be reached at (503) 226-4211, Ex. 4322.

Sincerely,

Sandra K. Hart, Manager
Environmental and Occupational Safety

Enclosure

cc: William F. Giarla, Beazer East, Inc. w/o attachments
Bruce B. Samson w/o attachments
Carla L. Kelley w/o attachments
Ronald K. Opitz w/o attachments
R. D. Bach w/o attachments

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M E M O R A N D U M

MONTGOMERY WATSON

A.

To:	Eric Blischke, Oregon DEQ	**Date:**	August 16, 1996
From:	Steve Sonnen SS	**Job No.:**	4810.0010
cc:	Sandra Hart, NWNG		
	Frank Selker, Decision Focus		
	Richard Bach, Stoel Rives		
Subject:	Baseline Human Health Risk Assessment for Northwest Natural Gas Gasco Site - Conceptual Model		

This memorandum describes the conceptual model proposed for the baseline human health risk assessment for the Gasco Site, based on Site-related chemicals, exposure pathways, and receptors of likely concern as identified in the remedial investigation (RI; Hahn and Associates, 1996). Also included is a brief description of the methodology which will be employed to complete the risk assessment.

Methodology for Construction of the Conceptual Model

The conceptual model to be employed in the Gasco Site risk assessment will identify chemicals, exposure pathways, and receptors of potential concern and will be used to guide the implementation of the analysis and risk characterization phases of the risk assessment.

Chemicals of possible concern, as identified in the RI, have been initially evaluated to focus the risk assessment efforts on those chemicals having a potential to cause significant human health impacts. To focus the analysis, the maximum concentration of chemicals detected at the Site, within each environmental medium was compared to a possibly relevant regulatory standard. If the maximum concentration was greater than its medium-specific standard, it was retained for further evaluation.

At the Gasco Site, background data have been collected only for Willamette River sediments. Therefore, all chemicals for which there are no regulatory standards will be retained for further evaluation. Because there are no standards for the chemicals detected in the sediments, a background comparison will be used as the retention criterion. Chemicals retained through these focusing steps are deemed to be chemicals of potential concern (COPCs).

Possible exposure pathways will be evaluated to determine whether or not they are complete. As shown in Figure 1, a pathway will be deemed to be complete if all of the following are present: a contaminant source (current or historic), a release mechanism, an environmental transport or residency medium, an exposure route, and a receptor. Pathways which are incomplete at the Site and are expected to remain incomplete will be dismissed. Complete pathways will be retained and considered to be of potential concern. Such pathways will be subject to further evaluation.

Possible receptors will be evaluated to identify populations potentially exposed to COPCs. This evaluation will be based on current and reasonably likely future land and water uses.

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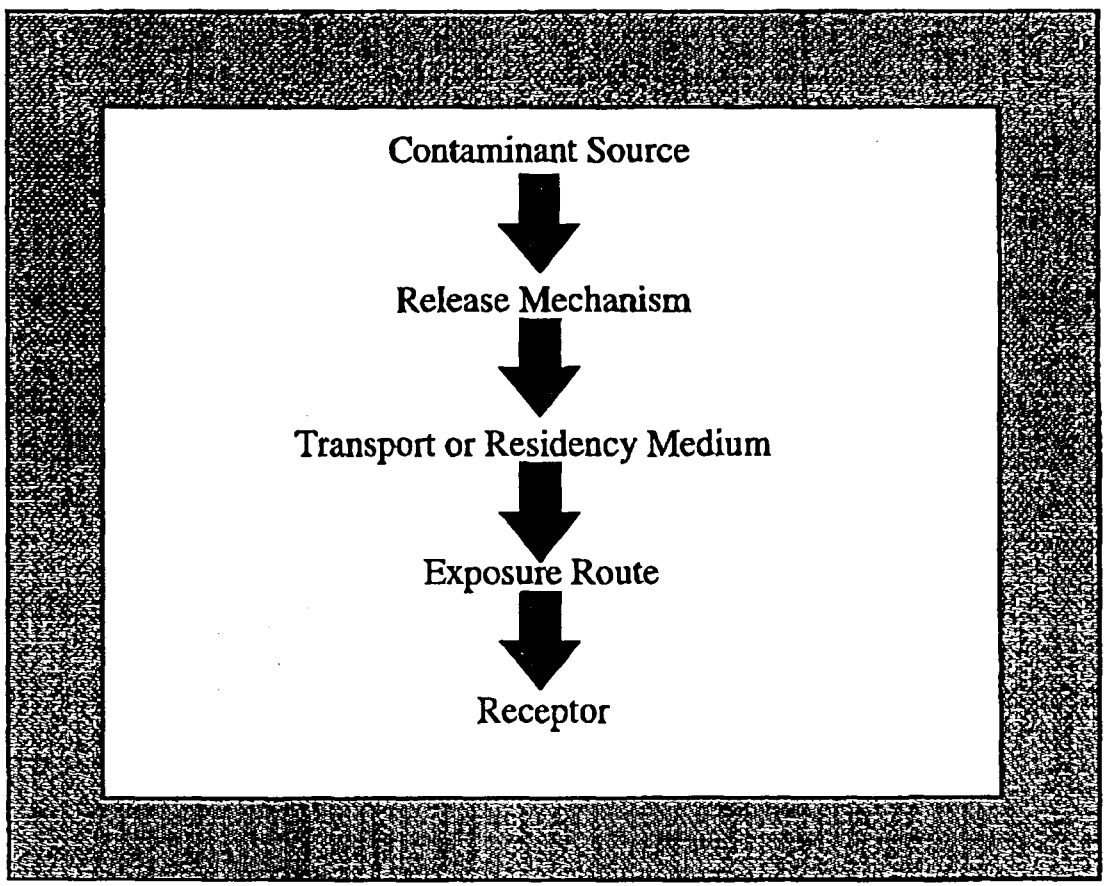
Figure 1. Conceptual Model Elements



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Populations identified as having exposure potential under appropriate land use scenarios are regarded as being of potential concern and will be subjected to further evaluation.

The process of identifying chemicals, exposure pathways, and receptors of potential concern will be iterative. Designation of COPCs, for example, will take information regarding likely exposure pathways and receptors into account. Likewise, pathways and receptors can not be identified in isolation of the other two components of the conceptual model.

This process of identification of chemicals, exposure pathways, and receptors of potential concern has provided the basis for the proposed conceptual model, with the understanding that the conceptual model may need to be updated and refined as information about the Gasco Site is analyzed and placed in perspective.

Designation of Chemicals of Potential Concern

The RI has identified the release of various chemicals to the soil, air, surface water, and sediments. The COPCs have been designated by environmental medium from the universe of chemicals detected during the RI, with consideration of pathways and receptors.

Each medium addressed below is accompanied by a table of information. The accompanying table lists each chemical analyzed for (excluding general indicator analytes), the maximum observed concentration in that medium during the RI, and the standard against which the maximum concentration has been compared. In the case of sediments, for which no standards are available, no table is provided.

Air

Table 1 provides the information used to designate COPCs in air for the Gasco Site. Air monitoring was conducted during drilling activities performed during the RI. More extensive air monitoring was also performed to assess ambient air concentrations downwind of the LNG Storage Tank Containment Basin. Only benzene, toluene, ethylbenzene, xylenes (BTEX), and titanium were detected during air monitoring performed while drilling for the RI, and the maximum concentrations of these chemicals are far below their respective regulatory standards. Thus, no COPCs are defined for air, and it is proposed that air be dismissed as being a pathway of potential concern (see Designation of Exposure Pathways of Potential Concern below). Dust is further evaluated separately below.

Surface Soil

Table 2 provides the information used to designate COPCs in surface soil for the Gasco Site. Shading in Table 2 indicates that the maximum concentration exceeds the medium-specific regulatory standard for that particular chemical and the chemical is, therefore, deemed to be a COPC.

As indicated in Table 2, the following compounds are deemed to be COPCs and are to be evaluated in the risk assessment:

- total petroleum hydrocarbons (TPH)-diesel/oil range
- arsenic
- benzo(a)anthracene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- benzo(a)pyrene

Table 1. Maximum Concentration of Chemicals in Air at the Gasco Site

Chemical	Maximum Concentration	Oregon OSHA PEL[†]		
		TWA	E	C
VOCs	(ppm)	(ppm)	(ppm)	(ppm)
benzene	0.11	1	5.0	
toluene	0.007	100 (skin)	300	500
ethylbenzene	0.090	100	300	
xylenes	0.046	100	300	
Metals	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)
antimony	<0.009[††]	0.5	1.5	
arsenic	<0.0009[††]	0.01	0.03	
beryllium	<0.0005[††]	0.002	0.005	0.025
cadmium	<0.0002[††]	0.005	0.015	
chromium	<0.002[††]	0.5	1.5	
copper	<0.002[††]	0.1	0.3	
lead	<0.0009[††]	0.05	0.15	
nickel	<0.0005[††]	1	3	
selenium	<0.002[††]	0.2	0.6	
silver	<0.0005[††]	0.0	0.0	
titanium	0.005	10[*]	30	
zinc	<0.002[††]	5[*]	15	
Particulates	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)
Total Airborne Dust	<0.2[††]	10	30	
PAHs	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
acenaphthene	<0.3[††]			
acenaphthylene	<0.1[††]			
anthracene	<0.01[††]	200	600	
benzo(a)anthracene	<0.01[††]			
benzo(b)fluoranthene	<0.02[††]			
benzo(k)fluoranthene	<0.01[††]			
benzo(a)pyrene	<0.01[††]	200	600	
benzo(ghi)perylene	<0.01[††]			
chrysene	<0.01[††]	200	600	
dibenzo(ah)anthracene	<0.01[††]			
fluoranthene	<0.01[††]			
fluorene	<0.01[††]			
indeno(1,2,3-cd)pyrene	<0.01[††]			
naphthalene	<0.1[††]	50,000	150,000	
phenanthrene	<0.01[††]	200	600	
pyrene	<0.01[††]	200	600	

[†]PEL-Permissible Exposure Limit, TWA-Time Weighted Average, E-Exposure Limit, C-Ceiling Limit.

[††]Not detected. Value listed is the detection limit which was highest for all samples tested.

[*]Titanium TWA is as titanium oxide, zinc TWA is as zinc oxide.

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Table 2. Maximum Concentrations of Chemicals in Surface Soils at the Gasco Site

Chemical	Maximum Concentration (mg/kg)	Regulatory Standard (mg/kg)
VOCs		
benzene	<0.3[f]	2[a]
toluene	<0.3[f]	6,000[a]
ethylbenzene	<0.3[f]	20,000[a]
xylenes	<0.3[f]	2,500[a]
TPH		
TPH-gasoline	<10[f]	80[b]
TPH-diesel/oil	1,600	500[c]
Metals		
antimony	6.6	280[d]
arsenic	21	3[d]
beryllium	<1.0[f]	1[a]
cadmium	1.1	1,000[a]
chromium	30	1,500[a]
copper	60	80,000[a]
lead	60	2,000[a]
mercury	<0.1[f]	600[a]
nickel	26	40,000[a]
selenium	<0.1[f]	100[e]
silver	<0.1[f]	10,000[a]
thallium	7.6	56[d]
zinc	160	7,500[e]
Phenols		
4-chloro-3-methylphenol	<51[f]	
2-chlorophenol	<51[f]	
2,4-dichlorophenol	<51[f]	
2,4-dimethylphenol	<51[f]	
2,4-dinitrophenol	<99[f]	
2-methyl-4,6-dinitrophenol	<51[f]	
cresols, total	<51[f]	
4-methylphenol	<51[f]	
2-nitrophenol	<51[f]	
4-nitrophenol	<51[f]	
2,3,4,6-tetrachlorophenol	<51[f]	
pentachlorophenol	<51[f]	50[a]
phenol	<51[f]	
2,4,5-trichlorophenol	<51[f]	
2,4,6-trichlorophenol	<51[f]	500[a]

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Table 2. Maximum Concentrations of Chemicals in Surface Soils at the Gasco Site

Chemical	Maximum Concentration (mg/kg)	Regulatory Standard (mg/kg)
PAHs		
acenaphthene	9.2	100,000[a]
acenaphthylene	29	
anthracene	212	600,000[a]
benzo(a)anthracene	53	1[a]
benzo(b)fluoranthene	124	1[a]
benzo(k)fluoranthene	45	1[a]
benzo(a)pyrene	129	1[a]
benzo(ghi)perylene	202	
chrysene	75	1[a]
dibenzo(ah)anthracene	33	1[a]
fluoranthene	115	80,000[a]
fluorene	20	80,000[a]
indeno(1,2,3-cd)pyrene	141	1[a]
naphthalene	9	8,000[a]
phenanthrene	92	
pyrene	134	60,000[a]

[a]Not detected. Value listed is the detection limit.
[b]Not detected. Value listed is the detection limit which was highest for all samples tested.
[a]Industrial Maximum Allowable Soil Concentration (OAR 340-122-045).
[b]UST Level 2 Cleanup Standard (OAR 340-122-335).
[c]40CFR 530.13(b)1.
[d]Risk-based calculation. Assumes 70 kg body weight, 100 mg/d soil ingestion rate, a hazard quotient of 1.0, and reference doses (RfDs) of 4E-4 and 8E-5 (mg/(kg*d)) for antimony and thallium, respectively. (Source: IRIS, April 1996.)

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- chrysene
- dibenzo(ah)anthracene
- indeno(1,2,3-cd)pyrene.

Three chemicals for which no soil standards exist were detected. All are non-carcinogenic polycyclic aromatic hydrocarbons, PAHs—acenaphthylene, benzo(ghi)perylene, and phenanthrene. Other non-carcinogenic PAHs detected at the Site have regulatory standards which exceed the maximum concentrations of these three by several orders of magnitude. If these other non-carcinogenic PAHs are considered to be surrogates for the three non-carcinogenic PAHs lacking standards, they can be dismissed. Further, given the extensive presence of carcinogenic PAHs in Site surface soils, the magnitude of risk contributed by PAHs will not be affected significantly by dismissing these three compounds from further analysis. Thus, acenaphthylene, benzo(ghi)perylene, and phenanthrene are not regarded as COPCs in surface soil.

Subsurface Soil

Table 3 provides the information used to designate COPCs in subsurface soil. Again, background data are not available at this time. Shading in Table 3 indicates that the maximum concentration exceeds the medium-specific regulatory standard for that particular chemical and the chemical is, therefore, deemed to be a COPC. The COPCs identified for this medium are:

- benzene
- TPH-gasoline range
- TPH-diesel/oil range
- arsenic
- benzo(a)anthracene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- benzo(a)pyrene
- chrysene
- dibenzo(ah)anthracene
- indeno(1,2,3-cd)pyrene
- naphthalene
- phenanthrene.

As was the case for surface soils, standards do not exist for all analytes listed in Table 3. By the same rationale as for surface soils, acenaphthylene and benzo(ghi)perylene in subsurface soils have not been retained for further analysis. Phenanthrene will, however, be retained as its maximum concentration exceeds the regulatory standard for naphthalene, a reasonable surrogate compound.

Dust

Wipe samples were taken at two locations during the RI. The concentrations of PAHs found in these samples are presented in Table 4. Because personal monitoring data for exposures to VOCs and dust were collected in association with drilling activities which took place during the RI and exposures to these compounds were well below permissible limits, dust will not be

Table 3. Maximum Concentrations of Chemicals in Subsurface Soils at the Gasco Site

Chemical	Maximum Concentration (mg/kg)	Regulatory Standard (mg/kg)
VOCs		
benzene	360	2[a]
toluene	280	6,000[a]
ethylbenzene	140	20,000[a]
xylenes	220	2,500[a]
TPH		
TPH-gasoline	3,400	80[a]
TPH-diesel/oil	7,700	500[b]
Metals		
antimony	<1.0[†]	280[d]
arsenic	14	3[a]
beryllium	<1.0[†]	1[a]
cadmium	4.3	1,000[a]
chromium	30	1,500[a]
copper	80	80,000[a]
lead	130	2,000[a]
mercury	<0.10[†]	600[a]
nickel	41	40,000[a]
selenium	<1.0[†]	100[c]
silver	<1.0[†]	10,000[a]
thallium	5.0	56[d]
zinc	3,000	7,500[c]
Phenols		
4-chloro-3-methylphenol	<51[††]	
2-chlorophenol	<51[††]	
2,4-dichlorophenol	<51[††]	
2,4-dimethylphenol	<51[††]	
2,4-dinitrophenol	<99[††]	
2-methyl-4,6-dinitrophenol	<51[††]	
cresols, total	<51[††]	
4-methylphenol	<51[††]	
2-nitrophenol	<51[††]	
4-nitrophenol	<51[††]	
2,3,4,6-tetrachlorophenol	<51[††]	
pentachlorophenol	0.36	50[a]
phenol	<51[††]	
2,4,5-trichlorophenol	<51[††]	
2,4,6-trichlorophenol	<51[††]	500[a]

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Table 3. Maximum Concentrations of Chemicals in Subsurface Soils at the Gasco Site

Chemical	Maximum Concentration (mg/kg)	Regulatory Standard (mg/kg)
PAHs		
acenaphthene	9,210	100,000[a]
acenaphthylene	1,960	
anthracene	1,650	600,000[a]
benzo(a)anthracene	1,540	1[e]
benzo(b)fluoranthene	972	1[e]
benzo(k)fluoranthene	370	1[e]
benzo(a)pyrene	954	1[e]
benzo(ghi)perylene	1,080	
chrysene	1,810	1[e]
dibenzo(ah)anthracene	159	1[e]
fluoranthene	8,480	80,000[a]
fluorene	4,530	80,000[a]
indeno(1,2,3-cd)pyrene	738	1[e]
naphthalene	20,700	8,000[a]
phenanthrene	15,500	
pyrene	6,530	60,000[a]

[1]Not detected. Value listed is the detection limit.

[11]Not detected. Value listed is the detection limit which was highest for all samples tested.

[c]Industrial Maximum Allowable Soil Concentration (OAR 340-122-045).

[b]UST Level 2 Cleanup Standard (OAR 340-122-335).

[e]40CFR 530.13(b)1.

[d]Risk-based calculation. Assumes 70 kg body weight, 100 mg/d soil ingestion rate, a hazard quotient of 1.0, and reference doses (RfDs) of 4E-4 and 8E-5 (mg/(kg*d)) for antimony and thallium, respectively. (Source: IRIS, April 1996.)

[e]Exceeds naphthalene standard.

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Table 4. Concentrations of Chemicals in Dust Samples at Gasco Site

Chemical	Concentration - Koppers		Concentration - Gasco (mg/kg)	
	(mg/kg)	Fraction of Total	(mg/kg)	Fraction of Total
PAHs				
acenaphthene	380	0.014	4.4	0.012
acenaphthylene	<20[†]	0	1.7	0.004
anthracene	440	0.016	5.6	0.015
benzo(a)anthracene	2600	0.097	33	0.087
benzo(b)fluoranthene	3400	0.126	48	0.125
benzo(k)fluoranthene	1300	0.048	18	0.047
benzo(a)pyrene	2900	0.108	41	0.109
benzo(ghi)perylene	2500	0.093	37	0.096
chrysene	2900	0.108	36	0.095
dibenzo(ah)anthracene	550	0.020	7.5	0.020
fluoranthene	3500	0.130	54	0.141
fluorene	150	0.006	1.9	0.005
indeno(1,2,3-cd)pyrene	1900	0.071	27	0.072
naphthalene	68	0.003	1.1	0.003
phenanthrene	1500	0.056	24	0.062
pyrene	2800	0.104	42	0.110

[†] Not detected. Value listed is detection limit.
Shading indicates exceedance of soil standards (see Table 3).

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evaluated via the inhalation pathway. Dust will be considered, however, as part of the ingestion pathway (see Designation of Exposure Pathways of Potential Concern below).

The following chemicals are regarded as COPCs in dust:

- acenaphthene
- acenaphthylene
- anthracene
- benzo(a)anthracene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- benzo(a)pyrene
- benzo(ghi)perylene
- chrysene
- dibenzo(ah)anthracene
- fluoranthene
- fluorene
- indeno(1,2,3-cd)pyrene
- naphthalene
- phenanthrene
- pyrene.

Ground Water

The RI indicates that the ground water beneath the Gasco Site is contaminated with a variety of chemicals associated with the Site. However, the ground water in this area is not used as a potable source and it does not appear that there are any reasonably likely beneficial uses of groundwater. Thus, ground water will not be regarded as part of any direct exposure pathway of potential concern (see Designation of Exposure Pathways of Potential Concern below) and no COPCs for ground water are designated for the purpose of this risk assessment.

Surface Water

Given that direct surface water exposure pathways are not deemed to be complete (see Designation of Exposure Pathways of Potential Concern below), no COPCs have been designated for this medium. The only surface water on Site is within engineered waste water facilities, and the volume of water in the Willamette River would appear to result in considerable dilution of the permitted discharges and ground water seepage.

Sediments

Sediment samples were taken at several locations in the Willamette River, along, downstream, and upstream of the Gasco Site. The upstream samples will be regarded as Site-specific background samples. Given that no standards exist against which to compare maximum observed downstream chemical concentrations, all chemicals whose concentrations are elevated with respect to background are considered to be of potential concern and will be retained for further evaluation.

The data presented in the RI demonstrate that all chemicals detected in downstream sediment samples within the River are elevated with regard to background. Thus, all chemicals detected will be deemed to be of potential concern for this medium:

- TPH-gasoline range
- TPH-diesel/oil range
- benzene
- toluene
- ethylbenzene
- xylene
- acenaphthene
- acenaphthylene
- anthracene
- benzo(a)anthracene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- benzo(a)pyrene
- benzo(ghi)perylene
- chrysene
- dibenzo(ah)anthracene
- fluoranthene
- fluorene
- indeno(1,2,3-cd)pyrene
- naphthalene
- phenanthrene
- pyrene.

Because all on-Site sediments are located within engineered waste water facilities, exposure to such sediments is highly unlikely and will not be considered further (see Designation of Exposure Pathways of Potential Concern below).

Biota

Biota were not sampled during the RI. The most likely exposure pathway associated with biota that could be affected by chemicals released from the Site is ingestion of fish from the Willamette River (see Designation of Exposure Pathways of Potential Concern below). Chemical concentrations in fish will be estimated by modeling food chain uptake from sediment through the benthos or sediment-dwelling organisms that comprise the majority of the food resource for fish. Thus, the COPCs for biota are identical to those identified above for sediment in the River.

Designation of Exposure Pathways of Potential Concern

The conceptual model considers an exposure pathway to consist of an environmental medium and an exposure route. The universe of exposure pathways considered in this formulation include the following (categorized by medium, as discussed within Designation of Chemicals of Potential Concern above, within route):

- inhalation
  - air
  - dust
- ingestion
  - surface soil
  - subsurface soil
  - dust
  - ground water
  - surface water
  - sediment
  - biota
- dermal contact
  - surface soil
  - subsurface soil
  - dust
  - ground water
  - surface water
  - sediment.

Each of these possible exposure pathways is discussed below, by exposure route, to designate those of potential concern for the Gasco Site.

Inhalation

As indicated above within Designation of Chemicals of Potential Concern, no COPCs have been identified for air. These included both volatile compounds expected to be encountered within a vapor phase and relatively non-volatile compounds expected to be encountered within a particulate or dust phase.

Ingestion of soil and dust is considered to be an exposure pathway of potential concern (see Ingestion below). Thus, dismissing dust inhalation from further consideration is justified by not only the absence of detectable contamination in air while drilling (an activity deemed to have exposure potential similar to occasional excavation activities), but also by the fact that ingestion of soil and dust is expected to contribute orders of magnitude more to the risk estimate than is inhalation of these media.

Therefore, inhalation pathways will not be regarded as being of potential concern at the Gasco Site.

Ingestion

Incidental ingestion of surface soil and dust are deemed to be potentially operative pathways at this site. Subsurface soil can also be incidentally ingested during short-term exposure events such as excavation (see Designation of Receptors of Potential Concern below).

As noted above within Designation of Chemicals of Potential Concern, direct ground water exposure pathways are not complete at the Gasco Site. Although contaminants have been found in the ground water under the Site, the ground water is not in current beneficial use nor is it

expected to become a source of drinking water in the future. Therefore, ground water will not be included in the human health risk assessment in a direct sense. The effect of the ground water contamination will be evaluated, indirectly, through its impact on Willamette River sediment, the benthic community, and human ingestion of fish (see below).

Surface water is present on Site within engineered waste water facilities and adjacent to the Site within the channel of the Willamette River. Incidental direct ingestion of waste water is deemed to be highly unlikely. Incidental ingestion of Willamette River water, however, certainly does occur among recreational users of the River, but the volume of water in the Willamette is such that substantial dilution of the Site ground water seepage and permitted discharges to the River is inevitable. Thus, ingestion of surface water will not be regarded as being a pathway of potential concern for the Gasco Site.

Ingestion of sediment associated with the engineered waste water facilities on Site is deemed to be highly unlikely. While exposure to River sediments is more likely, the presence of boulders along the shore, the absence of a beach, and the steep and deep morphology of the Willamette channel next to the Site are not conducive to attracting recreational users. Moreover, the cleansing action of the overlying water column serves to mitigate any contact with sediment and lowers the opportunity for incidental ingestion considerably. Thus, incidental ingestion of sediment will not be regarded as a pathway of potential concern.

The final ingestion pathway under consideration is biotic ingestion. The Willamette River is a significant fishery. Fish can be exposed to Site chemicals through the ingestion of benthos dwelling on affected sediments. Thus, this pathway will be regarded as being of potential concern for this human health risk assessment. (It will also be considered in the ecological assessment).

In summary, the following ingestion pathways are deemed to be of potential concern for the Gasco Site and will be subjected to detailed analysis:

- surface soil
- dust
- subsurface soil
- fish.

Dermal Contact

With the exception of biota, the universe of possible dermal exposure pathways is identical to that for ingestion. Thus, in accordance with the rationale provided above, the dermal contact pathways of potential concern have been identified as the following:

- surface soil
- dust
- subsurface soil.

Designation of Receptors of Potential Concern

The final element of this conceptual model is the receptors — the population of individuals potentially exposed to the designated COPCs. The universe of receptors of possible concern to be considered in this formulation will be as follows:

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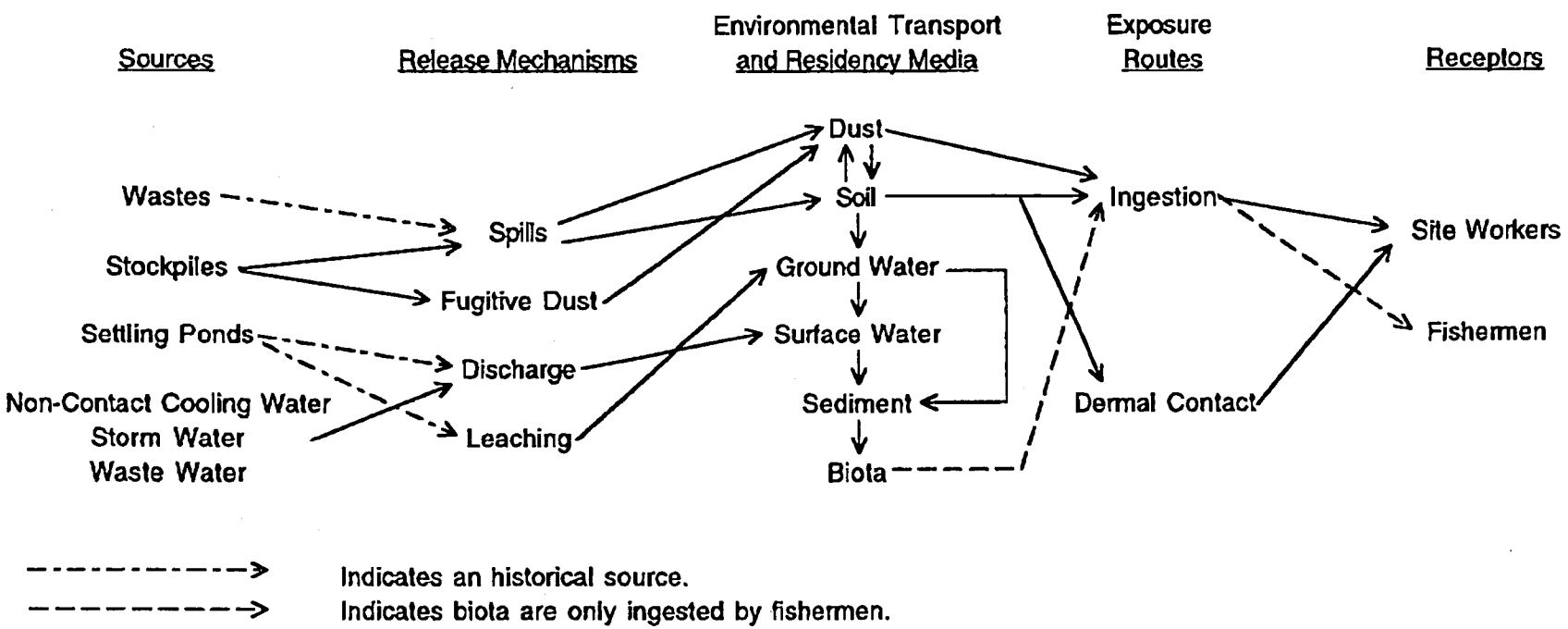
Figure 2. Proposed Initial Conceptual Model for the Gasco Facility



- on-Site employees
  - permanent
    - Northwest Natural Gas (NWNG)
    - Koppers Company (Koppers)
    - Pacific Northern Oil (PNO)
  - short-term contractors
    - NWNG
    - Koppers
    - PNO
- Site visitors and trespassers
- recreational users of the Willamette River
  - fishermen
  - swimmers.

Each of these possible receptors is discussed below to designate those of potential concern for further analysis in connection with the Gasco Site.

On-Site Employees

The primary receptor population at the Gasco Site consists of on-Site employees. This category includes both permanent full-time employees and contractors on the three parcels operated by NWNG, Koppers, and PNO. Given that there are three distinct operational parcels of land on the Site, each parcel will be evaluated separately as to its receptors of potential concern.

Operative pathways for permanent employees may include ingestion of and dermal contact with surface soil and dust. Contractors could experience significant but short-term exposures not likely to be experienced by the permanent staff, such as ingestion of and dermal contact with subsurface soil.

Site Visitors and Trespassers

A second set of receptors includes authorized visitors to the Site and trespassers who wander onto the Site without authorization. This set of receptors will not be analyzed explicitly, because visitors and trespassers spend far less time on the Site than do permanent full-time employees, any health effects for these occasionally exposed receptors will clearly be far less. Accordingly, Site visitors and trespassers will not be regarded as being of potential concern for purposes of the remaining analytical effort associated with this risk assessment.

Recreational Users of the Willamette River

The final set of possible receptors consists of recreational users of the Willamette River. As mentioned previously (see Designation of Chemicals of Potential Concern and Designation of Exposure Pathways of Potential Concern above), Site discharges to the River are highly diluted, there is no beach adjacent to the Site, and the cleansing effect of the water column serves to mitigate sediment exposures. Therefore, swimmers and similar types of recreational users (*e.g.*, jet skiers, water skiers, boaters, and wind surfers) are expected to experience minimal exposures to Site-related chemicals. This group of recreational users of the River will thus not be considered as being of potential concern. The category of individuals who ingest fish caught from the River, however, will be retained for further analysis.

NWT 003218

Receptor Summary

Receptors of potential concern for the Gasco Site are thus deemed to be:

- permanent full-time and contractor employees on each of the three operating parcels
- fishermen.

Initial Conceptual Model and Methodology forAnalysis and Risk Characterization

The proposed initial conceptual model for the Gasco Site is depicted in Figure 2. As mentioned earlier, the conceptual model will be subject to update and refinement pending further review and incorporation of further information from either site characterization or data analysis efforts. Thus, risk conceptualization is best regarded as a dynamic, ongoing process throughout the duration of the risk assessment.

The next phases of the baseline risk assessment will be analysis and risk characterization. These phases, too, are best regarded as dynamic. The chemicals, exposure pathways, and receptors of potential concern designated above will be evaluated initially to further refine the conceptual model and focus the subsequent probabilistic evaluation.

Additional technical memoranda will be produced to document model structure and input assumptions for the exposure and toxicity assessment subphases. If necessary, an interim risk characterization technical memorandum will document the results of the initial evaluation and refine the conceptual model. The final probabilistic evaluation will be documented by means of a risk assessment report.

In addition to the baseline human health risk assessment, a baseline ecological health risk assessment will be conducted. A separate conceptual model technical memorandum for this effort is under development.

References

Hahn and Associates, 1996, *Data Package for Remedial Investigation/Feasibility Study, Northwest Natural Gas Company Gasco Facility*, July 1996.

NW Natural
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PORTLAND, OR 97209
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August 30, 2000

SEP 2 6 2000
file
Northwest Terminal
86-119
(E) E.3 other

Ms. Shannon Craig
Beazer East, Inc.
436 Seventh Avenue
Pittsburgh, PA 15219

Re: Koppers Company, Inc. Operations
Gasco Facility, 7900 NW St. Helens Road, Portland, Oregon

Dear Ms. Craig:

This letter provides an update on the ongoing environmental investigations and remedial activities at our Gasco Site in Portland, which includes the facility that you operated for many years as Koppers Company, Inc. Much has happened since our last correspondence with you regarding this project.

We are nearing completion of the remedial investigation phase of the uplands project. Enclosed are copies of the Phase I and Phase II remedial investigations. These reports include comprehensive data packages and findings on the uplands soil and groundwater assessment. We have also started the Ecological and Human Risk Assessment process and we expect to develop a feasibility study in the near future. These activities are being conducted under the Oregon Department of Environmental Quality (DEQ) Voluntary Cleanup Program.

The Environmental Protection Agency (EPA) has proposed that a six-mile reach of the Willamette River be placed on the National Priorities List because of contaminants in the sediments. The Governor of Oregon has concurred with the listing. The Gasco site is located along this reach of the river. DEQ and EPA will work together, with DEQ taking the lead role on investigation of the uplands, and EPA taking the lead role on the sediments.

As presented in the enclosed reports, contaminants of concern with the chemical characteristics of the pencil pitch processed at your facility have been identified in the soils, groundwater and sediments at our property. Given the accelerating pace of activities at the site, and the agencies' enhanced interest in identifying responsible parties, we respectfully suggest that it is time for Beazer East, Inc. to become more involved.

We invite you to join with us as we move into the next phases of investigation and remediation. Specifically, we propose that we enter into an agreement pursuant to which your company would pay its fair share of response costs and participate in the

process. We would be pleased to meet with you to develop a mechanism for determining that fair share.

Please call me at your earliest convenience to discuss how we might best resolve these issues. Best Regards.

Sincerely,

Robert J. Wyatt, R.G.
Environmental Compliance Specialist

Enclosures

cc: Richard D. Bach

NEW KOPPERS CO., INC. PORTLAND PLANT BEGINS PRODUCTION

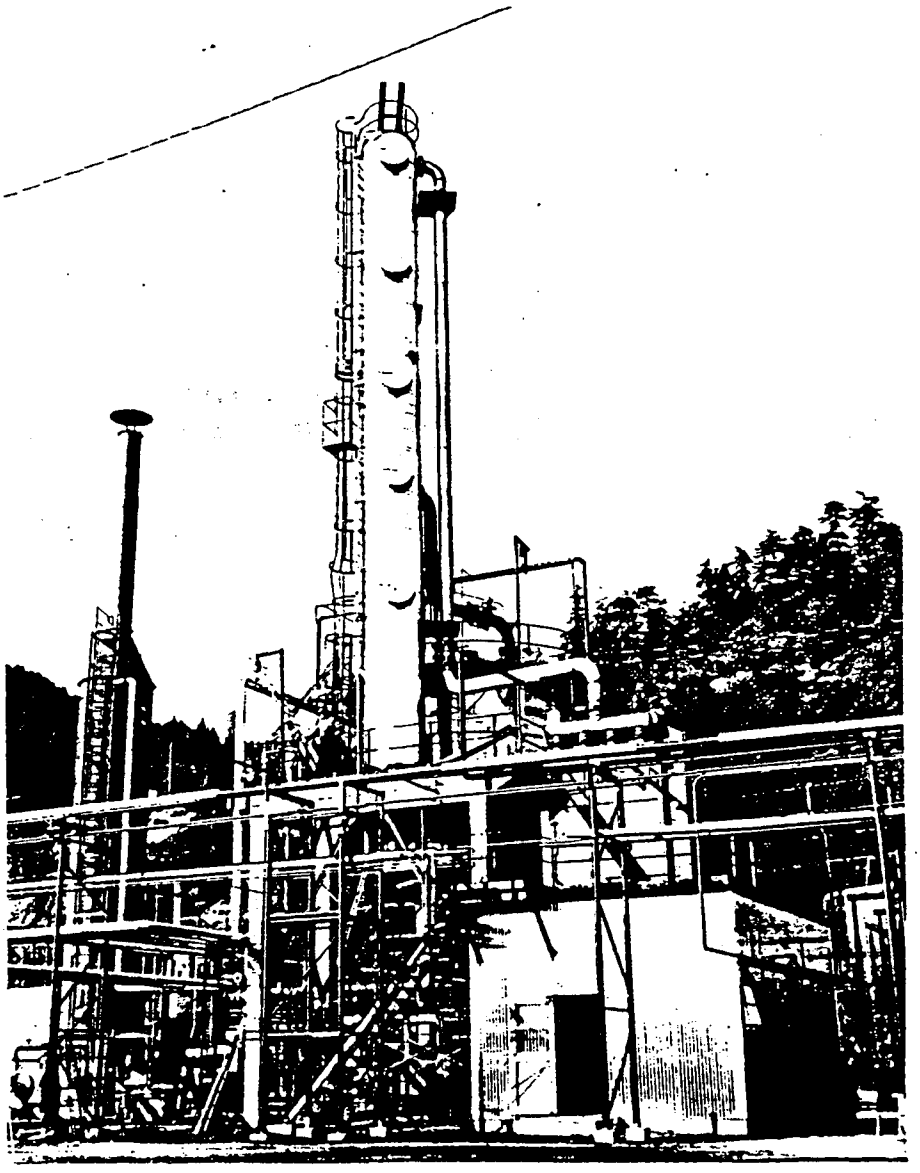
Production began last month at the new $1 million plant of Koppers Co., Inc., Tar and Chemical Division, located in Portland's Linnton area. Full operation is expected this month. The plant is employing 12 persons at the start-up.

Construction of the new facility began last August on ground leased from Northwest Natural Gas Company. The plant centers around a large distillation tower which is the heart of the process. From it, creosote and hot pitch are produced, the former for the wood preserving industry and the carbon pitch for use in aluminum production.

The new plant installation also includes an air-conditioned office building with employe locker rooms, a tank farm, pitch cooling facilities, a machine shop and modern boiler building. Thousands of feet of piping are used for transferring raw and finished materials to and from transportation facilities or storage tanks.

Coal tar, the raw material for Koppers production, is brought by boat to Willamette River docks at the plant site.

Carbon electrode pitch produced by Koppers is made into electrodes used by the aluminum industry ore reduction. The creosote is produced in the distillation of coal tar.



Coal tar distillation tower at the new plant of Koppers Co., Inc. in Portland's Linnton area is the heart of the company's processing operation. Koppers produces carbon pitch for the aluminum industry and creosote for wood preserving. The products may be shipped out by water, rail or truck since the plant has access to all three facilities.

NWT 003222

Re-119
New Sub pls: Settlement Discuss

Beazer

BEAZER EAST, INC., 436 SEVENTH AVENUE, PITTSBURGH, PA 15219 USA
TEL: 412 227-2430 FAX: 412 227-2042

LAW DEPARTMENT

Jill M. Blundon
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June 5, 1996

Carla Kelley, Esq.
Northwest Natural Gas Company
One Pacific Square
220 N.W. Second Avenue
Portland, OR 97209

Re: Former Koppers Company
Portland, Oregon Site

Dear Ms. Kelley:

I am in receipt of your letter of March 8, 1996.

The demand stated in your letter exceeds Beazer's view as to its liability for the above site, but it is a basis for our companies to begin discussing settlement of the Northwest Natural Gas Company ("NWNG") claim.

Beazer is anxious to formulate a response to the NWNG demand, but finds it cannot respond in a way likely to advance negotiations on a final allocation without more information.

As we told you when we met with you concerning the NWNG claim, Beazer needs to see data from the site in order to take a position as to its liability. Without data to help educate us as to what Beazer's historic contribution to the current environmental problem may have been, we would be limited to a qualitative assessment of Beazer's fair share. Such a qualitative assessment would have to be based, for example, on the many years of NWNG operations on the former Beazer parcel, and on the actions of NWNG in spreading waste from its lagoons over it. On this basis, we could not approach the level of participation demanded in your letter. Data may show us that Beazer's participation should be greater than would be suggested by such historical facts.

It was our understanding that, following our meeting last year, NWNG was going to send Beazer both such data and an estimate of the costs NWNG is asking Beazer to share. We never received such data or cost information, and have been

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Writer's Direct Dial Number 412/227-2635

given no opportunity to participate in the Remedial Investigation ("RI") work in any way. To reiterate what we told you last year, in order to respond to the NWNG demand for a final allocation, Beazer needs to see any data that has been collected to date concerning the site and the former Koppers parcel. This would now include data from the RI sampling completed to date. Beazer also needs to have the right and opportunity to obtain splits of samples taken by NWNG in the future, both in connection with the RI and otherwise. This would require NWNG to give Beazer sufficient advance notice of, and information on, future sampling events to allow Beazer to decide whether to have someone present to split samples and to make arrangements if we decide we want to do so. Beazer would give NWNG a chance to review the results of its split sampling, and would like to have the opportunity to review NWNG's results before they go to the agency. Finally, Beazer would like the opportunity to confer with NWNG regarding upcoming RI activities and regarding meetings with the agency, and the chance to attend such meetings as at least a silent participant.

Please confer with Sandra Hart about the data, cost information and rights Beazer is requesting. Once Beazer has the RI sampling data, it may be in a position to respond to the NWNG demand with a final allocation offer. However, additional analysis of the chemical fingerprints of the constituents present will most likely be necessary in order to distinguish between the contributions of NWNG and Beazer to the environmental conditions on the former Beazer parcel. Such analysis may take some time.

If NWNG is interested in exploring an interim allocation covering the duration of the remaining RI work, Beazer is willing to discuss that. It would have to be an allocation that would be reopened and adjusted once the RI (and any other necessary work) is complete, and NWNG and Beazer agree on, or otherwise determine, a final allocation. Once those things occur, either cost payments made earlier would be redistributed based on the final allocation, or the allocation as to future costs would be adjusted to make up for the difference between the interim allocation and the final allocation.

In terms of an interim allocation, Beazer would presently be willing to pay 10% of future RI costs on a nonbinding, interim basis, provided that Beazer gets the data and is allowed to participate in the RI work as described above. In other words, Beazer must first receive the existing data and information on costs NWNG wants Beazer to share, and Beazer must be given the right and a genuine opportunity: to

split samples; to review and comment on data before it goes to the agency; to discuss with NWNG upcoming RI work and meetings with the agency; and to attend meetings with the agency.

Please let me know whether you would like to explore an interim arrangement on terms such as these. Beazer is willing to discuss any counterproposal NWNG would like to make.

I look forward to hearing from you soon concerning the data and cost information needs described above.

Please feel free to call me if you have any questions or comments concerning the above.

Very truly yours,

Bill Giarla

William F. Giarla

WFG:kem

bcc: Shannon Craig
A. Kammerer - via FAX

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Koppers Company, Inc., Pittsburgh, PA 15219
Telephone 412-227-2000

86-119

KOPPERS

MAY 04 1988

May 2, 1988

VIA FEDERAL EXPRESS

Mr. Lee M. Thomas
Administrator
United States Environmental
Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Mr. Robie G. Russell
Regional Administrator
United States Environmental
Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Re: Koppers Company, Inc.'s Storage Terminal
Located in Portland, Oregon

Gentleman:

Koppers Company, Inc. ("Koppers") owns and operates a storage tank terminal located in Portland, Oregon ("Northwest Terminal"). The Northwest Terminal operates as a transfer station for a number of products such as creosote, carbon pitch, and refined tars. While most of the facilities that manufacture these products are subject to the final Organic Chemicals and Plastics and Synthetic Fibers Category Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards ("OCPSF ELGs") promulgated by EPA at 52 Fed. Reg. 42522, 42568 (November 5, 1987), there are no manufacturing processes at the Northwest Terminal. The purpose of this letter

is to request a ruling that the OCPSF ELGs are not applicable to the Northwest Terminal. In the alternative, if EPA concludes that the OCPSF ELGs are applicable to the Northwest Terminal, this letter should be considered a request for a Fundamentally Different Factors ("FDF") variance under section 301(n) of the Clean Water Act, as amended, and, to the extent applicable, under 40 C.F.R. Part 125, Subpart D.

INTRODUCTION TO THE NORTHWEST TERMINAL

From 1966 to approximately 1972, the Koppers facility located at 7540 Northwest Street Helens Road, Portland, Oregon, was a tar processing plant which distilled crude coke oven tar.

In approximately 1972, the processing of tar ceased. The tar processing facility was abandoned and partially dismantled and in 1973 the facility became a transfer terminal. Creosote and other coal tar products are transferred from the tank cars to storage tanks. In addition, solid coal tar pitch occasionally is handled at the terminal. From the storage tanks, products are either pumped into tank trucks or drummed and delivered to customers.

The NPDES Permit for the Northwest Terminal facility was issued by the State of Oregon on January 8, 1988 and expires November 30, 1992. The source of the water discharged under this permit is stormwater run-off only.

APPLICABILITY OF THE OCPSF ELGS

The OCPSF ELGs are applicable to "process wastewater discharges" from establishments manufacturing OCPSF products or products otherwise set forth in the ELGs. 52 Fed. Reg. 42569 (1987)(to be codified at 40 C.F.R. §414.11). The term "process wastewater discharges" is defined as "discharges from all establishments that manufacture products or product groups listed in the applicability sections of this regulation . . . ." 52 Fed. Reg. 42523 (1987)(emphasis added). As noted in the Federal Register preamble to the OCPSF ELGs, "nonprocess wastewater is regulated by permit writers on a case-by-case basis . . . ." Id. at 42530. Thus, the OCPSF ELGs do not apply to facilities that do not operate an ongoing OCPSF manufacturing process.

As described above, there are no manufacturing processes at the Northwest Terminal. Thus, there are no "process wastewater discharges" from the terminal and the OCPSF ELGs are

not applicable to the terminal's NPDES discharge. The Northwest Terminal is certainly a better example in this regard than "stand-alone OCPSF research and development, pilot plant, technical service, and laboratory bench scale operations" which are expressly excluded from regulation under the OCPSF ELGS. Id. at 42523. Because the ELGs are not applicable, the terminal remains subject to the effluent limitations in the current NPDES permit which was written on a case-by-case basis by the State of Oregon.

Koppers believes that the inapplicability of the OCPSF ELGs to the Northwest Terminal is self-evident from the language of the ELGs. However, Koppers hereby requests an agency ruling on the issue to avoid any potential misunderstanding.

FUNDAMENTALLY DIFFERENT FACTORS

Section 301(n) of the Clean Water Act, as amended, provides that EPA may issue an FDF variance where the following conditions are found to exist:

1. The facility is fundamentally different with respect to the factors (other than cost) specified in section 304(b) or 304(g) and considered by the Administrator in establishing the OCPSF ELGs;

2. The FDF variance application is (a) based solely on information and supporting data submitted to the Administrator during the rulemaking for establishment of the OCPSF ELGs specifically raising the factors that are fundamentally different for such facility; or, (b) based on information and supporting data referred to in clause (a) and information and supporting data the applicant did not have a reasonable opportunity to submit during such rulemaking;

3. The alternative requirement is no less stringent than justified by the fundamental difference; and,

4. The alternative requirement will not result in a non-water quality environmental impact which is markedly more adverse than the impact considered by the Administrator in establishing the OCPSF ELGs.

As the following discussion illustrates, the Northwest Terminal satisfies these four criteria and therefore justifies an FDF variance.

Fundamental Differences

Section 304(b) of the Clean Water Act directs the EPA to consider the following factors when promulgating the OCPSF ELGs: the age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, the cost of achieving such effluent reduction, non-water quality environmental impact (including energy requirements), the total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application (best practicable control technology only), and such other factors as the Administrator deems appropriate.

The Northwest Terminal is fundamentally different from the factors considered by EPA in promulgating the OCPSF ELGs in one major and undeniable respect: the Northwest Terminal is not a manufacturing facility. Because the ELGs are designed to regulate discharges from manufacturing facilities, almost all of the factors listed in section 304(b) are different for the Northwest Terminal. Most notable, the processes employed, the engineering aspects of the application of control techniques, and the process changes at the terminal bear absolutely no resemblance to those of the manufacturing facilities considered by the EPA in promulgating the ELGs. See, e.g., 52 Fed. Reg 42528-529 (1987) (specific data collection effort for engineering cost methodology based upon questionnaires received from sixty-seven OCPSF manufacturers). Thus, the first requirement for an FDF variance is satisfied by the Northwest Terminal.

Submission of Information

Based upon our understanding that nonmanufacturing facilities were not subject to the proposed OCPSF ELGs, Koppers did not submit comments to EPA regarding the Northwest Terminal during the rulemaking. However, information regarding the fundamental differences of the Northwest Terminal was provided to EPA in Koppers' section 308 questionnaires. This information was again submitted indirectly to EPA during the recent NPDES permitting process for the facility. Thus, the second requirement for an FDF variance is satisfied by the Northwest Terminal.

Alternative Requirements

Koppers proposes that the Northwest Terminal remain subject to the effluent limitations in its current NPDES permit which were written by the State of Oregon on a case-by-case basis pursuant to section 402(a)(1) of the Clean Water Act. These limitations were calculated in accordance with the provisions of 40 C.F.R. Part 125, Subpart A, were approved by EPA, and, by definition, satisfy the third and fourth requirements for an FDF variance.

CONCLUSION

Koppers respectfully requests a ruling from the EPA that the OCPSF ELGs are not applicable to the Northwest Terminal because there is no manufacturing process and, hence, no process wastewater discharge at the facility. If, in the alternative, the EPA determines that the Northwest Terminal is subject to the OCPSF ELGs, Koppers hereby requests that the terminal's NPDES discharge be granted an FDF variance pursuant to section 301(n) of the Clean Water Act, as amended.

Sincerely,

James R. Batchelder
Vice President, Technology
and Environment
Tar and Wood Products Sector

cc: Jill M. Blundon, Esquire
~~Billie~~ S. Nolan, Esquire
Dean A. Calland, Esquire

Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

September 10, 1993

CERTIFIED MAIL NO. P-915-447-128
RETURN RECEIPT REQUESTED

Ms. Sandra Hart
Northwest Natural Gas Co.
220 NW 2nd Ave.
Portland, OR 97209

Re: Northwest Natural Gas Co.
ECSI ID # 84

Dear Ms. Hart:

The Oregon Department of Environmental Quality (DEQ) has completed a Preliminary Assessment Equivalent (PAE) for the Northwest Natural Gas Co. site. In completing the PAE, the DEQ reviewed its file information on the site, including a 1987 federal Preliminary Assessment (PA). A Strategy Recommendation is included.

As noted in the Strategy Recommendation, the DEQ has determined that further action is required at this site to address releases of hazardous substances that threaten public health or the environment. Specifically, further sampling needs to be performed to characterize the extent of soil and groundwater contamination caused by the past disposal of coal tars by the Portland Gas & Coke Company. As described in the Strategy Recommendation, DEQ anticipates that the investigation will involve sampling on portions of the site currently leased to Pacific Northern Oil Co. and Koppers Industries, and on adjacent property owned by Wacker Siltronic Corporation.

The DEQ looks to parties responsible under Oregon's Environmental Cleanup Law to undertake necessary action beyond the PAE. In general, persons who have owned or operated a site during the time releases of hazardous substances have occurred and persons who knew or should have known of the release when they purchased the property are strictly liable for investigation and cleanup costs. Persons who have caused or contributed to the release are similarly liable. Oregon's Environmental Cleanup Law, ORS 465.255, describes the liability provisions more specifically, including defenses allowed. If the DEQ conducts further investigation or remedial action, it may recover its remedial action costs against responsible parties. The DEQ may also require liable parties to undertake remedial action necessary to protect public health and the environment under ORS 465.260.

Persons potentially responsible for investigation and cleanup of a site have the following options for pursuing further action. They may:

- Request the DEQ to oversee further investigation or cleanup through its Voluntary Cleanup Program; or

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 5

To L. Flaherty	From Amos
Co.	Co.
Dept. EYI	Phone #
Fax #	Fax # 9/15/93

811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
TDD (503) 229-6993
DEQ-1

- Wait until the DEQ notifies them of its intent to pursue further action at the site, determine responsibility at that time, and pursue the action required; or

- Pursue further action independently of the DEQ. The DEQ will review independent work in accordance with its priorities and may require additional action at the site. DEQ will track its cost in reviewing any site information and will seek to recover those costs against persons liable under ORS 465.255 if it determines that removal or remedial action is needed or was needed at the time DEQ made its recommendation for further action.

The DEQ strongly encourages persons to pursue action through the Voluntary Cleanup Program. Under any of these options, the DEQ will either require an agreement to pay its oversight costs as work proceeds or will track its costs and seek to recover them against responsible parties at a later date. The DEQ has determined that this site is a priority for further action, and unless we hear from you in the requested time period, we will contact you to proceed under the first or second of the listed options.

The status of this site will be updated in our Environmental Cleanup Site Information (ECSI) database and the site recommended for listing on the DEQ's Confirmed Release List and Inventory of hazardous substances sites list pursuant to ORS 465.215 and 465.225 and OAR 340-122-430 and 440. A letter regarding listing will follow.

We appreciate your cooperation in addressing this site. Please let us know within 30 days of receipt of this letter whether you plan to proceed with further action at this site. I can be reached at (503) 229-5657. To discuss the Voluntary Cleanup Program, please contact Karla Urbanowicz, at (503) 229-6729.

Sincerely,

Heather Schijf

Heather Schijf, Coordinator
Site Assessment Section
Environmental Cleanup Division

KD:m
SA\SM5385
Enclosure: Strategy Recommendation
cc: John Oxford, Koppers Co., Inc.
Bob Salling, Pacific Northern Oil Co.
Rudolf Staudigl, Wacker Siltronic Corp.
Dick Bach, Stoel, Rives, Boley, etc.
Mary Wahl, ECD, DEQ
Mike Rosen, VCS, DEQ
Thomas Miller, SRS, DEQ
SAS file #84

DEQ SITE ASSESSMENT SECTION - STRATEGY RECOMMENDATION

Site Name: Northwest Natural Gas Co.

Site CERCLIS Number: 027734359

DEQ ECSI Number: 84

Site Address: 7540 NW St. Helens Road
Portland, OR 97210

Recommendation By: Kevin Dana, Environmental Specialist,
Site Assessment Section

Approved By: Heather Schijf, HS Coordinator,
Site Assessment Section

Date: June 7, 1993

Background:

There is conflicting information as to when operations began on-site. Apparently, Portland Gas and Coke Company purchased the site in the 1880's, and by 1913 had constructed a gasification plant. Portland Gas operated the plant until 1956, when it was transferred to Northwest Natural Gas Company. During this time, waste products from the gasification operations were deposited on-site. Until 1925, all waste products were discharged directly to the Willamette River. After 1925, tars were separated from the wastewater in settling ponds. A total of 30,000 cubic yards of coal tar accumulated in the ponds on the southern end of the property, near the shores of Doane Lake. 41,000 cubic yards of spent oxide were piled on the northern end of the property. Northwest Natural Gas razed most of the facilities in the late 1960's and built a liquified natural gas plant in their place. Five large above ground storage tanks were leased to Pacific Northern Oil Co. and used for oil storage, receiving, and distribution activities.

In 1965, the Koppers Company leased an eight acre portion of the site from Northwest Natural Gas and built a coal tar distillation plant. The distillation process produced oil, which was stored in an on-site tank farm. Waste streams of creosote and pitch were cooled and solidified in storage tanks, then apparently dumped into an on-site disposal pit. It is not precisely known how wastewater was disposed of. The plant operated until 1973, when it was shut down due to a lack of raw materials.

About this time, Northwest Natural Gas was sprucing up its property in preparation for building a substitute natural gas plant. (The plant was never constructed). Most of the spent oxide was hauled

to the Scappoose landfill. The rest was mixed with overburden and used to cover the coal tar pits to a depth of about ten feet. (Part of Doane Lake was apparently also filled in). Northwest Natural Gas then sold this portion of the site to Wacker Siltronic Corporation, which built a plant on at least part of the fill. (See ECSI #183 for more information on the Wacker Siltronic site).

The Koppers plant reopened in 1974, producing experimental batches of "electrode pitch". About 1975, Koppers installed a rainwater collection and treatment system around the tank farm to comply with a permit condition. (Apparently, the company had an NPDES permit for its surface water runoff, since the water was funnelled into a ditch). The "treatment" system simply consisted of an oil/water separator. Koppers also began to discharge its industrial wastewaters to the sewers under permit. Since about 1977, the facility is believed to have only been used for the bulk transfer of creosote oil and coal tar pitch.

In 1982, DEQ sampled five groundwater monitoring wells that ringed Koppers' waste disposal site. The wells were sampled for phenols. One sample had 24 mg/l; the other four samples were all under 1 mg/l. DEQ performed more extensive groundwater sampling in 1984. The sampling found naphthalene (48 mg/l), acenaphthene (45 mg/l), fluorene (65 mg/l), phenanthrene (240 mg/l), anthracene (330 mg/l), fluoranthene (110 mg/l), pyrene (88 mg/l), lead (236 mg/l), and ethylbenzene (380 mg/l), all of which are well above SOCLEAN's groundwater standards. DEQ also sampled the sediment in a containment basin, and found similar contaminants (only benzo(a)pyrene (120 ppm) was at levels that violated SOCLEAN). It is unclear exactly where the containment basin is located.

Camp Dresser & McKee, Inc. performed a "site characterization" in 1987, which incorporated the results of DEQ's sampling. (A copy of Camp Dresser's report was not in the file; however, a 1988 summary of the information by Tetra Tech was available). Also in 1987, Ecology and Environment (E&E) performed a Preliminary Assessment (PA) on the Koppers portion of the site for EPA. E&E recommended no further action under the federal Superfund, because the contamination was unlikely to affect human health. Because DEQ planned to conduct a study of area groundwater, EPA agreed to defer to state authority.

In 1990, DEQ signed a consent decree with the property owners in the Doane Lake area to study the area's groundwater contamination. The seven month study ended with a recommendation that the sites in the Doane Lake area be remediated separately. (See ECSI #36 for more information on the Doane Lake study).

Recommendation/Action:

The Site Assessment Section has reviewed file information relating to this site. Contamination at the site is extensive but does not pose an imminent threat to human health. The coal tars are buried under ten feet of fill, and groundwater in the area is not used for

Oregon

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

September 10, 1993

CERTIFIED MAIL NO. P-915-445-841
RETURN RECEIPT REQUESTED

Mr. John Oxford
Koppers Industries, Inc.
7540 NW St. Helens Road
Portland, OR 97210

Re: Koppers Co., Inc, Portland
ECSI ID # 84

Dear Mr. Oxford:

The Oregon Department of Environmental Quality (DEQ) has completed a Preliminary Assessment Equivalent (PAE) for the Northwest Natural Gas Co. site. As a lessee, your property at 7540 NW St. Helens Road is considered a part of the Northwest Natural Gas Co. site.

You should soon be receiving a copy of a letter that was sent to Northwest Natural Gas. As described in the letter, DEQ has determined that further sampling needs to be performed to characterize the extent of soil and groundwater contamination caused by the past disposal of coal tars by the predecessor company of Northwest Natural Gas. As part of its review of information in the Northwest Natural Gas site file, DEQ determined that a disposal pit exists on your property, into which waste streams of creosote and pitch were apparently dumped in the past. DEQ believes that further sampling is necessary in the pit area to determine if hazardous substances are present in concentrations that may pose a threat to human health or the environment.

The DEQ looks to parties responsible under Oregon's Environmental Cleanup Law to undertake necessary action beyond the PAE. In general, persons who have owned or operated a site during the time releases of hazardous substances have occurred and persons who knew or should have known of the release when they purchased the property are strictly liable for investigation and cleanup costs. Persons who have caused or contributed to the release are similarly liable. Oregon's Environmental Cleanup Law, ORE 465.255, describes the liability provisions more specifically, including defenses allowed. If the DEQ conducts further investigation or remedial action, it may recover its remedial action costs against responsible parties. The DEQ may also require liable parties to undertake remedial action necessary to protect public health and the environment under ORS 465.260.

0006

9/14/93
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To L. Flaherty	From Amos
Co. W. Turner	Co.
Dept. FYI	Phone #
Fax #	Fax #

811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
TDD (503) 229-6993
DEQ-1

Persons potentially responsible for investigation and cleanup of a site have the following options for pursuing further action. They may:

- Request the DEQ to oversee further investigation or cleanup through its Voluntary Cleanup Program; or

- Wait until the DEQ notifies them of its intent to pursue further action at the site, determine responsibility at that time, and pursue the action required; or

- Pursue further action independently of the DEQ. The DEQ will review independent work in accordance with its priorities and may require additional action at the site. DEQ will track its cost in reviewing any site information and will seek to recover those costs against persons liable under ORS 465.255 if it determines that removal or remedial action is needed or was needed at the time DEQ made its recommendation for further action.

The DEQ strongly encourages persons to pursue action through the Voluntary Cleanup Program. Under any of these options, the DEQ will either require an agreement to pay its oversight costs as work proceeds or will track its costs and seek to recover them against responsible parties at a later date. The DEQ has determined that the disposal pit is a priority for further action, and unless we hear from you in the requested time period, we will contact you to proceed under the first or second of the listed options.

We appreciate your cooperation in addressing this site. Please let us know within 30 days of receipt of this letter whether you plan to proceed with further action at this site. I can be reached at (503) 229-5657. To discuss the Voluntary Cleanup Program, please contact Karla Urbanowicz, at (503) 229-6729.

Sincerely,

Heather Schijf

Heather Schijf, Coordinator
Site Assessment Section
Environmental Cleanup Division

KD:m
SA\SM5384
cc: Sandra Hart, Northwest Natural Gas Co.
Dick Bach, Stoel, Rives, Boley, etc.
Mary Wahl, ECD, DEQ
Mike Rosen, VCS, DEQ
Thomas Miller, SRS, DEQ
SAS file #84

drinking. However, the contamination is apparently migrating, and may pose a threat to the environment. In May 1992, the Army Corps of Engineers found polynuclear aromatic hydrocarbons (PAHs) in the 5-20 ppm range in core samples in Willamette River sediments adjacent to the site. Site Assessment recommends that further sampling be performed to determine the extent of the soil and groundwater contamination. The Wacker Siltronic property should be included in this investigation. Because the known levels of groundwater contamination are so high, Site Assessment recommends that the sampling be given a high priority. Site Assessment also recommends that the site owner enter the Voluntary Cleanup Program. Finally, the site should be placed on the Confirmed Release List and the Inventory.

Referrals Within or Outside DEQ:

This site has not been referred to another division of DEQ or an outside regulatory agency. The Site Response Section was consulted regarding the disposition of this site.

Other:

This site is currently listed in DEQ's ECSI database under three filenames: Northwest Natural Gas Co. (ECSI #84); Koppers Company, Inc. - Portland (ECSI #62); and Pacific Northern Oil Co. (ECSI #396). The files will be combined under the filename Northwest Natural Gas Co. and updated with information contained in this decision document. The updated information will reflect Site Assessment's decision for further action at the site.

RECEIVED
SEP 15 1993
KOPPERS INDS., INC.
PORTLAND, OR

9/22 TC w/ Larry Flaherty
Chicago Tar (708) 656 5900
I described the DEQ document briefly
Larry thought it was:
correct re operations

Wrong re disposal pit. It was a, he thinks
a sprayfield for process wastewater - under permit
from DEQ
Sampling before (the sprayfield) showed hits there
before sprayfield was installed.

1982 - Mark Urbassic and Larry attended
mtgs w/ NW Nat Gas at which NWNG
admitted that when they shut their
plant down they spread waste
all over the place - across the
road in Wacker Siltronic facility
area. Notes of the mtg shd be in file.
They had tar pits that are still there.
You can step into them.
Sampling (was done and) could not tell the diff between gasifica-
tion constituents and tar constituents, Larry thinks

(AY, esq)

NWT 003238

M E M O R A N D U M

June 11, 1985

TO:	Robert Abendroth	Seattle
	Bill Baldwin	Pittsburgh
	Don Marion	Pittsburgh
	Neil Wallis	Portland
FROM:	John Denham	Seattle

SUBJECT: NORTHWEST TERMINAL WOODTREATING SITE

This is a status update regarding cleanup of soil at our Portland Oregon terminal where the Pentachlorophenol operation existed.

Following Don Marion and Bill Baldwin's March 13, 1985 visit, the following occurred:

a. On April 2, Bill B called to coordinate results of his contact with Koppers geologists. Bill requested sampling per enclosure 1. On April 4, Robert A agreed with this action. On April 5, Neil W was tasked to locate a firm to accomplish soil sampling and a laboratory which could handle this sizable soil analysis within a reasonable time frame at the lowest possible costs.

b. After a diligent search, it was learned there was only one firm in the area that had the capability to do this job - Riedel Environmental Services, Inc. On April 25, Riedel submitted their cost of $18,600 (enclosure 2). I asked for a cost breakdown. Riedel submitted it on May 18 (enclosure 3). Drilling cost of $7,544 is actual fee of drilling contractor Sweet and Edwards out of Kelso (I verified this). Analytical cost of $4,956 is strictly the laboratory charge for processing 96 samples from 16 holes at 6 six samples per hole. (Note this is 7 less holes than Bill B requested but covers a larger 80' x 80' area). Method of analysis is GC/MS, which is the only one allowed by EPA/DEQ. Cost to analyze each sample is $51.63. Labor cost of $3,985 includes taking nine additional composite surface samples (3 on northeast, 3 on east and 3 on south) outside bermed area to determine soil contamination boundaries, taking the 96 samples mentioned above, drawing the drilling plan, preparing the contour map which shows location of contamination at the various depths, supervision of entire job on site by a qualified hydrologist and writing the report. Other direct costs of $2,115 cover decontamination of equipment between the taking of each sample, sample jars, safety gear used, drums for and disposal of decontamination solvent used for all equipment decontamination and the bentonite used to plug all holes drilled.

c. Contract with Northwest Vacuum Truck Service was negotiated (enclosure 4). Certificate of insurance coverage (enclosure 5) and contract bond (enclosure 6) were obtained from contractor. An "approved" transporter was obtained (Gresham Transfer Service).

d. Disposal request for contaminated soil was approved by DEQ (Enclosure 7).

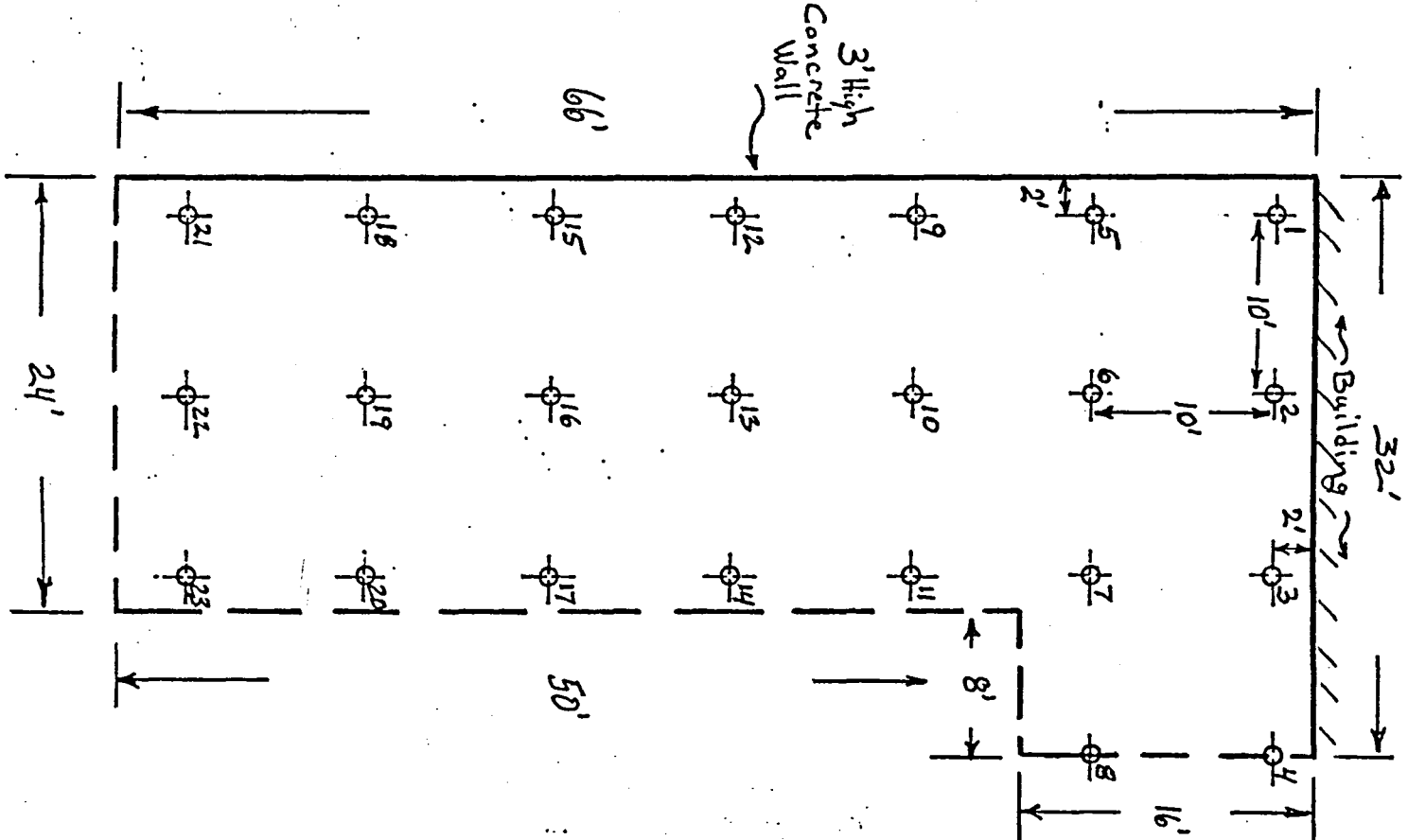
e. Hazardous Waste Manifests with appropriate instructions were obtained (enclosure 8).

f. The required "Waste Transportation and Disposal Agreement" was obtained from Chem-Security Systems, operators of the Arlington disposal facility (enclosure 9). I disagreed with item 2(b) on page 17 (in that it limited disposal on this tender to only one movement) and item 10(c) on page 20 (in that there was no price break after 250 tons as was originally quoted). Telecon contact with their offices resulted in satisfactorily worded replacement pages for agreement, which arrived today and are included in enclosure 9.

At this point in time, everything seems to be "go". All arrangements have been made to start the first phase of digging, hauling and disposing on June 24, 1985. I will be on site. Plan is to remove and dispose of several truck loads of soil, stop, have sampling and analyses done, then repeat as needed. This approach takes advantage of lower disposal costs (prior to July 1) and the conduct of the expensive sampling and analysis only one time. Current known costs for first phase are $53,000 plus $18,600 = $71,600.

JPD/ch

Encl. 1



NORTHWEST TERMINAL WOODTREATING SOIL SAMPLING PLAN

Scale: 1" = 10'

1. Drill 23 holes and obtain samples from each.

2. On holes 2, 3, 4, 6 & 7:
   a. Sample at 6", 1', 2', 3', 5', 10' and 15' levels.
   b. Analyze samples at 1', 2', 3', 5' & 10' levels (25 analyses). Also analyze holes 2,3 & 6 at 15' level.
   c. Hold remaining samples at 40 degrees F.

3. On all other holes:
   a. Sample at 6", 1', 2', 3', 5' and 10' levels.
   b. Analyze samples at 6", 1', 2' & 3' levels (72 analyses).
   c. Hold remaining samples at 40 degrees F.

CHEM-SECURITY SYSTEMS, INC.

NATIONAL RESPONSE CENTER 1-800-424-8802
OREGON ACCIDENT RESPONSE CENTER 1-800-452-0311

Please print or type. (Form designed for use on elite (12-pitch) typewriter)

Form Approved. OMB No. 2000-0404. Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.	Manifest Document No.	2. Page 1 of
		Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address

4. Generator's Phone ( )

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name — 6. US EPA ID Number — C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name — 8. US EPA ID Number — E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address — 10. US EPA ID Number — G. State Facility's ID

Chem-Security Systems, Inc.
Star Route
Arlington, Oregon 97812 — **ORD 089 452 353**

H. Facility's Phone: **503-454-2643**

11. US DOT Description (*Including Proper Shipping Name, Hazard Class, and ID Number*)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	EPA/L Waste No.
a.						
b.						
c.						
d.						

J. Additional Descriptions for Materials Listed Above
a.
b.
c.
d.

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information **Waste Profile Sheet Number(s)**
a.
b.
c.
d.

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

Printed/Typed Name	Signature	Date (Month / Day / Year)

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month / Day / Year)

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month / Day / Year)

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Date (Month / Day / Year)

EPA Form 8700-22 (3-84)

NWT 003242

4.0 MANIFEST REQUIREMENTS

When hazardous waste is transported from the generator's location to the Arlington Facility, the Oregon DEQ, U.S. DOT and EPA require proper manifesting. Beginning September 20, 1984, these agencies required use of a uniform hazardous waste manifest form (Exhibit 7a) and, where necessary, a continuation sheet (Exhibit 7b).

Each load of chemical waste shipped to the Arlington Facility must be accompanied by one or more properly completed uniform manifests. All copies of manifests and continuation sheets must be legible. If manifest forms are needed by the generator, treater or transporter, they can be obtained by contacting the appropriate Chem-Security Systems sales office. When the transporter arrives at the Arlington Facility, the manifest(s) and other shipping paper(s) must be presented to the site receiving clerk for verification.

4.1 WHEN TO USE THE CONTINUATION SHEET

The continuation sheet must be used if:

- o More than two transporters are used to transport the waste, or;
- o More space is required for U.S. DOT description and related information in Section 11 of the manifest.

4.2 GENERATOR SUPPLIED INFORMATION REQUIRED ON MANIFESTS

To meet all the applicable current regulations on manifesting of hazardous waste to the Arlington Facility, and to help us efficiently and speedily handle waste loads, the items described below are needed on a properly completed manifest. A sample completed manifest is shown in Exhibit 7c. States other than Oregon may require other information (see Exhibit 7d).

NWT 003243

Continuation Sheet Section #	Manifest Section #	
21	1	Generator's EPA identification number and annually unique manifest document number (preprinted on CSSI supplied manifest forms, must be added on continuation form).
22	2	Number of pages used (manifest) and page number of this sheet (continuation sheet).
23	3-4	Generator's name, mailing address (address where manifest records are kept), and telephone number. The continuation sheet requires name only.
24-27	5-8	Name and EPA identification number of each transporter.
O and Q	D and F	Phone number of each transporter.
None	9, 10, H	Name, address, EPA identification number, and phone number of the designated disposal facility (preprinted on manifests and continuation sheets provided by CSSI).
28	11	DOT proper shipping name, hazard class, identification number (49 CFR Parts 172.101, 172.202, and 172.203); and, a. Designation of whether the waste is hazardous material (check "HM" column), or b. Designation, if the waste is a hazardous substance (write "RQ" instead of a check in the "HM" column) and listing of the

NWT 003244

constituent making the waste a hazardous substance after the proper shipping name, if it is not part of the proper shipping name.

29 12 Enter the number of containers for each waste and the appropriate abbreviation from the table below for type of container.

DM = Metal drums, barrels, kegs
DW = Wooden drums, barrels, kegs
DF = Fiberboard or plastic drums, barrels, kegs
TP = Tanks portable
TT = Cargo tanks (tank trucks)
TC = Tank cars
DT = Dump truck
CY = Cylinders
CM = Metal boxes, cartons, cases (including roll-offs)
CW = Wooden boxes, cartons, cases
CF = Fiber or plastic boxes, cartons, cases
BA = Burlap, cloth, paper, or plastic bags

30-31 13-14 Enter the total quantity of waste at 13 and the unit of measure abbreviation from the table below at 14. The quantity should be as precise as possible.

G = Gallons (liquids only)
P = Pounds
T = Tons (2,000 pounds)
Y = Cubic yards
L = Liters (liquids only)
K = Kilograms
M = Metric tons (1,000 kg)
N = Cubic meters

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R	I	EPA waste number (if the waste is hazardous under RCRA).
S	J	Oregon Department of Environmental Quality's approved waste description, per Generator's Waste Profile Sheet description - "Waste Name" and physical state.
32	15	Please enter Waste Profile Sheet number(s) here. If an alternate facility is designated, information and identification number must appear here. Generators may use this space to indicate special transportation treatment, storage or disposal information.
None	16	Generator's Certification. Generator must read, sign by hand, and date this section. Please include this person's title along with printed/ typed name in the space provided.

For each lab pack drum, an itemized list of each waste container placed in the drum showing waste description and volume, must be stapled to the manifest. This list should be readily identifiable with a specific drum through a drum numbering or other system.

For certain PCB wastes, the following additional information is required:

- For any PCB article, the date each item was placed in storage for disposal should be written in Section 15 (this date must also appear on the article container).
- For each less than 500 ppm PCB liquid container or transformer waste write in PCB concentration on the manifest in Section 15, and staple to the manifest a lab analysis signed by a qualified analyst.
- For drained and flushed transformers, a statement that each unit was drained and flushed in accordance with 40 CFR 761 must be signed by a responsible representative of the generator and stapled to the manifest.

NWT 003246

- o For full transformers or empty ones requiring flushing at Arlington, if it is not possible for the generator to determine the exact gallonage of PCB transformers, a designation of "estimated" volume should be stated on the manifest.
- o For each container of PCB capacitors a list of manufacturer name, serial number, and KVAR for each capacitor inside must be stapled to the manifest.

4.3 TRANSPORTATION INFORMATION

Continuation Sheet #	Manifest Section #	
33-34	17-18	Enter the name of the person accepting on behalf of the transporter. That person must sign, acknowledging acceptance of the waste. Use 17 for first transporter, 18 for second, and use continuation sheet for additional transporters.

4.4 TSD SUPPLIED INFORMATION

Continuation Sheet Section #	Manifest Section #	
35	19	The authorized representative of the designated facility must note in this space any significant discrepancy between waste described and waste actually received (see Section 9.1).
None	20	The person accepting waste on behalf of the facility must acknowledge acceptance of the waste by signing and entering date of receipt.

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4.5 MANIFEST COPIES

The manifest consists of at least the number of copies which will provide the generator, each transporter, and the Arlington Facility with one copy for their records and an additional copy to be returned to the generator. On CSSI pre-printed manifest forms the use of each copy is designated at the bottom center. After the first transporter signs the manifest, the generator keeps one copy of the manifest and the remaining copies and the original remain with the transporter to accompany the shipment to the disposal facility or to another transporter or treater.

A signed copy of the manifest for loads of waste accepted at the Arlington Facility will be returned to the generator attached to the invoice for the waste shipment.

4.6 UNMANIFESTED WASTES

Wastes that arrive at the facility without manifests or approved Waste Profile Sheets may be returned to the generator as required under 40 CFR Part 262, State of Oregon requirements, and compliance policy.

NWT 003248

CHEM-SECURITY SYSTEMS, INC.

EXHIBIT 7a

NATIONAL RESPONSE CENTER 1-800-424-8802
OREGON ACCIDENT RESPONSE CENTER 1-800-452-0311

Please print or type
(Form designed for use on elite (12-pitch) typewriter)

Form Approved. OMB No. 2050-0039 Expires 7-31-88

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. . . . . Manifest Document No. 01207

2. Page 1 of

Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address

4. Generator's Phone ( )

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name

6. US EPA ID Number

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address

Chem-Security Systems, Inc.
Star Route
Arlington, Oregon 97812

10. US EPA ID Number

ORD 089 452 353

G. State Facility's ID

H. Facility's Phone
503-454-2643

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	HM	12. Container No.	12. Container Type	13. Total Quantity	14. Unit Wt/Vol	EPA/I. Waste No.
a.						
b.						
c.						
d.						

GENERATOR

J. Additional Descriptions for Materials Listed Above

a.
b.
c.
d.

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information **Waste Profile Sheet Number(s)**

a.
b.
c.
d.

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

Printed/Typed Name	Signature	Date (Month / Day / Year)

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month / Day / Year)

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month / Day / Year)

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Date (Month / Day / Year)

CHEM-SECURITY SYSTEMS, INC

EXHIBIT 7b

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039 Expires 9-30-86

UNIFORM HAZARDOUS WASTE MANIFEST
(Continuation Sheet)

21. Generator's US EPA ID No.	Manifest Document No.	22. Page	Information in the shaded areas is not required by Federal law.

23. Generator's Name

L. State Manifest Document Number

M. State Generator's ID

24. Transporter _____ Company Name

25. US EPA ID Number

N. State Transporter's ID

O. Transporter's Phone

26. Transporter _____ Company Name

27. US EPA ID Number

P. State Transporter's ID

Q. Transporter's Phone

28. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	HM	29. Containers No	Type	30. Total Quantity	31. Unit Wt/Vol	R. Waste No.
a.						
b.						
c.						
d.						
e.						
f.						
g.						
h.						
i.						

GENERATOR

S. Additional Descriptions for Materials Listed Above

a.
b.
c.
d.
e.
f.
g.
h.
i.

T. Handling Codes for Wastes Listed Above

32. Special Handling Instructions and Additional Information

Waste Profile Sheet Number(s)

a.
b.
c.
d.
e.
f.
g.
h.
i.

TRANSPORTER

33. Transporter _____ Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month / Day / Year)

34. Transporter _____ Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month / Day / Year)

FACILITY

35. Discrepancy Indication Space

CHEM-SECURITY SYSTEMS, INC. EXHIBIT 7c NATIONAL RE[illegible]SE CENTER 1-800-424-8802
OREGON ACCIDENT RESPONSE CENTER 1-800-452-0311

Please print or type
Form designed for use on elite (12-pitch) typewriter

Form Approved OMB No 2000-0404 Expires 7 31 86

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. O.R.D.0.0.0.0.1.2.3.4.5 Manifest Document No. 01297
2. Page 1 of 1 — Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address
X Y Z COMPANY
123 Main Street, Process, Oregon

4. Generator's Phone (503) 555-1234

A. State Manifest Document Number
B. State Generator's ID

5. Transporter 1 Company Name: CHEM-SECURITY SYSTEMS, INC.
6. US EPA ID Number: O.R.D.0.8.9.4.5.2.3.5.3
C. State Transporter's ID
D. Transporter's Phone: 503/454-2643

7. Transporter 2 Company Name
8. US EPA ID Number
E. State Transporter's ID
F. Transporter's Phone

9. Designated Facility Name and Site Address
Chem-Security Systems, Inc.
Star Route
Arlington, Oregon 97812
10. US EPA ID Number: ORD 089 452 353
G. State Facility's ID
H. Facility's Phone: 503-454-2643

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	HM		12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	EPA/I. Waste No.
a.	RQ	Waste Hydrofluoric acid solution corrosive material UN 1790	001	TT	3000	G	D002
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
a. Hydrofluoric Acid Etchant waste, liquid
b.
c.
d.

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information — Waste Profile Sheet Number(s)
a. D85311
b.
c.
d.

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

Printed/Typed Name	Signature	Date Month	Day	Year
John Jones		9	20	84

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month	Day	Year
Robert Smith		9	20	84

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month	Day	Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Date Month	Day	Year

GENERATOR — TRANSPORTER — FACILITY

EPA Form 8700-22 (3-84)

NWT 003251

Bill - Your team first - OK?

call Wed. 703 816-8632 Kim Nash

S. Back to me next week

FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN

Northwest Natural Gas Company
Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

August 4, 1995

HAHN AND ASSOCIATES, INC.
Environmental Management

434 NW 6th Avenue, Suite 203
Portland, Oregon 97209-3600
503/796-0717 • 503/227-2209 FAX

Recycled Recyclable

FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN

Northwest Natural Gas Company
Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

August 4, 1995

Prepared for:

Northwest Natural Gas Company
Portland, Oregon

Prepared by:

Hahn and Associates, Inc.
Portland, Oregon

HAI Project #2708

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E Example Chain-of Custody Form

F Example Project Field Notes Form

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FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN

Northwest Natural Gas Company
Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

August 4, 1995

1.0 INTRODUCTION

The Northwest Natural Gas Company (NWNG) has retained the environmental management firm of Hahn and Associates, Inc. (HAI) to perform a Remedial Investigation/Feasibility Study (RI/FS) at the NWNG Gasco facility, 7900 NW St. Helens Road, Portland, Oregon (Figure 1). NWNG has also retained Decision Focus Incorporated ("Decision Focus") to perform an Endangerment Assessment for the Gasco site. NWNG and the Oregon Department of Environmental Quality (DEQ) have entered into an Agreement for Remedial Investigation/Feasibility Study (DEQ No. ECVC-WMCVC-NWR-94-13) for the Gasco site. This Work Plan is intended to meet the *Draft RI/FS Work Plan* requirement as outlined in the RI/FS Agreement.

The RI/FS Work Plan presents a phased approach for the investigation of the Gasco site and is partially based on the Expedited Site Characterization (ESC) process[1]. The ESC is a flexible and iterative process that involves the development of a dynamic work plan that serves as a guide for investigation and can be modified as necessary. The ESC process recognizes that uncertainties are involved in the investigation and remediation of a site, and that there is a point in the investigation and design process where additional study only leads to marginal returns of value. The ESC process is performed by an interdisciplinary team that is involved in all phases of the site characterization.

---

[1] J. C. Burton et al, Argonne National Laboratory, *Expedited Site Characterization: A Rapid, Cost-Effective Process for Preremedial Site Characterization*, Proceedings of Superfund XIV: Conference and Exhibition (December 1993).

The RI/FS for the subject site will be performed in phases as three general projects as follows:

- Phased Remedial Investigation
- Endangerment Assessment
- Feasibility Study

A Remedial Investigation of soils, groundwater, surface water, sediments, and air at the subject site will be performed by HAI in at least two phases. An Endangerment Assessment that will assess the risks to human health and the environment at the site will be performed by Decision Focus. The Endangerment Assessment will be finalized based on the results of the Remedial Investigation. Based on the results of the Remedial Investigation and the Endangerment Assessment, a Feasibility Study will be prepared for the site that will evaluate the potential remedial action alternatives.

This RI/FS Work Plan document is composed of a number of plans including:

- Remedial Investigation (Site Characterization) Plan
- Project Management Plan
- Sampling and Analysis Plan (SAP)
- Health and Safety Plan
- Endangerment Assessment Work Plan
- Feasibility Study Work Plan

Elements of a Quality Assurance Project Plan (QAPP) are included in the SAP. Therefore a separate QAPP is not included in the RI/FS Work Plan.

Laboratory QAPP Should be included

2.0 REMEDIAL INVESTIGATION/FEASIBILITY STUDY OBJECTIVES

The primary objectives of the proposed RI/FS activities at the Gasco site are to:

- Perform an evaluation of the hydrogeologic conditions at the subject site, including determining site lithology, evaluating vertical and horizontal gradients, flow direction, rate of flow, and potential stratigraphic controls for contaminant migration beneath the site
- Confirm the contaminants of concern at the site
- Determine the media that have been affected by the contaminants of concern at the site, e.g. soil, surface water, groundwater, sediments, and/or air
- Characterize the nature and extent of the contaminants of concern in the affected media at the site
- Identify migration pathways for the contaminants of concern and determine the direction and rate of migration of the contaminants in the affected media
- Perform an assessment of the risks to human health and/or the environment posed by the subject site
- Obtain information that can be utilized in a feasibility study to select appropriate remedial action(s).

An evaluation of the aforementioned objectives indicates that the proposed investigations at the site will be gathering data for four general purposes:

- Hydrogeologic characterization
- Contaminant characterization
- Risk assessment
- Remedial action selection.

3.0 SITE DESCRIPTION

For purposes of this RI/FS Work Plan, the NWNG Gasco site comprises approximately 47 acres on the west bank of the Willamette River in the North Doane Lake area. The site is located in the Northwest Industrial Area of Portland which has been an industrial area for over 80 years. The Gasco site includes NWNG's established liquefied natural gas (LNG) facility and parcels leased to Pacific Northern Oil Company (PNO) for bulk fuel storage and distribution, and to Koppers Company, Inc. (Koppers) for creosote oil distribution (Figure 2). The LNG facility is a crucial component of NWNG operations. Due to permit limitations, this facility cannot be relocated. Leases with PNO and Koppers have recently been re-negotiated.

The Gasco site was the former location of the Portland Gas and Coke Company oil gasification facility from 1913 to 1956. The locations of former structures and features associated with the former gas manufacturing facility are shown on Figure 3.

The most detailed history of the operations at the Gasco site that is available is included in a report prepared by Camp Dresser & McKee Inc. ("Camp Dresser"), 1987[2]. Excerpts from the 1987 Camp Dresser report relating to the history of operations at the site are included in Appendix A. Discussions in this RI/FS Work Plan regarding potential source areas (Section 4.2) and contaminants of concern (Section 4.3) rely, in part, on the 1987 Camp Dresser report. The potential source areas and contaminants of concern at the site are summarized on Table 1.

---

[2] Camp Dresser & McKee Inc., *North Doane's Lake Site Characterization Work Plan*, (June 1987).

A detailed report on the hydrogeology of the Doane Lake area was prepared by Geraghty & Miller, Inc., 1991[3]. A summary report prepared by Mr. Eric Blischke[4] of the DEQ in April 1994 contains a good synthesis of the investigative and regulatory history of the Gasco site and a summary of the hydrogeology of the area. A copy of the April 1994 DEQ report is include in Appendix B.

4.0 PRELIMINARY CONCEPTUAL MODEL OF SITE

A preliminary conceptual model is presented here based on the investigations performed to date at the site and in the surrounding area. This model presents an interpretation of the most probable site conditions as suggested by the available data. Phase I of the Remedial Investigation has been designed based on this preliminary conceptual model. The information gathered during the Phase I investigation will be utilized to modify or reconstruct the conceptual model if necessary. Subsequent investigations will be performed and the conceptual model modified in an iterative manner until the conceptual model is verified with a high degree of confidence and further uncertainties can be handled as reasonable deviations from the model.

---

[3]Geraghty & Miller, Inc., *Hydrogeological Investigation of the Doane Lake Area, Portland, Oregon*, prepared for The Industrial Group Doane Lake Area (February 1991).

[4]Blischke, Eric, Oregon Department of Environmental Quality, *Northwest Natural Gas – North Doane Lake*, Interoffice Memorandum (April 20, 1994).

4.1 Preliminary Hydrogeologic Model

The preliminary conceptual model of the hydrogeology of the site is shown schematically on Figure 4. The geologic units of interest in the vicinity of the subject site can be subdivided as follows, from youngest to oldest:

- Fill Unit
- Alluvial Deposits
  - Willamette River Deposits
  - Catastrophic Flood Deposits
- Columbia River Basalt

It is assumed that the bedrock beneath the subject site is composed of the Columbia River Basalt and that the Troutdale Formation is absent beneath the Gasco site. The basalt surface dips steeply to the northeast, with the top of the basalt lying at depths of less than 50 feet below ground surface (bgs) along the southwest border of the site at NW St. Helens Road and at depths of greater than 150 feet bgs along the northeast border of the site at the Willamette River.

Overlying the basalt at the site are alluvial deposits composed of unconsolidated sands, silts, and clays ranging in thickness from approximately 50 to 150 feet. The alluvial deposits have been differentiated by Geraghty & Miller, 1991, into the Catastrophic Flood Deposits and Willamette River Deposits. Since these two units may be difficult to differentiate in places, the conceptual model groups the two units together and refers to them as undifferentiated Alluvial Deposits. The uppermost unit of the Alluvial Deposits at the site has been identified as a clayey silt by Camp Dresser, 1987. Determining the presence, continuity, and permeability (both to water and tar) of this Clayey Silt Unit will be of critical importance for the investigations at the site, since this unit may act as a barrier to downward migration of contaminants at the site.

The Alluvial Deposits are overlain by a surface Fill Unit that may be up to 25 feet thick in places. Although most of the Fill Unit is likely composed of hydraulically-placed sands

and silty sands, areas of the site have been filled with various materials, including lampblack, spent oxide, tars, and quarry reject rock.

Groundwater occurs in two principal hydraulic systems at the site including the unconfined Alluvial Aquifer in the Alluvial Deposits and semi-confined Basalt Aquifers in the Columbia River Basalts. The water table at the site likely occurs at depths of 15 to 20 feet bgs. Groundwater may also be locally found in the Fill Unit in areas where the depth of fill is below the water table. Groundwater flow direction is estimated to be towards the north to northeast. Groundwater in the Alluvial Aquifer likely discharges directly to the Willamette River. Groundwater in the Basalt Aquifers likely discharges to the Alluvial Aquifer in places. It is anticipated that downward vertical hydraulic gradients will be present in the Alluvial Aquifer throughout most of the site, with possible reversals of vertical gradient near the Willamette River.

4.2 Potential Contaminant Sources

The potential sources of contamination at the Gasco site are subdivided into two general areas: 1) process or operational areas and 2) by-product and residue placement areas. These potential source areas were identified from a review of the operational history of the site prepared by Camp Dresser, 1987 (Appendix A). The locations of the potential source areas at the site are shown on Figure 5. A summary of the identified source areas and the potential contaminants of concern in each area is presented on Table 1.

The process areas of concern at the site are identified as:

- Retort Area – Mfg Gas
- Tar Processing Area ? – Mfg Gas
- Light Oil Plant/Koppers Plant
- Naphthalene Plant
- Coke Oven Area Mfg Gas
- Pitch Plant/Tar Loading Area – Mfg Gas?
- Oxide Reactor Area
- PNO Tank Farm

any others ons? See p. 14

The by-product and residue placement areas of concern at the site are identified as:

- Lampblack Storage/Central Fill Area
- Spent Oxide Storage Area Mfg Gas
- Settling Ponds/South Fill Area Mfg Gas
- Koppers Land Treatment Area

4.3 Predicted Contaminants of Concern

Based on the history of the operations at the Gasco site, and based on the experience of investigations at other manufactured gas facilities, the potential contaminants of concern at the subject site are:

- Polynuclear aromatic hydrocarbons (PAHs)
- Volatile aromatic hydrocarbons, including benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Total petroleum hydrocarbons (TPH)
- Phenols
- Lead
- Cyanide

PAHs are present in the raw materials, by-products, and residues of the oil gasification process and also in Koppers' past and current processes at the site, including heavy oils, oil tars, lampblack, creosote, pitch, and coke. PAHs are also present in the fuels stored at the PNO facility including bunker and diesel fuels. PAHs are generally considered to be the primary contaminants of concern at manufactured gas sites, particularly the carcinogenic PAHs. PAHs have been detected at the Gasco site.

Volatile aromatic hydrocarbons are present in the motor fuels and light oils that were produced at the Gasco facility and have been detected at the site.

Although total petroleum hydrocarbons (TPH) is listed as a contaminant of concern at the subject site, TPH is not expected to constitute a significant portion of the total risk at the site. TPH contains other compounds that are contaminants of concern, notably PAHs and BTEX. Therefore, TPH will be used as a screening parameter at the site to determine the presence of these other contaminants.

Again, what did NWN do with these by-prod before Koppers?

Phenols are present in the tar by-products of the oil gasification process. Phenols have been detected at the Gasco site in low concentrations.

Lead, a common additive to motor fuels, has also been detected at the Gasco site. Other metals, which may be expected at coal gasification sites, would not be expected at elevated concentrations at the subject site since the process used at Gasco was an oil gasification process.

interesting used to

Cyanide may be present at the site due to the use of oxide reactors (for purifying the manufactured gas) and the storage of spent oxide materials at the site. However, the experience of investigations at other manufactured gas plants has shown that free cyanide is generally not present at levels of concern. Camp Dresser, 1987, suggests that the potential for high cyanide levels at the site appears small because the oil gas generally had a low nitrogen content and the feed rate of ammonia was low in a low temperature and low pressure process.

Preliminary sampling of soil and groundwater at the Gasco site, appears to confirm that the contaminants of concern are limited to the aforementioned parameters.

4.4 Additional Potential Contaminants

For various reasons, additional chemicals may be potential contaminants at the Gasco site. These potential contaminants will be investigated in phases at the areas where they are most likely to be present. If the potential contaminants are not detected in the areas most likely to be impacted, then additional investigation for the potential contaminants

will not occur. However, if any of the potential contaminants are detected, then they will be elevated to known "contaminants of concern", and additional investigations will occur for these chemicals. The additional potential contaminants at the site include:

- Hydrogen sulfide (H_2S)
- Ammonia (NH_3)
- Chlorinated pesticides and solvents
- Metals

The potential exists for hydrogen sulfide (H_2S) to be present in spent oxide that did not fully oxidize. However, the presence of significant H_2S levels in the soils at the site appears remote because the spent oxide piles were either removed from the site or were moved and mixed with other fill at the site. The loading, transporting, mixing, and filling process likely allowed for adequate liberation of any residual H_2S. However, an evaluation for dissolved H_2S in the groundwater will take place in areas where spent oxide was stored and/or used as fill.

Ammonia (NH_3) was utilized during the gas purifying process. An evaluation of the groundwater for NH_3 down-gradient of the oxide reactor area will take place to determine the presence of this potential contaminant.

Although not used at the Gasco facility, chlorinated solvents and pesticides have been detected on the adjacent Wacker Siltronic Corporation ("Wacker") site and the nearby Rhone Poulenc Ag Company site. Since these chlorinated compounds can affect the mobility of other contaminants and would impact the selection of a remedial action, an evaluation will be performed for the presence of chlorinated pesticides and solvents at locations that would most likely detect these compounds if they are migrating onto the site in the groundwater. Given current knowledge of where these chlorinated compounds were detected on the nearby sites and the groundwater flow direction, testing for chlorinated pesticides and solvents in the groundwater will take place on the southeast portion of the Gasco site. If during the Phase I investigation, it is found that groundwater flow direction is different than expected, then additional areas of the Gasco site may be evaluated for the chlorinated compounds.

Naturally-occurring metals in the soils can be mobilized in groundwater due to changes in groundwater chemistry resulting from subsurface contamination by organic compounds. An evaluation of groundwater will take place at the Gasco site to determine the presence of elevated levels of Priority Pollutant metals. The selection of the monitoring wells where sampling for Priority Pollutant metals will take place will occur after the results of the sampling for organic contaminants has been received. Only those wells where significant groundwater contamination was detected will be sampled for Priority Pollutant metals, as this should represent a worst-case situation for the presence of mobilized metals.

4.5 Potentially Affected Media

The various media that may be affected by the contaminants of concern at the subject site include:

- Surface and Subsurface Soil
- Groundwater
- Surface Water
- Sediments
- Air

Both surface or subsurface soil in the vicinity of any of the identified source areas could potentially be impacted by the contaminants of concern. PAHs were previously detected in surface soil samples collected in the vicinity of the former Naphthalene Plant, Coke Oven Area, and Koppers Land Treatment Area.

Mentions of Koppers area makes me suspicious I agree

Groundwater may contain constituents of the source areas where free product or soil contamination has reached the depth of the water table. Due to the hydrogeology of the area, it is postulated that the groundwater only in the Fill Unit and upper Alluvial Deposits may be impacted at the site. PAHs, phenols, and lead have been detected in the shallow

groundwater at monitoring wells located at the Koppers facility. BTEX compounds are also suspected to be present in the groundwater in this area.

The surface water bodies that may potentially contain contaminants at the site include, the settling ponds and drainage ditch located on the southeastern portion of the site, and the Willamette River.

Process water may have flowed to the Willamette River in the early years of operation possibly depositing tar and lampblack in the river sediments. Some sediments deposited prior to 1936 were likely covered by subsequent filling along the shoreline. The potential for contamination of these pre-1936 sediments will be evaluated as part of the soil investigation at the site. Sediments along the current-day shoreline may also contain contaminants from groundwater or free-phase contaminants that may have or may be migrating into the river from the site. Due to the industrial nature of up-stream properties on the Willamette River, it is likely that contaminants from up-stream sources will also be present in the sediments adjacent to the Gasco site.

Air may be periodically impacted if dust is stirred up from surface soils that contain contaminants. The dust could be naturally wind blown or stirred up by vehicular traffic or other activities. Non-volatile contaminant can become airborne as particles or adhered to soil dust particles. It is also possible that air may be impacted by the volatilization of volatile contaminants from contaminated soils or surface water.

4.6 Estimated Nature and Extent of Contamination

A preliminary conceptual model of the nature and extent of the contaminants of concern at the subject site will be discussed in this section. The nature of the various types of potential contamination that may be present at the site can be predicted with some certainty given a knowledge of the operations at the site. The extent of the potential contaminants can be estimated given a general knowledge of the hydrogeology of the site. However, it has not been confirmed that the expected contaminants are actually present at all or many of the

areas of the site. The conceptual model of the nature and extent of contamination at the site was used to help design the Phase I Remedial Investigation. The model will be revised and refined based on the results of the Phase I investigation.

The contaminants at the site will likely occur in a number of states including:

- Solid – spent oxide, lampblack, naphthalene, coke, and pitch, and as airborne particulates
- Semi-solid – tar, creosote, and pitch
- Liquid – tar, creosote, light oil, and petroleum fuels
- Dissolved – BTEX, PAHs, phenols, cyanide, and Pb
- Vapor – BTEX

The solid and semi-solid contaminants will be found primarily as fill material in the by-product and residue placement areas such as the former Settling Ponds, Lampblack Storage/Fill Area, and the Spent Oxide Storage Area. Other areas where solid contaminants may be expected are in the former Coke Oven, Pitch Plant, and Naphthalene Plant areas, and in the current area of pencil pitch storage at Koppers. Once in place, the solid and semi-solid contaminants are considered to be relatively immobile. However, percolating surface waters may pass through the solid and semi-solid material and leach dissolved contaminants to the water table. This would primarily be a concern with tars and pitch where PAHs (i.e. naphthalene) could possibly be leached to groundwater. If stirred up, some of the solid contaminants could pose a risk as airborne particulate material, such as lampblack, coke dust, or pencil pitch dust.

Liquid contaminants in the subsurface will occur either as free-phase liquids or as residual liquids adsorbed onto the soils. Free-phase liquids are mobile in subsurface soils whereas residual liquids are immobile in soils. Contaminants in free-phase liquid form will occur in the subsurface either as light non-aqueous phase liquids (LNAPLs) or dense non-aqueous phase liquids (DNAPLs). Given the general sandy nature of the Fill Unit at the site, it is suspected that non-aqueous phase liquids (NAPLs), if present, would have migrated to the water table unimpeded.

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LNAPLs, being lighter than water, will collect and pond on top of the water table and then migrate in the direction of groundwater flow. Possible LNAPLs at the site include light oils, motor fuels, and other petroleum products. LNAPLs may be present in the vicinity of and down-gradient of the Light Oil Plant and the PNO Tank Farm.

DNAPLs, being heavier than water, will tend to sink in the subsurface until some strata of low permeability is encountered that will slow or halt their downward migration. Possible DNAPLs at the site would include tar and creosote. Due to the viscous nature of tars and creosote, they are expected to be relatively immobile and would be found relatively close to their source areas. DNAPLs may be present in the vicinity of the former Retort Area, Tar Processing Area, Pitch Plant, Coke Oven Area, and the former Settling Ponds, all of which were associated with the manufactured gas plant. In addition, DNAPLs may be present in the vicinity of the Koppers Plant. The greatest potential for the presence of DNAPL tars is in the vicinity of the former Settling Ponds where large volumes of tar were known to be discharged. The conceptual model assumes that due to the viscous nature of tars and creosote, the Silty Clay Unit will act as a barrier for further downward migration of any DNAPLs at the site.

mfg Gas
Koppers

Residual liquid contamination, generally referred to as soil contamination, may be present in any of the source areas where liquids could have leaked, spilled, or have been discharged to the soils at the site. Soil contaminated with residual liquids may be present in the following areas at the subject site: Retort Area, Tar Processing Area, Light Oil Plant, Naphthalene Plant, Coke Oven Area, Settling Pond Area, Koppers Land Treatment Area, and the PNO Tank Farm. The vertical extent of soil contamination at the site is generally expected to occur in the unsaturated zone, in the zone of water table fluctuation where LNAPLs have been present, and possibly below the water table if DNAPLs have been present. The lateral extent of soil contamination will be dependent on the size of the releases from the source area and the lateral extent of LNAPL or DNAPL migration. The areas with the greatest extent of soil contamination at the site are expected to be the Light Oil Plant and Settling Pond areas.

Contaminants in dissolved form may be present in either surface water or groundwater. Waters percolating through contaminated soils or fill can leach contaminants to the water table to create a dissolved plume in the groundwater. If present, LNAPLs or DNAPLs are generally a source of dissolved contaminants in the groundwater. A dissolved plume will migrate with the groundwater in the direction of the hydraulic gradient. It appears the ultimate fate of any dissolved plumes at the subject site is discharge to the Willamette River. PAHs have been detected in water samples collected from pits excavated near the river's edge. Dissolved plumes could be present in various source areas at the site, but particularly down-gradient of the Light Oil Plant, Naphthalene Plant, Settling Pond Area, Koppers Land Treatment Area, Retort Area, and the PNO Tank Farm. The contaminants of concern that can be expected to be present in dissolved form at the site are PAHs including naphthalene, BTEX, phenols, cyanide, and lead.

Vapor phase contaminants may be present in subsurface soils, structures, or utilities in areas where soils are contaminated with volatile compounds, such as the volatile aromatics (BTEX). Vapor plumes may be present at the subject site in the vicinity of and down-gradient of the Light Oil Plant. Although vapors may escape from contaminated soils and surface water to the air, this route of migration is likely not significant at the subject site.

4.7 Potential Migration Pathways

Three migration pathways for the contaminants at the site are estimated to be of possible significance: the groundwater pathway, the surface water pathway, and the air pathway.

4.7.1 Groundwater Pathway

The groundwater pathway may allow dissolved and free phase contaminants to migrate in the aquifer in a down-gradient direction. The groundwater pathway is not of direct concern since drinking water wells are not present in the aquifers of interest. In addition,

it is exceedingly unlikely that water wells will be installed in the future at the site (see NWNG memorandum in Appendix C). However, the groundwater pathway is indirectly of concern since the ultimate destination of the contaminants migrating in the groundwater is the Willamette River where sediments and river water can be affected.

4.7.2 Surface Water Pathway

Two surface water features are present at the site that may contain the contaminants of concern, including the drainage ditch and the two on-site settling ponds. In addition, the site is bounded to the northeast by a major surface water feature, the Willamette River.

The on-site drainage ditch carries NPDES-permitted non-contact cooling water from the NWNG LNG Plant operations and storm water from the property. These waters are discharged to the Willamette River. Treated water from the LNG containment basin is discharged separately to the Willamette River under a temporary 1500J permit with the DEQ. The drainage ditch is unlined and may pass through zones of contaminated soil, possibly picking up contaminants along its path.

The two ponds at the site formerly acted as holding ponds for water pumped from the LNG containment basin. In addition, the on-site ponds formerly discharged to the drainage ditch, although they are currently damned with no outlet. The ponds are seasonal features and generally dry up in the summer months. The ponds are situated in the former tar Settling Pond Area and thus may be impacted by the presence of tars in their vicinity.

The Willamette River presents the most significant potential surface water pathway for off-site migration of contaminants. The Willamette River may possibly receive contaminants from groundwater discharge, drainage ditch discharge, and from disturbed sediments that may be contaminated.

4.7.3 Air Pathway

Non-volatile contaminants, such as metals and PAHs, may be present in the air at the site in the form of particulates or adsorbed onto soil dust particles. This air pathway may be the result of natural wind-borne dust or dust stirred up by vehicular traffic or other activities. Volatile contaminants may be present in the air at the site by volatilization from contaminated soils and surface water.

4.8 Potential Human Health and Environmental Risks

Human health and environmental risks depend on 1) the presence of contaminated groundwater, soil, air, or other media, and 2) the pathways available for human or environmental exposure. Based on preliminary information, there appears to be some contamination of soil and groundwater at the subject site. However, there is limited access to or contact with contaminated soil or groundwater. In addition, groundwater is not used as a drinking water source down-gradient of this area. The level of contamination of Willamette River sediments along the site is unknown. The conceptual model of human health risks assumes few human contacts with river sediments, so the exposure pathway again appears to limit potential health risks. Environmental risk related to sediment contamination may need to be investigated based on the results of the proposed sediment sampling activities.

Since surface water runoff and groundwater both discharge to the Willamette River, the river water is a potential source of exposure. An important issue in river water contact is the degree of dilution that occurs at the point of possible human or environmental contact. ✓ Discharges from the site are likely to be several orders of magnitude lower than river flows, so dilution will be significant. Therefore, the conceptual model of human health and environmental risks at the site suggests that human health and environmental impacts would be very low. agreed

5.0 REMEDIAL INVESTIGATION PLAN

5.1 Phased Remedial Investigation

The primary goals of the Remedial Investigation are to define the hydrogeology of the site, identify the nature and extent of the contaminants at the site, and gather other information that will be useful for completing the Endangerment Assessment and Feasibility Study. Therefore, the Remedial Investigation will involve collecting data for four primary purposes: characterization of hydrogeology, characterization of contaminants, performance of a risk assessment, and evaluation of remedial action alternatives. The data will be used to refine and modify the hydrogeological and contaminant distribution conceptual models of the site (Section 4.0).

The Remedial Investigation will likely be performed in at least two phases. The Phase I investigation will gather the basic information necessary to generally define the hydrogeology of the site and to confirm the presence of contamination in the identified potential source areas of the site. Although definition of the extent of contamination will be attempted during Phase I, full definition of the identified contamination will likely be performed during Phase II. The Phase II investigation will primarily involve filling data gaps that were identified in Phase I. If necessary, a third phase of remedial investigation will be performed at the site. This Work Plan primarily presents the proposed Phase I activities. If a Phase II investigation becomes necessary for the site, then an addendum to this Work Plan will be presented to DEQ detailing the Phase II activities.

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The objectives of the Phase I Remedial Investigation include:

- Determine the hydrogeologic framework of the site
- Confirm the contaminants of concern
- Determine if soil and groundwater have been impacted in potential source areas
- Attempt to define extent of soil and groundwater impacts
- Determine impacts to surface water
- Determine if sediments have been impacted
- Perform preliminary air monitoring or modeling

The objectives of the Phase II Remedial Investigation include:

- Define extent of soil and groundwater impacts not defined in Phase I
- Perform additional sediment sampling, if necessary
- Perform additional air monitoring, if necessary
- Fill other data gaps identified in Phase I

The following subsections summarize the selected analytical parameters and the various investigations to be performed at the Gasco site subdivided by the potentially affected media, including soils, groundwater, surface water, sediment, and air.

5.2 Analytical Parameters

The analytical parameters selected for the Remedial Investigation are divided into three main categories, including primary parameters, secondary parameters, and Feasibility Study parameters. A summary of the selected analytical parameters is included in Table 2.

The primary analytical parameters were selected based on the predicted contaminants of concern (see Section 4.3), and are expected to be somewhat widespread at the site. The primary analytical parameters include PAHs, BTEX, TPH, phenols, lead, and cyanide. Analyses for PAHs and TPH will generally be performed on most soil and water samples

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from the site. Analyses for BTEX, phenols, lead, and cyanide will be performed on samples from selected potential source areas at the site.

The secondary analytical parameters were selected based on other potential contaminants that may be present at the site (see Section 4.4). The secondary analytical parameters include H_2S, ammonia, chlorinated pesticides and solvents, and Priority Pollutant metals. Although not anticipated to be present or present at levels of concern at the Gasco site, analyses for the secondary parameters will be performed on groundwater samples from selected areas at the site to confirm this supposition.

The Feasibility Study analytical parameters were selected for an evaluation of their potential impact on various remedial options and treatment technologies. The Feasibility Study parameters include alkalinity, hardness, iron, manganese, nitrate, nitrite, orthophosphate, and total organic carbon (TOC). Analyses for these parameters will be performed on groundwater samples from selected monitoring wells at the site. Temperature, conductivity, and pH will be measured in the field for all the groundwater samples. In addition, analyses for British Thermal Unit (BTU) content will be performed on selected tar samples.

Selected soil samples will also be analyzed for various geotechnical parameters, including grain size distribution, plasticity, and moisture content. These parameters will be used to confirm field estimates of soil type and to evaluate the optimum slot size and sand pack for any future monitoring or recovery wells at the site.

5.3 Soil Investigation

The overall objectives of the soil investigation are to identify releases of hazardous substances to the soils, to characterize the extent of the identified releases, and to characterize the hydrogeology of the site. Another key objective of the soil investigation is to determine the continuity and extent of the Silty Clay Unit and to determine the unit's capability to act as a barrier to vertical migration of contaminants. The soil investigation

will be performed in phases. The Phase I investigation is designed to confirm the presence of releases in the identified potential source areas of the site and to generally define the geology of the site. The Phase II investigation will primarily involve defining the extent of releases that were identified in Phase I and filling in other data gaps.

During Phase I, the soils at the subject site will be investigated both by direct sampling and indirect geophysical methods. The surface and subsurface soils will be directly sampled for lithologic description and analytical testing by means of soil borings and/or test pits. Soil samples will be collected from all the identified potential source areas at the site to confirm the presence of the contaminants of concern in each of these areas. The subsurface soils will also be investigated indirectly by geophysical means in attempt to identify fill zones, tar zones, contaminant plumes, and lithologic changes. Aerial photographs and other maps will be used to confirm and delineate past fill areas at the site.

5.3.1 Soil Sampling Activities

Soil samples will be gathered from 35 soil borings and 12 monitoring well borings to be installed at the site. The proposed locations of the soil borings are shown on Figure 6. A summary of the soil sampling and analytical plan is presented on Table 3.

All of the soil borings will be installed into the Fill Unit and Silty Clay Unit to depths of approximately 20 to 25 feet bgs. The soil borings are proposed to be installed to this depth since it is not anticipated that soil contamination will extend below these soil units. However, if soil contamination is encountered, the borings will be advanced until contamination is no longer evident by field screening techniques. If free product tars or DNAPLs are suspected, then drilling will not extend through any significant confining unit to prevent further downward migration of free product. Six of the monitoring well borings will be advanced into the Alluvial Deposits to depths of approximately 50 feet bgs to evaluate the deeper soils below the water table.

The soil borings will be installed with a hollow-stem auger drilling rig. Upon completion, the soil borings will be abandoned by filling with 3/8-inch bentonite chips as the augers are withdrawn. Above the water table, the bentonite chips will be hydrated in two-foot lifts. The soil borings will be abandoned in accordance with the *Rules for Construction and Maintenance of Monitoring Wells and Other Holes in Oregon* (OAR 690-240-130 to 135) and the ODEQ guidance document *Groundwater Monitoring Well Drilling, Construction, and Decommissioning Guidelines* dated August 24, 1992.

If auger refusal occurs at any of the boring locations, then test pits may be excavated to evaluate the shallow soils in those areas. If the installation of test pits becomes necessary at the site, then an addendum to this Work Plan will be presented to DEQ that will outline the installation procedures and sampling methodologies.

In approximately one-half of the soil borings, soil samples will be collected with a split-spoon sampling device at 2.5 foot intervals. The split-spoon sampling will allow for the collection of undisturbed soil samples and Standard Penetration Test (SPT) data. In the other soil borings, the subsurface soils will be sampled on a continuous basis with a 5-foot long split-barrel continuous coring device. This type of sampling will allow for the observation of soil lithology on a continuous basis and the collection of soil samples at desired locations for analytical purposes.

A minimum number of soil borings (four) have been located in the Former Settling Pond area, because this is an area of know tar accumulation. An attempt will be made to define the extent of the tars by geophysical means, utilizing the soil borings to confirm the geophysical results. Drilling and sampling in known thick tar zones is not desired because the decontamination of equipment is extremely difficult and subsurface cross-contamination is possible. In order to minimize the potential for cross-contamination, all borings within the known tar zones will be drilled by a "step down" method where casing is utilized to seal off the tar zone and drilling is continued through the casing.

In areas where tar zones are suspected, such as in the vicinity of the Former Settling Ponds, a "step down" drilling method will be used to drill through the tar zones. Once sampling

has indicated that the base of the tar zone has been reached, then 10-inch diameter steel surface casing will be installed through the augers in the borehole. A cement-bentonite grout will be installed as a seal in the annular space as the augers are withdrawn. The grout-slurry mixture will be allowed to set-up, at which point 4 1/4-inch ID augers will be used to drill out through the surface casing into the undisturbed soils. The small-diameter augers will be used to drill to the proposed depth of the borings (20 feet bgs). Upon reaching total depth, the borehole will be immediately sealed with a cement-bentonite grout as the augers and surface casing are pulled from the hole.

A surface soil sample will be collected at each of the boring locations primarily for purposes of assessing exposure risks at the site. A minimum of 25 surface soil samples will be selected for laboratory analyses. Additional surface soil samples may be collected for the Endangerment Assessment after evaluating the results of the Phase I soil investigation.

5.3.2 Selection of Soil Samples for Laboratory Analysis

Subsurface soil samples will be selected for laboratory analyses based on field screening indicators (visual, odor, sheen, and headspace vapor methods). A minimum of two subsurface soil samples will be selected for analysis from soil borings where field screening indicates possible soil contamination. Samples will be selected for analysis to characterize the contaminated zones, both above and below the water table, and to bracket those contaminated zones to define their vertical extent.

A minimum of one subsurface soil sample will be selected for analysis from soil borings where field screening does not indicate the presence of soil contamination. If soil contamination is not indicated by field screening, then a soil sample will be selected in that boring from the zone of water table fluctuation. In addition, soil samples will be selected from the base of any soil unit that lies on top of a significant confining layer below the water table to evaluate for DNAPLs.

The analytical parameters that are selected for any given soil sample will depend on the location of the soil sample with respect to a potential source area as summarized on Table 3 and described in Section 7.6.1. In summary, analyses for cyanide will be performed on all selected samples from potential cyanide source areas. TPH analyses will be performed on all selected samples from all areas at the site, and will be used as a screen for determining analyses for other parameters. If TPH is detected in any given soil sample, then additional analyses for PAHs, BTEX, phenols, and lead will also be performed on that sample, depending on the location at the site.

5.3.3 Determination of Background Soil Concentrations

If necessary, background soil concentrations will be determined during the Remedial Investigation in accordance with the DEQ *Soil Cleanup Manual, Appendix C, Guidelines for Determining Background Concentrations*, dated April 1994. As stated in the guidance document, background samples only need to be collected for naturally-occurring materials.

but can they be collected for others?

Lead, being naturally-occurring, will be evaluated at the Light Oil Plant area during the Phase I investigation since lead was only known to be used as an additive to the motor fuels at the site. A full evaluation of background lead concentrations will only be performed during the Phase II investigation if the lead levels detected during the Phase I investigation are found to exceed the appropriate reference concentrations in the Soil Cleanup Table [Oregon Administrative Rules (OAR) 340-122-045]. If this evaluation becomes necessary, then the methodology for determining background lead concentrations will be presented in the Phase II Work Plan Addendum.

5.3.4 Geophysical Investigation

Following the installation of the soil borings at the site, the subsurface soils will also be investigated by surface and subsurface geophysical techniques in attempt to identify and map fill zones, tar zones, contaminant plumes, and lithologic changes. These methods allow for fast non-destructive measurements of parameters in the field with continuous data-acquisition. Two surface geophysical techniques will be applied that appear most useful for determining geological conditions and locating contaminant plumes, including ground penetrating radar (GPR) and the electromagnetic (EM) method. The subsurface geophysical method to be utilized at the site is natural-gamma logging to detail changes in lithology in the deep monitoring wells at the site.

necessary?

• Surface Geophysical Survey

A preliminary survey with the GPR and EM methods will be performed in the vicinity of the former Settling Ponds to confirm that the geophysical methods will yield useful profiles. If it appears that the GPR and EM methods will yield useful data, then either one or both of the methods will be applied in a full survey at the site. The full survey will be performed in the southeast part of the site where the major fill areas are located (see Figure 6). The survey will be performed on a 20-foot grid in the southeast area where possible. The geophysical survey will be tied into soil boring locations to confirm the lithologic and contaminant interpretations.

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• Geophysical Borehole Logging

Natural-gamma logging of the soils in the six 50-foot monitoring wells will be performed during the Phase I investigation. Natural-gamma logs are continuous records of the amount of gamma radiation which is emitted from the subsurface soils. This method is very useful in determining lithologic and geologic changes in the subsurface and may be useful for determining stratigraphic correlations across the site.

5.4 Groundwater Investigation

The objective of the groundwater investigation is to identify releases of hazardous substances to groundwater, to characterize the extent of the identified releases, and to characterize the hydrogeology of the site. The groundwater investigation will be performed in phases. The Phase I investigation is designed to generally define the hydrogeology of the site, to confirm the presence of releases in the identified potential source areas of the site, and to setup a basic monitoring network at the site. The Phase II investigation will primarily involve defining the extent of releases that were identified in Phase I and filling in other data gaps.

The Phase I groundwater investigation will include: 1) sampling of the groundwater from temporary well points, 2) the installation of groundwater monitoring wells, 3) water level monitoring, 4) quarterly groundwater monitoring, and 5) aquifer testing. The Phase II groundwater investigation, if necessary, will be presented to DEQ as an addendum to this Work Plan.

5.4.1 Temporary Well Points

In order to optimize the number of monitoring wells necessary at the site, other groundwater investigation techniques will be employed, including sampling the groundwater from temporary well points in soil borings or through the use of a probe unit. These methods can gather a large amount of groundwater contaminant data in a cost effective manner that can be used to better place additional permanent monitoring wells, if necessary. Vertical profiling of contaminant concentrations in the aquifer can also be performed by these methods.

During the Phase I investigation, the uppermost groundwater will be sampled from temporary well points set in 14 of the soil borings that are proposed for the soil investigation

at the site. The proposed locations of the 14 temporary well points are shown on Figure 7. A summary of the proposed temporary well point locations, depths, and analytical parameters is included on Table 4.

All temporary well point installation work will be performed by an Oregon-bonded and licensed monitoring well constructor. The temporary well points will be installed in accordance with the Oregon Groundwater Law (Oregon Revised Statute (ORS) Chapter 537) and the *Rules for Construction and Maintenance of Monitoring Wells and Other Holes in Oregon* (OAR Chapter 690, Division 240). The temporary well points will also be installed and abandoned according to the ODEQ guidance document *Groundwater Monitoring Well Drilling, Construction, and Decommissioning Guidelines* dated August 24, 1992.

If additional groundwater investigation becomes necessary during Phase II to define the lateral and vertical extent of contamination at the site, then a soil probe unit will likely be used to gather the additional data.

The temporary well points will be installed to a depth of 20 feet bgs in the 14 selected soil borings. If necessary, the soil borings will be advanced deeper so that they are approximately 10 feet below the water table. The well points will be composed of 2-inch diameter steel tubing and a 5-foot long stainless-steel screen that are decontaminated by steam cleaning prior to use. Once the desired water sampling depth is reached, the well point will be placed inside the augers and the augers will be pulled up approximately 5 feet as a temporary sand pack is placed in the annulus. The well point will then be purged of at least one borehole volume of water (approximately 28 gallons for an 8 1/4-inch hole), or until the casing is entirely evacuated, whichever occurs first. Following the purging, the water sample will be collected according to the methodology described in Section 7.2.3. Once the groundwater sample is collected, the well point will be pulled out of the hole and the sand pack will be drilled out. The borehole will then be abandoned by filling with 3/8-inch bentonite chips as the augers are withdrawn. It is anticipated that the temporary well points will be in-place for no more than 4 hours per boring.

As indicated on Table 4, the groundwater samples from all 16 temporary well points at the site will be analyzed for TPH and BTEX. If TPH is detected in any given sample, then that sample will also be analyzed for PAHs. The other analytical parameters were chosen based on the location of the well point relative to potential source areas. Phenols will be analyzed at well points that are in the vicinity of the former Retort Area, Light Oil and Naphthalene Plants, and Koppers Land Treatment Area. Cyanide and H_2S will be analyzed at well points that are down-gradient of the former Spent Oxide Storage Area and Oxide Reactor Area, and down-gradient of the former Settling Ponds since spent oxide may have been used as fill in this area. Ammonia will be analyzed at well points in the vicinity of the former Oxide Reactor Area, since it is known that ammonia was used in this area.

5.4.2 Monitoring Wells

The groundwater at the subject site will be investigated by a series of monitoring wells to be installed at various key locations and depths at the site. The monitoring wells will be used to: 1) determine hydraulic gradients and other aquifer parameters, 2) characterize dissolved contaminants in the groundwater, including their lateral and vertical extent, and 3) evaluate for the presence of LNAPLs and DNAPLs. In a number of locations, monitoring wells will be nested together at different depths to determine vertical hydraulic gradients. An extensive network of monitoring wells will be placed along the Willamette River on the site to determine the levels of contaminants that may be entering the river. Monitoring wells will be placed in the Fill Unit, Silty Clay Unit, or Alluvial Deposits throughout the site. If information from the proposed monitoring wells suggests that the Basalt Aquifer may be impacted at the site, then additional monitoring wells will be installed during a subsequent phase of investigation to evaluate the Basalt Aquifer.

5.4.2.1 Monitoring Well Designation

The monitoring well names will be designated by a prefix "MW", followed by the monitoring well number, followed by a number representing the depth of the well in feet below ground surface (bgs), such as "MW-6-50". Where monitoring wells are placed adjacent to one another at different depth intervals, they will bear the same well number, but a different depth designation, such as "MW-6-25" and "MW-6-50". For ease of reading, the depth designation may be dropped for the shallow monitoring wells, so that "MW-6-25" may be abbreviated as "MW-6".

5.4.2.2 Monitoring Well Locations and Depths

A network of 12 shallow monitoring wells (approximately 25 feet bgs) and 6 deep monitoring wells (approximately 50 feet bgs) is proposed for the Gasco site. The proposed locations of the monitoring wells are shown on Figure 7. A summary of and the rationale for the proposed monitoring well locations, depths, and analytical parameters is included on Table 5. A discussion of the selected analytical parameters is included in Section 5.4.4.

The locations of the Phase I monitoring wells will not be modified based on the results of the well point data for the following reasons: 1) the well point data will be gathered concurrently with the installation of the monitoring wells, 2) the proposed monitoring well locations will be drilled as part of the soil investigation, and 3) once a soil boring is drilled, the incremental cost of installing a monitoring well is minor compared to obtaining a groundwater sample from a temporary well point.

The depths of the proposed monitoring wells will be selected based on lithology data collected during the soil investigation. The deep monitoring wells will be installed prior to the shallow monitoring wells. Observations and interpretations of the lithology in the deep monitoring wells, in conjunction with the lithology data from the soil borings will be used to determine the depth of the shallow wells. DEQ will be consulted with the chosen

depths of the shallow monitoring wells prior to installing the wells. Field notes, boring logs, and cross-sections will be supplied to DEQ to justify the chosen shallow monitoring well depths.

Three preliminary up-gradient monitoring wells have been selected for the Phase I investigation (MW-9, MW-12-25, and MW-12-50). If groundwater flow direction information from the Phase I investigation indicates that there are no appropriate up-gradient monitoring wells, then the Phase I data will be used to place an appropriate up-gradient monitoring well during Phase II.

The locations and depths of any Phase II monitoring wells will be selected based on the results of the Phase I investigation and any groundwater data from a Phase II soil probe investigation.

- Shallow Monitoring Wells

The uppermost groundwater in the Fill Unit or Silty Clay Unit will be investigated through the installation of 12 shallow monitoring wells that will be installed to depths of approximately 20 to 25 feet. The actual depths of the shallow monitoring wells will be selected based on the estimated water table depth during drilling and the lithology data collected during the soil investigation. The shallow monitoring wells will be installed such that the screened interval will extend across the estimated seasonal fluctuation of the water table and allow for the detection of LNAPLs, if present. A 15-foot screen interval is proposed so that the screen will span the potential seasonal water table fluctuation at the site, and yet will also allow enough water in the well for sampling during low water table periods.

If groundwater is encountered in any particular well location in the Fill Unit, then the screen interval will not extend significantly into the underlying Silty Clay Unit, and under no circumstances will extend below the Silty Clay Unit. If groundwater is not encountered until the Silty Clay Unit or other underlying units, then the screen interval will be placed such that it will not extend up into the Fill Unit. The main objective for

screen placement in the shallow wells at the site is to isolate the Fill Unit from the underlying units to avoid commingling potentially different hydrogeologic units and to eliminate potential vertical conduits for contaminant migration.

- Deep Monitoring Wells

Six deep monitoring wells will be installed adjacent to six of the shallow monitoring wells to evaluate the deeper groundwater and to determine vertical hydraulic gradients. The deep wells will also be utilized to evaluate for the presence of DNAPLs at the site. The deep monitoring wells will be installed in the Alluvial Deposits to depths of approximately 50 feet bgs, although the actual depth of the wells will depend on soil lithology data obtained during drilling. A 10-foot screen interval is proposed for the deep monitoring wells.

All six deep monitoring well borings will be continuously cored during drilling to obtain detailed lithology data and to observe for DNAPLs. Previous geotechnical borings at the site have indicated the presence of a Sand Unit underlying the Silty Clay Unit at the site, and underlying the Sand Unit appears to be a Silt Unit. The objective of the screen placement for the deep monitoring wells is to screen across the base of the Sand Unit, if present. In addition, if any other significant confining units or possible DNAPLs are observed during drilling, then the screen interval will be adjusted to span the potential DNAPL zone. Under no circumstances, however, will the screen extend below the underlying confining unit. If no DNAPLs or significant changes in lithology are observed in the deep monitoring well borings during drilling, then the wells will be set at a depth of 50 feet bgs.

5.4.2.3 Monitoring Well Installation and Development

All monitoring well installation work will be performed by an Oregon-bonded and licensed monitoring well constructor. The monitoring wells will be installed in accordance with the Oregon Groundwater Law (Oregon Revised Statute (ORS) Chapter 537) and the *Rules for Construction and Maintenance of Monitoring Wells and Other Holes in*

Oregon (OAR Chapter 690, Division 240). The wells will also be installed according to the ODEQ guidance document *Groundwater Monitoring Well Drilling, Construction, and Decommissioning Guidelines* dated August 24, 1992.

All the proposed monitoring wells will be installed with the drilling rig through the hollow stem augers. The monitoring wells will be constructed with 2-inch inside diameter (ID), threaded, Schedule 40, polyvinyl chloride (PVC), blank casing and slotted screen. If DNAPLs are suspected based on observations during drilling, then stainless steel casing and screen will be utilized.

Fifteen (15) feet of screen will be set at the bottom of each shallow monitoring well with blank casing extending to the ground surface. Ten (10) feet of screen will be used in the deep monitoring wells. If the soils that the screen is to span are composed of sand, then a 0.020-inch slotted screen with a Colorado 10/20 silica sand pack will be used in the well. If the soils that the screen is to span are composed of silts or very fine silty sands, then a 0.010-inch slotted screen with a Colorado 20/40 silica sand pack will be used.

The sand pack will be placed in the annular space from the bottom of the boring to two feet above the top of the screen. The wells will then be developed with a surge block to set the sand pack. In the shallow monitoring wells, a well seal composed of 3/8-inch bentonite chips will be placed on top of the sand pack to a depth of two feet bgs and hydrated.

For monitoring wells with over 25 feet of standing water in the completed installation, the use of a grout-slurry mixture is required by the Oregon Water Resources Division (OWRD) in OAR 690-240 005-180. Therefore, in the six deep wells, a two-foot bentonite plug will be placed on top of the sand pack, and the well seal, composed of a cement-bentonite slurry, will then be placed by a tremie pipe from the top of the bentonite plug to within two feet of ground surface.

All of the monitoring wells will be completed with above-grade well monuments cemented in at the surface. The well monuments will be protected by three metal guard posts cemented in at the surface. The well casings will be fitted with locking caps. Schematic

well construction diagrams are shown in Figures 8 and 9 for the proposed shallow and deep monitoring wells respectively.

Following the installation of the monitoring wells, they will be further developed by purging with a submersible pump in an attempt to remove the fine sediment from around the well bore. During development, at least 10 well volumes of water, and the volume of the well construction water, will be removed from each well. If at this point, the wells are not sediment-free, then well development will continue until the wells are sediment-free.

5.4.2.4 Elevation Survey and Water Level Measurements

Following installation of the monitoring wells, the locations and elevations of the new monitoring wells will be surveyed to the City of Portland datum by an Oregon Registered Professional Land Surveyor. The ground surface elevation will also be surveyed at each location. The top of casing elevations will measured to an accuracy of 0.01 feet, and the locations of the monitoring wells will be measured to an accuracy of 1.0 feet. The locations and ground surface elevations of all other soil borings, well points, and sampling points will also be surveyed.

The static water levels in all the monitoring wells at the site will be measured following the monitoring well installation activities using a Solinst water level indicator (conductive probe). The water levels will be measured from the north side of the top of the casing where a notch will be cut.

Each well will also be checked for the presence of LNAPLs and DNAPLs using an MMC Interface Detector probe.

5.4.3 Water Level Monitoring

Two types of water level monitoring will be performed at the monitoring wells at the site to better characterize the hydrogeology of the site, including monthly water level monitoring and a short-term continuous water level monitoring test.

5.4.3.1 Monthly Water Level Monitoring

The water levels in all the monitoring wells at the site will be measured on a monthly basis for a period of six months to monitor seasonal fluctuations in groundwater elevations. River stage data will also be collected during each monitoring event to determine hydraulic continuity with the Willamette River. Following the initial six months of monitoring, an evaluation of the data will be conducted and presented to DEQ to determine if a change to quarterly water level monitoring is warranted. As part of the monthly monitoring activities, water levels will be collected quarterly in conjunction with the quarterly groundwater monitoring activities (Section 5.4.4).

The static water levels in the monitoring wells will be measured using a Solinst water level indicator (conductive probe). The water levels will be measured from the north side of the top of the casing. If NAPLs are detected in any given monitoring well during the initial monitoring event, then those wells will continue to be monitored for NAPLs.

5.4.3.2 Short-Term Continuous Water Level Monitoring Test

A 48-hour continuous water level monitoring test will take place at selected monitoring wells to determine if tidal fluctuations in the Willamette River influence groundwater flow direction and hydraulic gradients at the site. Water levels in three monitoring wells located along the river (MW-3, MW-4-25, and MW-4-50) will be collected electronically on a continuous basis using pressure transducers and a central data logger. Water levels will also be simultaneously recorded in the river to compare to the groundwater levels.

5.4.4 Quarterly Groundwater Monitoring

Quarterly monitoring of selected water quality parameters will be performed at selected monitoring wells at the subject site to establish if there are any seasonal fluctuations or long-term trends of the contaminant concentrations in the groundwater.

Following the installation of the proposed monitoring wells, the quarterly groundwater monitoring program will be initiated. During the first monitoring event, the groundwater will be sampled at all of the monitoring wells at the site. The groundwater samples will be analyzed for the parameters that are listed on Table 5. For the initial sampling event, all 18 wells at the site will be analyzed for TPH, PAHs, BTEX, and total lead. If total lead is detected in any given well, then the groundwater sample will also be analyzed for dissolved lead. The other analytical parameters were chosen based on the location of the monitoring well relative to potential source areas.

Phenols will be analyzed at wells that are down-gradient of the former Retort Area, Light Oil and Naphthalene Plants, and Koppers Land Treatment Area. Cyanide and H_2S will be analyzed at wells that are down-gradient of the former Spent Oxide Storage Area and Oxide Reactor Area, and down-gradient of the former Settling Ponds since spent oxide may have been used as fill in this area. Ammonia will be analyzed at wells in the vicinity of the Oxide Reactor Area, since it is known that ammonia was used in this area. Chlorinated volatiles and pesticides will be analyzed in one shallow and two deep wells located on the southeast portion of the Gasco site, since this is the area most likely to detect these compounds based on known groundwater gradients and the source area. Priority Pollutant metals will be analyzed on a total basis at 8 monitoring wells where the most significant groundwater contamination is detected since these wells should represent worst-case locations for the mobilization of naturally-occurring metals. If metals are detected in any given well on a total basis, then the groundwater samples will also be analyzed for those metals on a dissolved basis.

Feasibility Study analytical parameters will be analyzed during the second quarterly groundwater monitoring event. The selection of the monitoring wells for analysis of Feasibility Study parameters will be based on the results of the initial sampling event.

Based on the initial monitoring event results, the quarterly monitoring program may be modified to sample selected wells for selected parameters. Following the completion of the initial monitoring event, a groundwater monitoring sampling and analysis plan will be submitted to the DEQ as an addendum to this Work Plan.

5.4.5 Aquifer Tests

Aquifer slug tests and pump tests will be performed on monitoring wells at the site to gather data on aquifer characteristics, including hydraulic conductivity, transmissivity, and storativity. These aquifer characteristics will allow for a calculation of groundwater flow velocity and the rate of contaminant migration in the groundwater. This information, in conjunction with groundwater contaminant levels, will also allow for an estimate of the flux of contaminants from the site into the Willamette River. Knowledge of the aquifer characteristics is also necessary to properly design a groundwater remediation system, if necessary. The aquifer tests will also help in evaluating potential stratigraphic controls for groundwater beneath the site.

5.4.5.1 Slug Tests

During the Phase I investigation, rising-head slug tests will be performed in all monitoring wells at the subject site. The slug tests will be performed by lowering a PVC slug into the well to displace the groundwater in the well. The displaced water in the well is then allowed to return to the original static water level and the slug is quickly removed from the well. This procedure simulates the instantaneous removal of a slug of water from the well. The water level recovery data is measured by a pressure transducer and recorded

with an electronic data logger. The recovery data will be analyzed by the Bouwer and Rice, 1976[5] solution method to calculate preliminary estimates of transmissivity.

5.4.5.2 Pump Tests

An aquifer pump test will be performed at one or two selected monitoring well pairs at the site. Since there is no information at this time regarding the presence or extent of contaminants in the groundwater at the site, it would be premature to select the most appropriate locations for pump tests at this time. Pumping at an inappropriate location could adversely affect the distribution of contaminants in the groundwater at the site. Therefore, it is likely that the pump tests will occur during the Phase II investigation, after synthesis of the Phase I contaminant, slug test, and some monitoring data is complete. An addendum to this Work Plan will be submitted to DEQ to outline the details of the pump test investigation.

Separate 24-hour pumping tests will likely be performed on the shallow and deep wells at each selected monitoring well pair. The pumping test will be preceded by a step-drawdown test to determine an appropriate pumping rate. The pumping test will be followed by a recovery test, as a check against the pumping data. Water levels will be monitored throughout the testing period with pressure transducers installed in the pumping well and three to seven observation wells. Water level data will be collected electronically from a central data logger.

The aquifer characteristics of transmissivity, hydraulic conductivity, and storativity will be calculated, as well as an estimate of the average linear velocity of water through the aquifer. In addition, information regarding vertical hydraulic conductivity will be gathered.

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[5] Bouwer, H. and R. C. Rice, *A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells*, Water Resources Research, 12 (1976), pg 423-428.

5.5 Surface Water Investigation

Three surface water bodies, including the Willamette River, the current drainage ditch, and the existing settling ponds, will be sampled to evaluate the current impacts to surface water from the contaminants at the subject site. In addition, aerial photographs and other maps will be used to delineate any other past drainages at the site. The surface water in the settling ponds and the drainage ditch will be sampled during the Phase I investigation. The locations of the Phase I surface water sampling points are shown on Figure 10. The surface water in the Willamette River will be sampled during the latter part of the Phase I investigation. Groundwater quality data from the Phase I investigation will be used to select appropriate surface water sample locations in the river. An addendum to this Work Plan will be submitted to DEQ to outline the details of the Willamette River surface water investigation.

The drainage ditch will be sampled at an up-stream and down-stream location to determine if the ditch water picks up any contaminants as it flows through the site. Three water samples will be collected from the two existing settling ponds to determine potential impacts to the pond water. The surface water samples will be analyzed for the presence of TPH, PAHs, BTEX, and dissolved lead.

In concept, it is envisioned that the Willamette River water will be sampled at three locations adjacent to the site where groundwater impacts are detected during the Phase I investigation. In addition, a background water sample will be collected from an up-stream location adjacent to the Wacker site. The water samples will be collected from near the water/sediment interface and near the water/air interface at locations where it is predicted that contaminated groundwater may be discharging to the river. Water samples will likely be taken at both a high river stage and a low river stage period. In addition, multiple samples will be collected at each location in order to determine if differences in contaminant concentrations at differing locations are statistically significant. The water sample locations will be determined by a Global Positioning System (GPS) unit. If

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contaminants are detected in the samples near the sediment/water interface, then the water samples from near the air/water interface will also be analyzed.

5.6 Sediment Investigation

The sediment investigation will involve sampling of sediments from two surface water bodies at the Gasco site, the settling ponds and the Willamette River. The sediments along the Willamette River throughout the Northwest Industrial Area are likely contaminated due to the industrial history of the area. Therefore, it is likely that the sediments adjacent to the Gasco site contain contaminants from up-stream sources. In addition, the river in this area has been dredged on numerous occasions over the years likely disturbing any natural deposition of the sediments. The feasibility of cleaning up sediments without causing greater environmental harm is limited. Therefore, the focus of the sediment sampling program will be to gather information for performing the Endangerment Assessment.

The sediments in the two on-site settling ponds will be sampled at three locations as shown on Figure 10. The sediment samples in the ponds will be collected at the sediment/water interface.

The sediments in the Willamette River adjacent to the Gasco site will be sampled to determine potential impacts to the river sediments. Six sediment sampling points will be located at approximate 300-foot intervals along a line that will run parallel to the shoreline of the Gasco site. In addition, 5 sediment sampling points will be located up-stream at 300-foot intervals along the Wacker and Atochem North America sites to determine background sediment concentrations. The locations of the proposed sediment sampling points are shown on Figures 10 and 11. Data from recent sediment sampling offshore of the Rhone Poulenc site will be utilized to supplement the background sediment sampling activities at the Gasco site.

At each sampling point, sediment samples will be obtained approximately 10 feet offshore at an average river stage. At each sample location, sediment samples will be obtained at one-foot intervals to a depth of approximately ten feet below the sediment/water interface. Two discrete sediment samples from each location will be selected for laboratory analysis, including one from the oxygenated zone and one from a greater depth based on field observations. The sediment samples will be obtained from a barge using an impact coring device or a Vibracore device. Alternatively, the sediment samples may be obtained with a Geoprobe unit on a barge depending on the results of another project that is attempting this method. The sediment sample locations will be determined by a GPS unit.

The sediment samples will be analyzed for the presence of TPH, PAHs, BTEX, dissolved lead, and TOC.

5.7 Air Investigation

Potential emissions to the air at the Gasco site would likely take place by two mechanisms: 1) as contaminants sorbed onto soil particles entrained by wind and 2) as volatile contaminants by volatilization from soil or surface water. The former mechanism may be of concern where PAHs or metals occur at the surface and activities occur that generate dust, such as vehicular traffic or strong winds blowing across low vegetation areas. The latter mechanism may be of concern where VOCs occur in near-surface soils or surface waters, such as at the Light Oil Plant or in the LNG containment basin. By either mechanism contaminants rapidly disperse in a down-wind direction.

Two approaches were considered to evaluate the potential for air emissions at the site: 1) soil and water quality data from the Phase I investigation would be utilized to construct an air dispersion model to estimate potential emissions, and 2) air emissions would be evaluated by direct measurement through air monitoring. The results of the Phase I soil and water investigations would be necessary to properly design an investigation by either approach. In addition, some air sampling will occur at the site during the Phase I investigation for worker health and safety purposes (Section 8.0). Based on the Phase I

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results, a decision will be made as to which approach, or combination of approaches, is most appropriate for the site. An addendum to this Work Plan will be submitted to DEQ to outline the details of the air investigation.

If the air modeling approach is chosen for the air investigation, surface soil data including contaminant concentrations, grain size, and density of the fine fractions will be used to estimate the concentrations of contaminants that could be entrained on particulates. Subsurface soil temperatures and contaminant concentrations will be used to estimate soil vapor concentrations for volatile compounds. An estimate of the flux of contaminants from soil vapor to air will be made based on the nature of the ground cover. The estimated flux of contaminants to the air and meteorologic data from nearby stations will be used in an air dispersion model to estimate potential emissions at the site.

If the air monitoring approach is chosen for the air investigation, then fixed air monitoring stations will be setup at various locations at the site. The locations of the air monitoring stations will be determined based on the results of the Phase I investigation and the physical site layout. Likely locations would include an up-wind station, one or more down-wind locations, and locations where site workers tend to spend most of their time. Sampling for VOCs and particulates will take place during various seasons and wind conditions. Likely analytical parameters would include BTEX, PAHs, and lead.

The air quality information gathered by the modeling and/or monitoring approach will be used in the Endangerment Assessment to determine the potential for air emissions to impact potential receptors.

5.8 Investigative Derived Waste Plan

All soil cuttings generated during the drilling of the soil borings and monitoring wells will be placed in 55-gallon drums. The drums will be labeled and temporarily stored on-site. Based on the analytical results from the soil investigation, the disposition of the soil cuttings will be determined. If the soil cuttings are determined to be un-contaminated,

then they will be spread on-site. If the soil cuttings are determined to be contaminated, then they will be segregated by waste designation and appropriate disposal will be arranged.

All purge, development, and decontamination water from the Phase I activities will be placed in a temporary storage tank at the subject site. Based on the analytical results from the groundwater investigation, the disposition of the waste water will be determined. It is anticipated that the waste water will be discharged to the current water treatment system on site.

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6.0 PROJECT MANAGEMENT PLAN

6.1 Project Management

The overall project management for implementation of the RI/FS work activities, will be handled by Ms. Sandra Hart of NWNG. HAI will manage the field activities, including the sampling and reporting tasks. All project field work will be supervised by an Oregon Registered Geologist. All drilling and monitoring well installation activities will be performed by an Oregon-bonded and licensed monitoring well constructor. Surveying services will be performed by an Oregon Registered Professional Land Surveyor. Preparation of the Endangerment Assessment will be performed by Decision Focus.

Overall Project Management

Northwest Natural Gas Company
220 NW Second Avenue
Portland, Oregon 97209
(503) 226-4211 ext. 4322
Contact: Ms. Sandra Hart

Project Management – RI/FS

Hahn and Associates, Inc.
434 NW Sixth Avenue, Suite 203
Portland, Oregon 97209
(503) 796-0717
Contact: Mr. Roger Brown, R.G.

Project Management – Endangerment Assessment

Decision Focus, Inc.
6121 SW Tower Way
Portland, Oregon 97221
(503) 244-9765
Contact: Mr. Frank Selker

Laboratory Services (Tentative)

National Environmental Testing, Inc. (NET)
17400 SW Upper Boones Ferry Road
Portland, Oregon 97224
(503) 624-5449
Contact: Mr. Derek Chinn

Drilling Services (Tentative)

Geo-Tech Explorations, Inc.
19700 SW Teton
Tualatin, Oregon 97062
(503) 692-6400
Contact: Mr. Bill Klosterman

Sediment Sampling Services (Tentative)

Fishman Environmental Services, Inc.
434 NW Sixth Avenue, Suite 203
Portland, Oregon 97209
(503) 224-0333
Contact: Mr. Paul Fishman

Surveying Services (Tentative)

Chase Jones & Associates, Inc.
1500 SW 12th Street
Portland, Oregon 97201
(503) 228-9844
Contact: Mr. Eric Jones

Geophysical Services (Tentative)

Geopotential
437 NE Liberty Avenue
Gresham, Oregon 97030
(503) 228-9844
Contact: Mr. Ralph Soule

Borehole Geophysical Services (Tentative)

Well Scope
33132 Coleman Road
Eugene, Oregon 97401
(503) 344-4205
Contact: Mr. Mark Christensen

Utility Locating Services (Tentative)

Maintenance Northwest
18040 SW Lower Boones Ferry Rd. #23
Tigard, Oregon 97223
(503) 684-8824
Contact: Mr. Bruce Jangala

6.2 Project Deliverables

As per the Agreement, Monthly Reports will be prepared by HAI by the 10th day of the month following the reporting period throughout the RI/FS project. The Monthly reports will begin once the RI/FS Work Plan has been approved by DEQ. The Monthly Reports will summarize the activities that occurred during the previous month, describe in brief the data results collected during that time, describe any problems or difficulties encountered, and summarize the activities planned for the upcoming month.

Letter Reports will be prepared by HAI within 30 days of completion of each phase of the Remedial Investigation at the site. The Letter Reports will summarize the work completed to date, data collected during that phase, and preliminary conclusions and recommendations.

Addendums to this Work Plan will be submitted to DEQ for various activities that were not elaborated on in this document. The addendums may be combined to create a Phase II RI/FS Work Plan

Following the completion of all phases of the Remedial Investigation, a comprehensive Remedial Investigation Report will be prepared that will outline the methodologies and results of the investigations. The Remedial Investigation Report will include all the elements that are outlined in the Agreement. All sampling locations will be surveyed by an Oregon registered professional surveyor, and maps will be prepared to show all the sampling locations. The results of the Endangerment Assessment will be submitted as a separate document prepared by Decision Focus.

Following review and approval of the Remedial Investigation and Endangerment Assessment Reports by the DEQ, a Feasibility Study Report will be prepared which will include the elements outlined in the Agreement.

6.3 Project Schedule

An estimate of the overall RI/FS project schedule is presented on Table 8. The schedule starts with the signing of the RI/FS Agreement on August 8, 1994. The preparation, review, revision, and approval of the Final RI/FS Work Plan will proceed until approximately late July 1995, when the Phase I Remedial Investigation will start. It is estimated that the Phase I Remedial Investigation, an evaluation of remedial options, and the Endangerment Assessment will proceed until approximately December 1995. As per the schedule outlined in the Agreement, the preparation, review, and approval of the Phase I Remedial Investigation Letter Report and the Phase II Work Plan Addendum will proceed until approximately March 1996 when the Phase II Remedial Investigation will start.

It is estimated that the Phase II Remedial Investigation will proceed from approximately March through July 1996. This schedule assumes that additional phases of investigation will not be necessary. The Phase II Remedial Investigation Letter Report will be prepared for review and approval of DEQ by approximately August 1996.

As per the schedule outlined in the Agreement, the preparation, review, and approval of the Remedial Investigation Report Outline and the final Remedial Investigation Report will proceed until approximately March 1997. As per the schedule outlined in the Agreement, the preparation, review, and approval of the Feasibility Study Report will proceed until approximately August 1997. Preparation for the implementation of the remedial actions recommended in the Feasibility Study will begin in approximately August 1997.

The Phase I Remedial Investigation itself will be completed in phases, with the scope of some later tasks dependent on the results of earlier tasks. A Gantt chart and PERT chart detailing the schedule and dependencies of the Phase I investigation are displayed on Table 9. The initial Phase I field activities will occur from approximately July to October 1995, including the soil boring, temporary well point, and monitoring well installations, sediment sampling, geophysical surveys, slug tests, water level tests, and the first quarterly groundwater monitoring. Based on synthesis of the results of these activities, the scope of work for the aquifer pump tests, Willamette River surface water investigation,

and the air investigation will be determined, and an addendum to this Work Plan prepared for submittal to DEQ outlining these activities. In addition, an addendum will be prepared which will outline the sampling and analysis plan for subsequent quarterly groundwater monitoring at the site. It is possible that the aquifer pump tests may be delayed to be performed during the Phase II investigation.

7.0 SAMPLING AND ANALYSIS PLAN

7.1 Data Quality Objectives

Data will be gathered during the Remedial Investigation for a number of purposes including: 1) to determine the nature and extent of contaminants at the site, 2) to define the hydrogeology of the site, 3) to perform an Endangerment Assessment, 4) to identify cleanup criteria, and 5) to identify, screen, and evaluate remedial alternatives. The overall data quality objective for the project is to collect sufficient data of an adequate quality to meet the described data needs. The RI/FS Work Plan has been designed to collect sufficient data for the identified data needs as per EPA, 1987[6]. The data quality assurance objectives for this project are to develop and implement procedures to collect representative samples and to provide chemical and physical data of known quality. In order to meet these objectives, all field activities will be conducted according to the methods describe in this Sampling and Analysis Plan (SAP). Data quality is assessed by precision, accuracy, representativeness, completeness, and comparability, as described below.

Precision is a measure of the spread of the data when more than one measurement is taken of the same sample. Duplicate samples will be analyzed by the laboratory at a ratio of at least one sample per twenty samples analyzed. Split sample analysis (that is, two sub-samples of the same sample are sent to different laboratories for analyses) will not be performed.

Accuracy is a measure of the closeness of the measured value to the true value. Accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. Surrogate spiking analyses will be performed at a rate of at least one sample per twenty samples analyzed. Matrix spike and matrix spike

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[6]U.S. EPA, *Data Quality Objectives for Remedial Response Activities, Volume 1 - Development Process*, EPA/540/G-87/003A (1987)

duplicate samples will also be collected and analyzed for the groundwater sampling activities.

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the soil or water sampled. The sampling techniques and sample handling protocols outlined in this SAP were designed to collect representative samples.

Completeness is a measure of the amount of valid data obtained from the analytical measurement system described as a percentage of the planned measurements. The completeness of the data will be assessed during quality control reviews.

Comparability of the data will be maintained by using EPA-defined field and analytical procedures and protocols where available. Where EPA standards are not available, the procedures will be fully documented.

7.2 Field Sampling Procedures

7.2.1 Soil Sampling Procedures

During the drilling of the soil borings and monitoring well borings, soil sampling will be conducted with a split-barrel sampling device. The soil sampling will either be on a continuous basis or at 2.5-foot intervals as outlined on Table 3. In borings selected for continuous sampling, a 5-foot long, 3-inch outside diameter (OD), spilt-barrel coring device will be utilized. The coring device is advanced during drilling inside of the lead auger. In borings selected for 2.5-foot sampling, a 1.5-foot long, 3-inch OD, spilt-spoon sampling device will be driven into the undisturbed soils ahead of the augering bit using the Standard Penetration Test (SPT). Since the split-spoon sampler is 1.5 feet long, only one foot of soil is not observed between sampling points. If sample recovery is not adequate with the split-barrel coring device, then the sampling method will be changed to a split-spoon device.

Soil samples will be collected for both hydrogeological and contaminant characterization purposes. Upon removal from the soil boring, the split-barrel devices are opened at the surface to observe the soil profile. If based on field screening (see Section 7.2.2), a zone of potential soil contamination is observed, then a soil sample will be collected for laboratory analyses from that interval. If no contamination is suspected, then a soil sample will be collected from the middle of the device. Each soil sample will be immediately placed in a laboratory supplied 9-ounce sample jar and capped with a teflon-lined lid. The sample jars will be labeled and transferred to a chilled container for shipment to the analytical laboratory.

Following the collection of samples for analytical purposes, the soil profile will then be noted in the field by an HAI geologist. The properties of the soil, including color, moisture, plasticity, grading, structure, and texture will be noted in the field and incorporated into a boring log for each of the subsurface borings. An estimate of the Unified Soil Classification System (USCS) soil type designation (ASTM D 2487-85) will also be shown on the boring logs. The USCS soil type designation will be a field estimate only and will not be confirmed by laboratory analyses, although an occasion sample may be collected for this purpose. Visual or olfactory evidence of contaminant occurrence in the samples, if present, will also be noted on the boring logs. An example boring log and monitoring well log are included in Appendix D.

7.2.2 Soil Field Screening Procedures

Each soil sample will be screened in the field for the presence of organic contaminants by the visual, sheen, and headspace vapor methods. The sheen method involves mixing a portion of the soil sample into a pan containing water and observing for a sheen. Organic vapor levels in the soil samples will be determined by the headspace vapor method utilizing a MicroTIP Model MP-1,000 equipped with a photoionization detector and a 11.7 electron volt (eV) lamp.

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The headspace vapor method involves placing approximately 8 ounces of soil in a one-quart plastic bag. The bag is sealed and the sample is then set aside for a 20-minute stabilization period, whereupon the detector probe is inserted through the seal into the bag. The results of the headspace screening are recorded on the boring log in parts per million (ppm). The results of the headspace method will be used for qualitative screening purposes only.

7.2.3 Groundwater Sampling Procedures

Groundwater samples will be collected from the temporary well points at the site immediately following installation. The temporary well points will be purged with a submersible pump of at least one borehole volume of water (approximately 28 gallons for an 8 1/4-inch hole), or until the casing is entirely evacuated, whichever occurs first. The pH, temperature, and conductivity of the water will be measured during the purging process to monitor for stabilization of these parameters. The water sample will then be collected using the pump at a low flow rate.

Groundwater samples will be collected from the monitoring wells at the site at least 72 hours following development. The monitoring wells will be sampled in the order of suspected least-contaminated to suspected most-contaminated. Following the initial sampling event, the order of well sampling will be based on the initial analytical results.

Prior to sampling, at least three well volumes of water will be purged from each well using a peristaltic or submersible pump. The pH, temperature, and conductivity of the water will be measured during the purging process to monitor for stabilization of these parameters.

The shallow wells will be purged with a peristaltic pump and dedicated polyethylene tubing for each well. In addition, the silastic tubing in the peristaltic pump will be replaced for every well sampled, thus eliminating the need for decontamination and the risk of cross-contamination. The deeper wells will be purged with an electric submersible pump equipped with teflon tubing that will be decontaminated between wells. A comparison

study will be performed on three shallow monitoring wells to show that sampling with the peristaltic and submersible pumps will produce consistent data for volatile compounds. The three selected wells will be sampled by both types of pump during the first sampling event and the samples analyzed for BTEX compounds to check for consistency between methods.

Following completion of the purging of the well points or monitoring wells, a representative sample of the groundwater will be obtained using the pump at a low flow rate. The water will be carefully transferred to the appropriate sampling containers (see Table 10). The sampling containers will be completely filled such that no headspace is present that would allow the loss of volatiles. The sample bottles will then be transferred to a chilled container for shipment to the analytical laboratory. Unfiltered samples will be collected for all parameters except metals and orthophosphate, where the groundwater samples will be filtered with an in-line 0.445 micron filter.

7.2.4 Surface Water Sampling Procedures

During the Phase I investigation, surface water samples will be collected from the on-site drainage ditch and settling ponds. Since neither of these water bodies are very deep, the water sample will be obtained from a depth of approximately one foot. However, care will be taken so that the sample is not collected too near the sediment/water interface, thus potentially stirring up sediments into the water sample. If sediment and water sampling are to take place at the same time, all the surface water samples will be collected prior to collecting any sediment samples. In the drainage ditch, the down-stream sample will be collected prior to the up-stream sample. In addition, the ditch samples will be collected prior to the pond samples. The surface water samples will be collected with a 1-liter polypropylene Pond Sampler with a telescoping handle. The details of the Willamette River surface water sampling activities will be presented in an addendum to this Work Plan that will be submitted to DEQ.

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7.2.5 Sediment Sampling Procedures

During the Phase I investigation, sediment samples will be collected from the Willamette River at 11 different locations and from the on-site ponds at three locations. The locations of the proposed sediment sampling points are shown on Figures 10 and 11.

The sediment samples in the ponds will be collected at the sediment/water interface using either a stainless steel Ekman dredge (soft sediments) or 2-inch Lexan core tubes with stainless steel coring head if sandy sediments are present. The core tubes can be inserted into sediment by hand either from a small boat or from a wading position.

At each sampling point in the Willamette River, sediment samples will be obtained approximately 10 feet offshore at an average river stage. At each sample location, sediment samples will be obtained at one-foot intervals to a depth of approximately ten feet below the sediment/water interface. Two discrete sediment samples from each location will be selected for laboratory analysis, including one from the oxygenated zone and one from a greater depth which shall be based on field screening (see Section 7.2.2).

Collection of the sediment core samples will require use of an impact coring device to retrieve cores of approximately 10 feet in length. The coring device is mounted aboard a shallow draft, aluminum catamaran with a moveable A-frame on the forward deck allowing the core tubes to be retrieved and sealed effectively without losing core tube contents. The 4-inch OD core tubes are constructed of aluminum. Core tubes will be cut to the length of the extracted sample with a stainless steel cutting tool following retrieval. The tubes will then be sealed and labeled indicating sample orientation and location prior to transfer.

The core tubes will then be put on ice and transferred to an on-site location for extraction. Individual cores will be extracted using a piston-like extraction device onto polyethylene sheeting. Each sample shall be placed in a laboratory supplied 9-ounce sample jar and capped with a teflon-lined lid. The sample jars will be labeled and transferred to a chilled

container for shipment to the analytical laboratory. After samples are collected, each core will be logged and characteristics noted.

7.3 Sample Container, Label, and Custody Requirements

All samples will be transferred to the appropriate sampling containers and placed into a chilled (4°C) transport container (cooler) for shipment to the on-site laboratory. Chain-of-Custody tape will be affixed to each sample jar to assure that the sample has not been tampered with. The coolers will be utilized for temporary storage of the samples. Appropriate sample Chain-of-Custody forms will be placed in the sample coolers in a plastic bag. An example of the Chain-of-Custody form and seal are included in Appendix E. The coolers will then be sealed with chain-of-custody tape for delivery to the analytical laboratory. The sample container, preservation, and holding time requirements for each sample matrix and analytical method is summarized on Table 10. The types and numbers of sample bottles required per type of sample are summarized on Table 11.

A sample label will be attached to each sampling container prior to the sampling event. Information to be included on the label will include the following:

- Sample number
- Date and time of sample collection
- Initials of person collecting the sample
- Type of preservative, if any
- Analyses to be performed

Individual samples will be identified using a unique sample number which includes a sample prefix consisting of the HAI project number and a six digit date code. The prefix will be followed by a code indicating the type of sample and an individual sample

collection number which will be assigned sequentially as the samples are collected (e.g. 2708-9503429-B5-01). The sample type codes are as follows:

- "B" is a soil sample from a soil boring
- "M" is a soil sample from a monitoring well boring
- "BW" is a groundwater sample from a temporary well point
- "MW" is a groundwater sample from a monitoring well
- "SW" is a surface water sample
- "SD" is a sediment sample
- "A" is an air sample

A record of all field activities will be maintained by the Field Team Leader on an HAI Project Field Notes form (Appendix F).

7.4 Decontamination Procedures

The drilling equipment will be steam-cleaned between drilling locations to prevent cross-contamination between borings. All soil and sediment sampling equipment will be decontaminated after each sample by using a detergent solution wash, a potable water rinse, a dilute nitric acid rinse, a second potable water rinse, and a final distilled water rinse. In areas where tar is encountered, a specialized detergent may need to be utilized to remove the tar.

All water purging equipment will be decontaminated by using a detergent solution wash, two potable water rinses, and a final distilled water rinse. All water sampling equipment will be decontaminated by using a detergent solution wash, a potable water rinse, a dilute nitric acid rinse, a second potable water rinse, an isopropanol rinse, and a final de-ionized water rinse.

All water generated during the decontamination of the drilling and sampling equipment will be retained and stored in a temporary storage tank on-site (see Section 5.8).

7.5 Calibration Procedures

All field equipment will be calibrated prior to use according to the manufacturer's instructions. Users manuals and calibration records will accompany all monitoring equipment into the field and will be stored in the carrying case. Calibrated equipment will be identified by means of an HAI identification number or a manufacturer's serial number. The results of calibrations and records of repair will be maintained in a logbook. Equipment that fails calibration or fails to operate properly will be removed from service, tagged to indicate its condition, and segregated from the operational equipment. Such equipment will be repaired and re-calibrated if possible, or replaced. Preventive maintenance of field equipment is performed according to the procedures indicated in the manufacturer's manuals.

Laboratory analytical equipment and instruments will be calibrated in accordance with the laboratory's internal quality assurance/quality control (QA/QC) program.

7.6 Analytical Methods and Procedures

The analytical parameters selected for the Remedial Investigation are divided into three main categories, including primary parameters, secondary parameters, and Feasibility Study parameters. A summary of the selected analytical parameters and method numbers is included on Table 2.

Analyses for the primary parameters will be performed on soil, sediment, surface water, and groundwater samples and includes PAHs, BTEX, TPH, phenols, lead, and cyanide. Analyses for the secondary parameters will be performed on groundwater samples and includes sulfides, sulfate, ammonia, chlorinated pesticides and solvents, and priority pollutant metals. Analyses for the Feasibility Study parameters will be performed on groundwater samples and includes alkalinity, hardness, iron, manganese, nitrate,

nitrite, orthophosphate, and total organic carbon (TOC). In addition, analyses for BTU content will be performed on selected tar samples.

With some exceptions, all the analytical methods will follow standard U.S. Environmental Protection Agency (EPA) procedures as outlined in *Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods* (SW-846). The analytical methods for TPH analyses will follow DEQ-approved methods for underground storage tank (UST) cleanups (OAR 340-122-350). Analyses for PAHs will be performed by EPA Method 8270 modified to use the SIM mode. Analyses for phenols will be performed by EPA Method 8270 to achieve lower detection limits, since petroleum hydrocarbons cause interferences using EPA Method 8040. BTU content of the tar samples will be measured by ASTM Method D-2015.

7.6.1 Selection of Analyses for Soil and Sediment Samples

The analyses to be performed on any given soil sample will depend on the location of the soil boring with respect to a potential source area as indicated on Table 3. In addition, analyses will be performed on other soil samples at the site for purposes of performing the Endangerment Assessment as indicated on Table 3. TPH will generally be used as a screen to determine analyses for additional parameters as follows:

A) Cyanide analyses will be performed on all selected samples from the Former Spent Oxide Storage Area, Former Oxide Reactor Area, and Former Settling Ponds.
B) Total lead analyses will be performed on all selected samples in the Light Oil Plant area, former Koppers Land Treatment Area, and former Naphthalene Plant.
   1) Leachable lead analyses by the Toxicity Characteristic Leaching Procedure (TCLP) will be performed on samples where the detected total lead concentration, divided by a factor of 20, is greater than 2 ppm so that a comparison can be made to the Soil Cleanup Table (OAR 340-122-045).
C) Priority Pollutant metals analyses will be performed on all selected samples from the Former Spent Oxide Storage Area.

D) TPH-HCID analyses will be performed on all selected samples from all areas at the site, and will be used as a screen for determining analyses for other parameters.

1) If TPH is not detected, then additional analyses will not be performed on that sample.
2) If TPH is detected in any given soil sample, then additional analyses, depending on location at the site, will also be performed on that sample.
   a) TPH will be quantified by the appropriate DEQ method for gasoline, diesel, or oil range petroleum hydrocarbons.
   b) PAH analyses will be performed on all samples where TPH is detected.
   c) BTEX analyses will be performed on all samples where TPH is detected in the former Retort Area, Light Oil Plant, former Koppers Land Treatment Area, and former Naphthalene Plant.
   d) Phenol analyses will be performed on all samples where TPH is detected in the former Tar Processing Area, Light Oil Plant, former Koppers Land Treatment Area, and former Naphthalene Plant.

All fourteen sediment samples will be analyzed for TPH, PAHs, BTEX, total lead, and TOC as indicated on Table 7. Analyses for leachable lead will be performed based on the same criteria established for soil samples.

7.6.2 Selection of Analyses for Water Samples

The analyses to be performed on water samples from the temporary well points, monitoring wells, and surface water locations are summarized on Tables 4, 5, and 6 respectively.

As indicated on Table 4, the groundwater samples from all 16 temporary well points at the site will be analyzed for TPH and BTEX. If TPH is detected in any given sample, then that sample will also be analyzed for PAHs. The other analytical parameters were chosen based on the location of the well point relative to potential source areas. Phenols will be analyzed at well points that are in the vicinity of the former Retort Area, Light Oil and Naphthalene Plants and Koppers Land Treatment Area. Cyanide and H_2S (sulfides and

sulfate) will be analyzed at well points that are down-gradient of the former Spent Oxide Storage Area and Oxide Reactor Area, and down-gradient of the former Settling Ponds since spent oxide may have been used as fill in this area. Ammonia will be analyzed at well points in the vicinity of the former Oxide Reactor Area, since it is known that ammonia was used in this area.

During the first quarterly monitoring event (Table 5), the groundwater samples from all 18 monitoring wells will be analyzed for TPH, PAHs, BTEX, and total lead. If total lead is detected in any given well, then the groundwater sample will also be analyzed for dissolved lead. Phenols will be analyzed at wells that are down-gradient of the former Retort Area, Light Oil and Naphthalene Plants, and Koppers Land Treatment Area. Cyanide and H_2S (sulfides and sulfate) will be analyzed at wells that are down-gradient of the former Spent Oxide Storage Area and Oxide Reactor Area, and down-gradient of the former Settling Ponds. Ammonia will be analyzed at wells in the vicinity of the Oxide Reactor Area. Chlorinated volatiles and pesticides will be analyzed in one shallow and two deep wells located on the southeast portion of the Gasco site. Priority Pollutant metals will be analyzed on a total basis at 8 monitoring wells where the most significant groundwater contamination is detected by other parameters. If metals are detected in any given well on a total basis, then the groundwater samples will also be analyzed for those metals on a dissolved basis. Feasibility Study analytical parameters will be analyzed during the second quarterly groundwater monitoring event.

As indicated on Table 6, the surface water samples will be analyzed for the presence of TPH, PAHs, BTEX, and dissolved lead.

7.7 Quality Assurance /Quality Control Procedures

7.7.1 Field Quality Control Samples

As a check of field quality control (QC) procedures, a number of QC samples will be collected and analyzed, including soil and water duplicate samples, water trip blanks,

field/equipment blanks, matrix spikes, and matrix spike duplicates. The identity of the QC samples will not be made known to the analytical laboratory, with the exception of the matrix spike and matrix spike duplicate samples. The QC samples will be analyzed for the primary analytical parameters only. A summary of the project quality control sample plan is included on Table 12.

One duplicate soil and sediment sample will be collected and analyzed for every 20 investigative samples. A duplicate groundwater sample will be collected from one temporary well point (B-26) and one monitoring well (MW-7-25). One duplicate surface water sample will be collected from a drainage ditch location (SW-5).

One trip blank will be prepared by the analytical laboratory for every two days of sampling or for each sampling event if it is less than 2 days. The trip blank will be kept in the cooler with the investigative samples. A field/equipment blank of water will be obtained prior to sampling a deep and a shallow monitoring well by passing de-ionized water through the decontaminated sampling pump into the appropriate sampling containers. In addition, two soil equipment blanks will be obtained after sampling a tar zone at two different borings at the site. The soil equipment blanks will be obtained by passing de-ionized water through the decontaminated soil sampling device into the appropriate sampling containers.

A matrix spike and matrix spike duplicate sample of groundwater will be obtained from monitoring well MW-7-25. These samples will be spiked in the laboratory for the primary analytical parameters.

Laboratory QC for this project will involve the standard EPA guidelines as described in *Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods* (SW-846) and therefore will not be repeated here. Laboratory QC will include calibration standards, control samples, reagent blanks, matrix spikes, surrogate spikes, and laboratory duplicates.

7.7.2 Quality Assurance Audits

The HAI Project Manager will monitor and audit the performance of the QA/QC procedures. When necessary, the Project Manager will audit the field work in progress. These audits would evaluate the execution of sample identification, sample control, chain-of-custody procedures, field documentation, instrument calibration, field measurement, and sampling operations. The evaluation would be based on the extent to which the applicable procedures as set forth in the project plans are being followed.

Field documents pertaining to sample identification and control would be examined for completeness and accuracy. Field notebooks and data forms would be reviewed to determine that all entries are dated and signed and that the contents are legible, written in ink, and contain accurate and inclusive documentation of project activities. The auditor also would determine if chain-of-custody procedures were being followed and that samples were being kept in the custody of the Field Team Leader at all times.

If quality control audits result in detection of unacceptable conditions or data, the Project Manager will be responsible for developing corrective action. Corrective action may include:

- Re-analyzing samples if holding time criteria permit
- Re-sampling and analyzing samples
- Evaluating and amending sampling and analytical procedures
- Accepting data while acknowledging the level of uncertainty associated with the data

A Quality Assurance Report will be included as part of the Remedial Investigation Report. The Quality Assurance Report will address the following: assessment of data accuracy, precision, and completeness; results of quality assurance audits; significant QA/QC problems encountered during the project and the recommended solutions.

7.8 Data Reduction, Validation, Analysis, and Interpretation

All field data will be reviewed to determine accuracy, precision, and completeness. Descriptive data, such as field soil boring logs, will be transferred to a final appropriate format (Appendix F). Numerical data, such as water levels, will be reduced and entered into computer data bases.

All analytical data will be reviewed to determine accuracy, precision, and completeness and provide an assessment of the usability of the data. The review will include an evaluation of the field and laboratory blanks and duplicates results, surrogate and matrix spike recoveries, detection and quantitation limits achieved, holding times, and equipment calibrations. If the data is not considered to be of adequate quality, an appropriate data qualifier will be assigned. After the data have been reviewed and qualified, the data will be entered into computer data bases and presented in tabular and graphical formats for interpretation.

The field and analytical data will be interpreted as appropriate within the context of the Remedial Investigation. The hydrogeologic characteristics and the contaminant distributions of the site will be defined, as appropriate. The data interpretation will be performed so that information is generated that will be useful for the Endangerment Assessment and Feasibility Study.

8.0 SITE HEALTH AND SAFETY PLAN

A site-specific Site Health and Safety Plan will be developed as required by the Occupational Safety and Health Administration (OSHA) according to the Code of Federal Regulations (CFR) 29 CFR 1910.120. The Site Health and Safety Plan will include discussion under the following section headings: Site Description; Organization and Coordination; Site Control; Hazard Evaluation; Personal Protective Equipment;

Communication Procedures; Decontamination Procedures; and Site Safety and Health. The Site Health and Safety Plan will be submitted to DEQ prior to performing the field activities at the site.

Based on a review of the previous investigatory activities at the subject site, modified Level D protection is recommended during most site activities. The level of protection may be upgraded to Level C if monitoring of the work zone indicates levels of VOCs are above appropriate limits.

Level C protection is recommended during the drilling of the soil borings in the Light Oil Plant area, due to suspected VOCs in the subsurface in this area. Personnel and ambient air monitoring for VOCs and PAHs will be performed during the drilling activities at the site.

9.0 ENDANGERMENT ASSESSMENT WORK PLAN

An Endangerment Assessment will be prepared by Decision Focus for the Gasco site. The Endangerment Assessment will include a Human Health Evaluation to evaluate potential risks to human health, and an Environmental Evaluation to evaluate potential ecological impacts. Both the Human Health Evaluation and Environmental Evaluation will evaluate risks associated with the site in the absence of any actions to control or mitigate releases, that is, for the site with no further action. Where possible, the Endangerment Assessment will provide quantitative estimates of such impacts. The Endangerment Assessment will be based on data collected during the RI/FS, and will:

- Summarize the nature and extent of contaminants as found in the Remedial Investigation
- Identify potentially exposed individuals and ecosystems
- Describe and quantify potential exposure pathways
- Estimate potential impacts of Gasco site contaminants

9.1 Human Health Evaluation

The Human Health Evaluation will be divided into five elements:

1) Chemicals of concern
2) Dose-response data for chemicals of concern
3) Locations and concentrations of such chemicals
4) Exposure assessment for potentially exposed individuals
5) Quantitative estimates of potential health risks

The Human Health Evaluation will also include an executive summary and conclusions. Each of the elements is described in the following subsections.

9.1.1 Chemicals of Concern

The potential contaminants of concern to be assessed in the Human Health Evaluation are:

- Polynuclear aromatic hydrocarbons (PAHs)
- Volatile aromatic hydrocarbons, including benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Phenols
- Lead
- Cyanide

As outlined in Section 4.4, additional chemicals have also been listed as potential contaminants at the site:

- Hydrogen sulfide (H_2S)
- Ammonia (NH_3)
- Chlorinated pesticides and solvents
- Metals

The final list of chemicals of concern will be determined by the results of the Remedial Investigation.

9.1.2 Dose-Response Data

Toxicity and dose-response information will be summarized for each of the chemicals of concern. The primary source for this information will be the EPA Integrated Risk Information System (IRIS). For each chemical, adverse health impacts will be described and quantified for:

- Acute health effects
- Chronic, non-cancer health effects, and
- Cancer

For acute effects, the Human Health Evaluation will compare estimated short-term exposures with acute effect thresholds. For chronic non-cancer health effects, long-term exposures will be compared with the Reference Dose (RfD) or Reference Concentration (RfC). When long-term exposures are below the RfD or RfC, no adverse human health effects are expected to occur.

For carcinogens, an EPA cancer potency factor (CPF) will be used. Because the EPA assumes that at low doses the cancer risk increases linearly with dose, increased cancer risk may be estimated by multiplying the potency factor by a dose of the carcinogen. Where available, route-specific potency factors will be used.

There are large uncertainties associated with EPA dose-response estimates. For example, many RfD values have "Uncertainty Factors" (UF) of 10 to 1,000 incorporated into the values. Reasons for these factors include uncertainty in study results, uncertainty in extrapolating animal results to humans, and uncertainty in how effects will scale with organism size. The purpose of multiplying study results by the Uncertainty Factors is to produce standards likely to be protective for the most sensitive people of an exposed

population in spite of the large uncertainties. The logical implication is that such estimates are likely to overestimate risks. Similar protective assumptions are used for developing cancer potency factors. For example a linearized multi-stage model is used which implies risk at any dose. Further, a 95% upper confidence limit fit to that model is used. Additionally, multipliers similar to the "Uncertainty Factors" are used to be protective where assumptions regarding body size and inter-species extrapolation are required. Again, this is to provide a protective estimate of cancer potencies.

The implication is that results derived using standard EPA dose-response values are likely to overestimate risk, and thus provide a worst-case, rather than best-estimate, value of risk. We will calculate and report results using these standard, highly protective dose-response values. We may also calculate and report results using best-estimate values. Where such values are used, the basis for those values will be clearly explained and documented.

9.1.3 Locations and Concentrations Of Chemicals

The results of the Phase I Investigation will be used to estimate the concentrations of the chemicals of concern. Chemical concentrations will be estimated in:

- Subsurface soil
- Surface soil
- Groundwater
- On-site surface water
- River water
- River sediment
- Air

The focus will be estimating concentrations in the media and location combinations most important for estimating human exposures and environmental releases.

Groundwater is believed to flow directly into the Willamette river; and accordingly, a significant concern with respect to chemical concentrations in groundwater will be as a source of contaminants for the Willamette River.

Where extrapolation or estimates are required, all available information will be used. Fate and transport modeling may also be used where needed.

There will be uncertainties in concentrations of chemicals. The primary reason is that contaminants are spread unevenly at the site, so it is impossible to know precise concentrations at exposure points. Therefore concentration of a particular chemical in a particular media will be described with low/medium/high values or a probability distribution that reflects Remedial Investigation findings.

9.1.4 Exposure Assessment

In this step the routes of human and environmental exposure will be enumerated and described. Exposure routes will include:

- Surface soil contact
- Surface soil ingestion
- Subsurface soil contact
- Subsurface soil ingestion
- Groundwater dermal contact
- Groundwater incidental ingestion
- Surface water contact
- Surface water incidental ingestion
- River water contact
- River water incidental ingestion
- River sediment contact
- Inhalation

In addition, prior to commencing the Endangerment Assessment, NWNG and DEQ will consider the necessity of assessing groundwater as a potential source of drinking water. Such consideration will take into account current DEQ policies on this issue, HB 3352 as enacted by the 68th Legislative Assembly (1995), and present and reasonably likely future beneficial uses of and human exposure by ingestion to groundwater.

Information needed to characterize human contact with the site, such as personnel on site, usage of the site, and usage of the river, will be collected to characterize the potentially exposed populations. Examples of parameters to be estimated in this regard include frequency of visits and the time spent in various activities. Exposure parameters will be quantified according to standard EPA practices (EPA, 1989a[7]; EPA Region 10, 1991[8]; EPA, 1990[9] , EPA, 1992a[10]. Examples of such parameters include incidental soil and water consumption and inhalation rates. All assumptions will be clearly described and documented.

There will be uncertainty in many of the exposure parameters. For example, the number of years a person may work at the site, the number of times per week they participate in an activity, and the amount of incidental soil ingestion will all vary by individual. This uncertainty will be described using low/medium/high values or probability distributions.

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[7]U.S. EPA, *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, Interim Final, EPA/540/1-89/002 (1989a)

[8]U.S. EPA Region 10, *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors*, Interim Final, OSWER Directive 9285.6-03, March 25, (1991)

[9]U.S. EPA, *Exposure Factors Handbook*, Exposure Assessment Group, Office of Health and Environmental Assessment, EPA/600/8-89/043, (1990).

[10]U.S. EPA, *Guidelines for Exposure Assessments*, 57 CFR 22888 et seq., May 29,(1992a)

9.1.5 Quantitative Estimates Of Potential Health Risks and Uncertainty

Potential acute, chronic non-cancer, and cancer health risks will be separately estimated using the above information. For acute and chronic non-cancer results, the possibility of exposures exceeding thresholds (e.g., the RfD) is the primary concern. For carcinogens, estimated increases in cancer risk will be calculated. The chemicals, locations, and exposure routes accounting for the most important risks will be highlighted and discussed.

The information collected on uncertainties in the input parameters will allow reporting of best estimate results as well as the worst case results corresponding to Reasonable Maximum Exposure (RME) assumptions. We anticipate that calculations will be carried out using either discretized uncertainty values (e.g., low/medium/high) or standard probability distributions with selected parameters.

9.2 Environmental Evaluation

For the Environmental Evaluation, on-site wildlife and the Willamette river will be the areas of interest. The Willamette is a substantial river carrying a variety of contaminants from many sources. Since the Gasco site impact is likely to be small relative to other contaminants, biological assessments downstream of the Gasco site may not be useful. The most productive approach will probably be to estimate quantities of contaminants that may enter the river from the site, and project the impacts those contaminants may have on river life. The Environmental Evaluation will be conducted according to available guidance from the national and regional EPA offices (EPA, 1992b[11]; EPA, 1989b[12]). An EPA Region 10 environmental evaluation guidance document

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[11]U.S. EPA, *A Framework for Ecological Risk Assessment*, EPA 630/R-92/001, (1992b)

[12]U.S. EPA, *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference*, EPA/600/3-89/013, (1989b)

is scheduled for publication in the spring of 1995. The Environmental Evaluation will be defined in greater detail when that document is available.

10.0 FEASIBILITY STUDY WORK PLAN

The Feasibility Study will evaluate the potentially feasible remedial action alternatives that will meet the remedial goals, as appropriate, for the various contaminated media at the site.

Development and evaluation of remedial action alternatives and the remedy selection process will be conducted in accordance with OAR 340-122-080 and 090, as interpreted and applied consistent with the purpose and intent of ORS 465.315(1) as amended by Section 1 of HB 3352 as enacted by the 68th Legislative Assembly (1995), to the maximum extent practicable within the bounds of the existing rules of the Environmental Quality Commission, as may be amended or supplemented.

The Feasibility Study will include the following tasks: 1) development and screening of alternatives, 2) treatability investigations, if necessary, and 3) detailed analysis of alternatives. Guidance for performing the Feasibility Study will be taken from the EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.*[13]

10.1 Development and Screening of Alternatives

The development and screening of alternatives will be an important first step in the Feasibility Study process. The purpose of this task is to 1) define the remedial action objectives, 2) identify an appropriate range of remedial action alternatives that will meet those objectives, and 3) screen the range of appropriate alternatives. Prior to completing

[13]U.S. EPA, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Interim Final, OSWER Directive 9355.3-01 (October 1988).

the Remedial Investigation, a preliminary screening of remedial technologies will be performed to assess which technologies may be the most appropriate for the site. The results of the preliminary screening of remedial technologies will be presented in the Phase I RI Letter Report.

Information gathered during the Phase I investigation and Endangerment Assessment will be used to modify the development of alternative remedial options. The preliminary screening of remedial alternatives will also be used to focus the Phase II investigation.

The remedial action alternatives will be developed by assembling combinations of technologies, and the media to which they are to be applied, into alternatives that will address contamination at the Gasco site. This development and screening process will consist of six general steps, as outlined by EPA, 1988:

1) Develop Remedial Action Objectives – Remedial action objectives will be developed by specifying the affected media, exposure pathways, and preliminary remediation goals. The preliminary remediation goals will be developed based on the risk factors from the Endangerment Assessment, and any legally applicable or relevant and appropriate requirements (ARARs).

2) Develop General Response Actions – General response actions will be developed for each media defining the actions that may be taken to satisfy the remedial action objectives for the site. The general response actions at the site may include: 1) containment of hazardous substances to prevent or reduce migration, 2) prevention of exposure to hazardous substances by institutional or engineering controls, 3) removal, treatment, and/or disposal of high concentration deposits of hazardous substances, or 4) any combination of these options.

3) Identify Volumes or Areas of Affected Media – The volumes and areas of affected media that will require general response actions will be identified. Risk-based reference standards developed from the Endangerment Assessment will be used in conjunction with the chemical and physical characterization of the site to delineate the areas and volumes that will require response actions.

4) Identify and Screen Remedial Technologies and Process Options – The remedial technologies that are applicable to each general response action will be identified. The process options that are applicable to each technology type are also identified. The applicable technologies and process options will be screened to eliminate those that cannot be implemented technically at the site. Potential remedial technologies that will be considered in the Feasibility Study, grouped by general response action, will include, but not be limited to, the following:

- Containment Response Action
  - Capping
  - Gradient control
  - Stabilization/solidification
  - Vertical or horizontal barriers
- Prevention of Exposure Response Action
  - Capping
  - Institutional controls
  - Other engineering controls
- Removal or Collection Response Action
  - Excavation and removal
  - Groundwater extraction
  - Soil washing
  - Product recovery
  - Vapor extraction
- Treatment and/or Disposal Response Action
  - Biological treatment
  - Chemical treatment
  - Physical treatment
  - Thermal treatment
  - Landfill disposal
  - On-site disposal

5) Evaluate Process Options – The identified technology process options will be evaluated to select a representative process option for each technology type. At this point, the process options are evaluated based generally on cost, effectiveness, and implementability.

6) Assemble and Screen Alternatives – The general response actions and representative process options will be assembled into alternatives representing a range of possible remedial actions for the various media at the site. If a number of remedial action alternatives are identified as appropriate at the Gasco site, then the alternatives will be screened to reduce the number of alternatives that will be analyzed in detail. The screening process will include an evaluation of the interactions of the media to the various technologies and the protection afforded by each. The alternatives will also be evaluated based on site-specific criteria for cost, effectiveness, and implementability.

10.2 Treatability Investigations

If necessary, treatability studies will be conducted to provide sufficient data to allow for a detailed evaluation of the remedial action alternatives, and to support the remedial design of the selected alternative. Treatability studies can reduce performance and cost uncertainties to levels that will allow for a selection of a remedial action. Treatability studies may include bench tests and/or pilot scale tests.

10.3 Detailed Analysis of Alternatives

Following the development and screening of the remedial alternatives, a detailed analysis will take place in order to select or approve the final remedy. The objective of the detailed analysis ~~is~~ will be to compare and contrast screened alternatives, and their advantages and disadvantages, with respect to the remedial goals. The detailed analysis

will take into consideration, as appropriate and in accordance with the second paragraph of Section 10.0, the following evaluation criteria.

- Protection of human health and the environment
- Use of permanent solutions, alternative technologies or resource recovery technologies, or hot spot treatment
- Cost-effectiveness and cost-reasonableness
- Short-term and long-term effectiveness in achieving protectiveness
- Technical and practical implementability
- Current and reasonably anticipated future land uses

Information from any treatability studies and the Remedial Investigation will ~~also~~ be incorporated into the detailed analysis of the alternatives. The key advantages and disadvantages of each alternative will be integrated with a risk assessment for the site to select the preferred remedial alternative. The results of the detailed analysis will provide the basis for identifying the preferred alternative.

NWT 003331

GLOSSARY OF ABBREVIATIONS

ARARs	applicable or relevant and appropriate requirements
bgs	below existing ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
BTU	British Thermal Unit
Camp Dresser	Camp Dresser & McKee Inc.
CFR	Code of Federal Regulations
CPF	cancer potency factor
Decision Focus	Decision Focus Incorporated
DEQ	Oregon Department of Environmental Quality
DNAPLs	dense non-aqueous phase liquids
EM	electromagnetic method
EPA	U.S. Environmental Protection Agency
ESC	Expedited Site Characterization
GPR	ground penetrating radar
GPS	Global Positioning System
H_2S	hydrogen sulfide
HAI	Hahn and Associates, Inc.
ID	inside diameter
Koppers	Koppers Company, Inc.
LNAPLs	light non-aqueous phase liquids
LNG	liquefied natural gas
NH_3	Ammonia
NWNG	Northwest Natural Gas Company
OAR	Oregon Administrative Rules
OD	outside diameter
ORS	Oregon Revised Statute
OSHA	Occupational Safety and Health Administration
OWRD	Oregon Water Resources Division
PAHs	polynuclear aromatic hydrocarbons
PNO	Pacific Northern Oil Company
ppm	parts per million
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SPT	Standard Penetration Test
TOC	total organic carbon
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
USCS	Unified Soil Classification System
Wacker	Wacker Siltronic Corporation

NWT 003332

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NWT 003333

TABLE 1 - Summary of Potential Source Areas and Contaminants of Concern

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project #2708

Potential Source Area	Hazardous Materials	Predicted Contaminants of Concern	Other Potential Contaminants
• Retort Area	Tar	PAHs, TPH	Metals
• Tar Processing Area	Tar	PAHs, TPH	Metals
• Light Oil Plant	Light Oil	BTEX, PAHs, Phenols, TPH	Metals
	Motor Fuels	BTEX, PAHs, TPH, Lead	Metals
• Koppers Plant	Creosote	PAHs, Phenols, TPH	Metals
	Coal Tar Pitch	PAHs, TPH	Metals
	Pencil Pitch	PAHs, TPH	Metals
• Naphthalene Plant	Naphthalene	PAHs, TPH	Metals
• Coke Oven Area	Coke	PAHs, TPH	Metals
	Tar	PAHs, TPH	Metals
• Pitch Plant	Tar	PAHs, TPH	Metals
	Pitch	PAHs, TPH	Metals
	Creosote	PAHs, Phenols, TPH	Metals
• Oxide Reactor Area	Spent Oxide	Cyanide	H2S, Ammonia
• PNO Tank Farm	Diesel Fuel	PAHs, TPH	Metals
	Bunker Fuel	PAHs, TPH	Metals
• Lampblack Storage Area	Lampblack	PAHs, TPH	Metals
	Other		Pesticides & Solvents
• Spent Oxide Storage Area	Spent Oxide	Cyanide	H2S
• Settling Ponds/Fill Area	Tar	PAHs, TPH	Metals
	Spent Oxide	Cyanide	H2S
	Lampblack	PAHs, TPH	Metals
	Wastewaters	BTEX, PAHs, Phenols, TPH, Lead	Metals
	Other		Pesticides & Solvents
• Koppers Land Treatment Area	Wastewaters	PAHs, Phenols, TPH	Metals

BTEX = benzene, toluene, ethylbenzene, and xylenes
H2S = hydrogen sulfide
PAHs = polynuclear aromatic hydrocarbons
PNO = Pacific Northern Oil
TPH =total petroleum hydrocarbons

Updated: 8/2/95 REB
File: 2708-01 Source Area

NWT 003334

TABLE 2 - Summary of Analytical Parameters

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project #2708

Analytical Parameters	Matrix	Analytical Methods
Primary Parameters		
• Polynuclear Aromatic Hydrocarbons (PAHs)	Soil & Water	EPA Method 8270 SIM Mode
• Volatile Aromatic Hydrocarbons Benzene, Toluene, Ethylbenzene, & Xylenes (BTEX)	Soil & Water	EPA Method 8020
• Total Petroleum Hydrocarbons (TPH)	Soil Water	DEQ Method TPH-HCID EPA Method 418.1
Gasoline	Soil	DEQ Method TPH-G
Diesel	Soil	DEQ Method TPH-D
Oil, Bunker, Tar	Soil	DEQ Method TPH-418.1M
• Phenols	Soil & Water	EPA Method 8040
• Lead (Pb)		
Total & Dissolved	Soil & Water	EPA Method 6010 or 200.7
Leachable	Soil	EPA Methods 1311 (TCLP) and 6010
• Cyanide, Total & Amenable	Soil & Water	EPA Method 9010
Secondary Parameters		
• Hydrogen Sulfide (H2S)		
Sulfides	Water	EPA Method 9030
Sulfate	Water	EPA Method 9038
• Ammonia (NH3)	Water	EPA Method 350.3
• Chlorinated Solvents or VOCs	Water	EPA Method 8260
• Chlorinated Pesticides	Water	EPA Method 8080
• Priority Pollutant Metals Ag, As, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Tl, Zn	Water	EPA Methods 6010 and 7000 Series
Feasibility Study Parameters		
• Alkalinity	Water	EPA Method 310.1
• Hardness	Water	EPA Method 200.7
• Iron & Manganese	Water	EPA Method 200.7
• Nitrate & Nitrite	Water	EPA Method 300.7
• Phosphate, ortho	Water	EPA Method 365.2
• Total Organic Carbon (TOC)	Water	EPA Method 415.1
• Temperature, Conductivity, & pH	Water	Field Measurement
• BTU Content	Tar	ASTM Method D-2015

Note:

DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
HCID = hydrocarbon identification
SIM = single ion monitoring
TCLP = Toxicity Characteristic Leaching Procedure
VOCs = volatile organic compounds

Table 3 - Sampling and Analytical Summary for Soil Borings
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Soil Boring Number	Potential Source Area	Estimated Depth of (feet bgs)	Soil Sample Interval (feet)	Estimated Samples Selected for Analyses	Analytical Parameters					
					TPH	PAHs	BTEX	Phenols	Lead	Cyanide
B-1	Spent Oxide Storage Area	20	2.5	2	X				PP	X
B-2	Spent Oxide Storage Area	20	2.5	2	X				PP	X
B-3	Spent Oxide Storage Area PNO Tank Farm	20	2.5	2	X	X	*	*	PP	X
B-4	Former Oxide Reactor Area PNO Tank Farm	20	Continuous	2	X	X				X
B-5	Former Oxide Reactor Area	20	2.5	2	X					X
B-6	PNO Tank Farm	20	2.5	2	X	X				
B-7	PNO Tank Farm	20	2.5	2	X	X				
B-8	PNO Tank Farm	20	Continuous	2	X	X				
B-9	PNO Tank Farm	20	2.5	2	X	X				
B-10	PNO Tank Farm	20	Continuous	2	X	X	*	*	*	*
B-11	Former Retort Area	20	2.5	2	X	X	X			
B-12	Former Retort Area	20	2.5	2	X	X	X			
B-13	Former Retort Area	20	Continuous	2	X	X	X	*	*	*
B-14	Former Retort Area	20	2.5	2	X	X	X			
B-15	Former Retort Area	20	2.5	2	X	X	X			
B-16	Former Retort Area Former Tar Processing Area	20	Continuous	2	X	X	X	X		
B-17	Former Tar Processing Area	20	2.5	2	X	X		X		
B-18	Former Tar Processing Area Light Oil Plant	20	2.5	2	X	X	X	X	X	*
B-19	Former Tar Processing Area Light Oil Plant	20	Continuous	2	X	X	X	X	X	
B-20	Light Oil Plant	20	2.5	2	X	X	X	X	X	
B-21	Light Oil Plant	20	2.5	2	X	X	X	X	X	
B-22	Light Oil Plant	20	2.5	2	X	X	X	X	X	
B-23	Light Oil Plant Former Pitch Plant	20	Continuous	2	X	X	X	X	X	*
B-24	Former Pitch Plant	20	2.5	2	X	X				
B-25	Former Pitch Plant	20	Continuous	2	X	X				
B-26	Former Coke Ovens	20	2.5	2	X	X	X	X	X	
B-27	Former Koppers Land Treatment Area	20	2.5	2	X	X	X	X	X	

Table 3 - Sampling and Analytical Summary for Soil Borings
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Soil Boring Number	Potential Source Area	Estimated Depth of (feet bgs)	Soil Sample Interval (feet)	Estimated Samples Selected for Analyses	Analytical Parameters					
					TPH	PAHs	BTEX	Phenols	Lead	Cyanide
B-28	Former Koppers Land Treatment Area	20	Continuous	2	X	X	X	X	X	
B-29	Lampblack Storage/Fill Area	20	2.5	2	X	X				
B-30	Lampblack Storage/Fill Area	20	Continuous	2	X	X	*	*	*	*
B-31	Lampblack Storage/Fill Area	20	Continuous	2	X	X	*	*	*	*
B-32	Former Settling Ponds	20	2.5	2	X	X				X
B-33	Former Settling Ponds	20	2.5	2	X	X	*	*	*	X
B-34	Former Settling Ponds	20	2.5	2	X	X				X
B-35	Former Settling Ponds	20	2.5	2	X	X				X
MW-1	Spent Oxide Storage Area	25	Continuous	2	X					X
MW-2	PNO Tank Farm	25	Continuous	2	X	X	*	*	*	*
MW-3	PNO Tank Farm	25	Continuous	2	X	X				
MW-4	Lampblack Storage/Fill Area	50	Continuous	2	X	X	*	*	*	*
MW-5	Lampblack Storage/Fill Area	25	Continuous	2	X	X				
MW-6	Former Retort Area	50	Continuous	2	X	X	X			
MW-7	Lampblack Storage/Fill Area	50	Continuous	2	X	X				
MW-8	Former Settling Ponds	50	Continuous	2	X	X				X
MW-9	Former Retort Area	25	Continuous	2	X	X	X			
MW-10	Former Naphthalene Plant	25	Continuous	2	X	X	X	X	X	
MW-11	Former Koppers Land Treatment Area	50	Continuous	2	X	X	X	X	X	
MW-12	Light Oil Plant Former Tar Loading Area	50	Continuous	2	X	X	X	X	X	
Total 47		**1,150**		**94**	**47**	**43**	**27**	**22**	**22**	**19**

NOTE:
* = parameters selected for Endangerment Assessment
bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
PAHs = polynuclear aromatic hydrocarbons
PP = analysis for Priority Pollutant metals
TPH = total petroleum hydrocarbons
X = parameters selected based on source area

TABLE 4 - Sampling and Analytical Summary for Temporary Well Points
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAI Project # 2708

Soil Boring Number	Soil Boring Location	Estimated Screened Interval (feet bgs)	Analytical Parameters						
			TPH	PAHs	BTEX	Phenols	Cyanide	H2S	NH3
B-1	Former Spent Oxide Storage Area, PNO Tank Farm	15 - 20	X	*	X		X	X	X
B-5	Former Oxide Reactor Area, PNO Tank Farm	15 - 20	X	*	X		X	X	X
B-8	PNO Tank Farm	15 - 20	X	*	X				
B-16	Former Retort and Tar Processing Areas	15 - 20	X	*	X	X			
B-17	Former Tar Processing Area	15 - 20	X	*	X	X			
B-19	Light Oil Plant	15 - 20	X	*	X	X			
B-20	Light Oil Plant	15 - 20	X	*	X	X			
B-21	Light Oil Plant	15 - 20	X	*	X	X			
B-22	Light Oil Plant	15 - 20	X	*	X	X			
B-23	Light Oil Plant	15 - 20	X	*	X	X			
B-24	Former Pitch Plant	15 - 20	X	*	X				
B-25	Former Pitch Plant	15 - 20	X	*	X				
B-26	Former Coke Ovens	15 - 20	X	*	X	X			
B-28	Former Koppers Land Treatment Area	15 - 20	X	*	X	X			
B-29	Lampblack Storage/Fill Area	15 - 20	X	*	X				
B-31	Lampblack Storage/Fill Area	15 - 20	X	*	X		X	X	
TOTAL			**16**	**16**	**16**	**9**	**3**	**3**	**2**

NOTE: * = Analysis for PAHs will be performed if TPH is detected
bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
H2S = hydrogen sulfide (by sulfides and sulfates)
NH3 = ammonia
PAHs = polynuclear aromatic hydrocarbons
TPH = total petroleum hydrocarbons

Updated: 8/2/95 REB
File: 2708-04 Well Pt SAP

NWT 003338

TABLE 5 - Sampling and Analytical Summary for Proposed Monitoring Wells
Initial Sampling Event

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAI Project # 2708

Proposed Monitoring Well Number	Rational for Monitoring Well Location	Estimated Well Depth (feet bgs)	Estimated Screened Interval (feet bgs)	Analytical Parameters for Groundwater Sampling										
				TPH	PAHs	BTEX	Phenols	Cyanide	Total Lead*	PP Metals	H2S	NH3	CVOCs	Pesticides
MW-1	Down-gradient of Former Spent Oxide Storage Area; immediately up-gradient of Willamette River	25	10-25	X	X	X		X	X	**	X	X		
MW-2	Down-gradient of Former Oxide Reactor Area and PNO Tank Farm; immediately up-gradient of Willamette River	25	10-25	X	X	X		X	X	**	X	X		
MW-3	Down-gradient of PNO Tank Farm; immediately up-gradient of Willamette River	25	10-25	X	X	X			X	**				
MW-4-25	Down-gradient of Lampblack Storage/Fill Area and Former Settling Ponds; immediately up-gradient of Willamette River	25	10-25	X	X	X		X	X	**	X			
MW-4-50	Investigate for DNAPLs down-gradient of Former Settling Ponds; determine vertical hydraulic gradient	50	40-50	X	X	X		X	X	**	X			
MW-5	Down-gradient of Former Settling Ponds; immediately up-gradient of Willamette River	25	10-25	X	X	X		X	X	**	X		X	X
MW-6-25	Down-gradient of Former Retort Area	25	10-25	X	X	X	X	X	X	**	X	X		
MW-6-50	Investigate for DNAPLs down-gradient of Former Retort Area; determine vertical hydraulic gradient	50	40-50	X	X	X	X	X	X	**	X	X		
MW-7-25	Down-gradient of LNG Containment Basin, Former Naphthalene and Light Oil Plants, and Former Tar Processing Area	25	10-25	X	X	X			X	**				
MW-7-50	Investigate for DNAPLs down-gradient of Former Naphthalene and Light Oil Plants and Former Tar Processing Area; determine vertical hydraulic gradient	50	40-50	X	X	X			X	**				
MW-8-25	Down-gradient of Former Settling Ponds and Koppers Land Treatment Area	25	10-25	X	X	X		X	X	**	X			

TABLE 5 - Sampling and Analytical Summary for Proposed Monitoring Wells
Initial Sampling Event

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

HAI Project # 2708

Proposed Monitoring Well Number	Rational for Monitoring Well Location	Estimated Well Depth (feet bgs)	Estimated Screened Interval (feet bgs)	Analytical Parameters for Groundwater Sampling										
				TPH	PAHs	BTEX	Phenols	Cyanide	Total Lead*	PP Metals	H2S	NH3	CVOCs	Pesticides
MW-8-50	Investigate for DNAPLs down-gradient of Former Settling Ponds and Koppers Land Treatment Area; determine vertical hydraulic gradient	50	40-50	X	X	X		X	X	**	X		X	X
MW-9	Possible up-gradient shallow well for the property	25	10-25	X	X	X			X	**				
MW-10	At Former Naphthalene Plant; down-gradient of Light Oil Plant	25	10-25	X	X	X	X		X	**				
MW-11-25	Down-gradient of Former Koppers Land Treatment Area and Former Pitch Plant	25	10-25	X	X	X	X		X	**				
MW-11-50	Investigate for DNAPLs down-gradient of Former Koppers Land Treatment Area and Former Pitch Plant; determine vertical hydraulic gradient	50	40-50	X	X	X	X		X	**			X	X
MW-12-25	At Tar Loading Area; possible up-gradient shallow well for the property	25	10-25	X	X	X			X	**				
MW-12-50	Possible up-gradient deep well for the property; determine vertical hydraulic gradient	50	40-50	X	X	X			X	**				
TOTAL		**600**	**-**	**18**	**18**	**18**	**5**	**9**	**18**	**18**	**9**	**4**	**3**	**3**

NOTE: bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
CVOCs = chlorinated volatile organic compounds
DNAPLs = dense non-aqueous phase liquids
EPA = U.S. Environmental Protection Agency
H2S = hydrogen sulfide (by sulfides and sulfates)
NH3 = ammonia
PAHs = polynuclear aromatic hydrocarbons
PP = priority pollutant
TPH = total petroleum hydrocarbons

* = if total lead is detected, then analysis for dissolved lead will also be performed.

** = analysis for PP metals will depend on results of other parameter tests; only the 8 most contaminated monitoring wells will be analyzed

Updated: 6/21/95 REB
File: 2708-05 MW SAP

NWT 003340

Table 6 - Sampling and Analytical Summary for Surface Water Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Sample Number	Location	Analytical Parameters			
		TPH	PAHs	BTEX	Lead
SW-1	Northern Settling Pond	X	X	X	X
SW-2	Northern Settling Pond	X	X	X	X
SW-3	Southern Settling Pond	X	X	X	X
SW-4	Drainage Ditch; Down-Stream	X	X	X	X
SW-5	Drainage Ditch; Up-Stream	X	X	X	X
Total		**5**	**5**	**5**	**5**

NOTE: * = Analysis for PAHs will be performed if TPH is detected

BTEX = benzene, toluene, ethylbenzene, and xylenes
PAHs = polynuclear aromatic hydrocarbons
TPH = total petroleum hydrocarbons

Table 7 - Sampling and Analytical Summary for Sediments
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

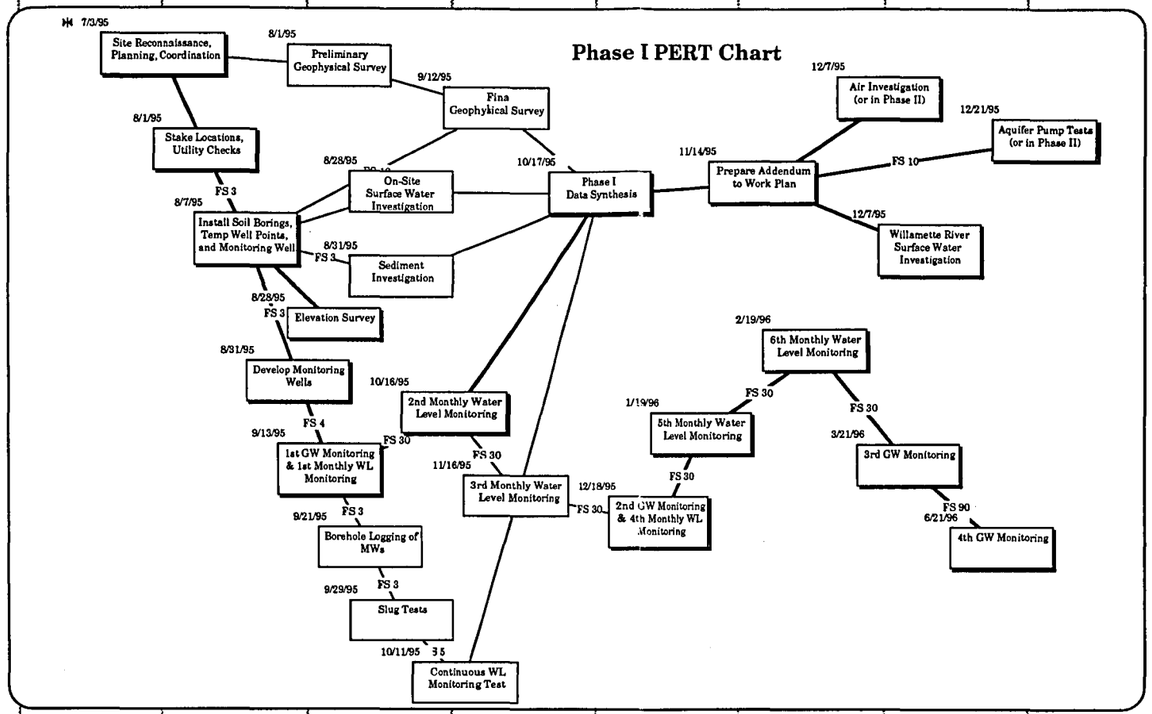
Sample Number	Location	Estimated Sample Depths (feet bss)	Samples Selected for Analyses	Analytical Parameters				
				TPH	PAHs	BTEX	Lead	TOC
SD-1	Northern Settling Pond	0.25 and 2.5*	2	X	X	X	X	X
SD-2	Northern Settling Pond	0.25 and 2.5*	2	X	X	X	X	X
SD-3	Southern Settling Pond	0.25 and 2.5*	2	X	X	X	X	X
SD-4	Willamette River @ Gasco Down-Stream	0.25 and 2.5*	2	X	X	X	X	X
SD-5	Willamette River @ Gasco Down-Stream	0.25 and 2.5*	2	X	X	X	X	X
SD-6	Willamette River @ Gasco Mid-Stream	0.25 and 2.5*	2	X	X	X	X	X
SD-7	Willamette River @ Gasco Mid-Stream	0.25 and 2.5*	2	X	X	X	X	X
SD-8	Willamette River @ Gasco Up-Stream	0.25 and 2.5*	2	X	X	X	X	X
SD-9	Willamette River @ Gasco Up-Stream	0.25 and 2.5*	2	X	X	X	X	X
SD-10	Willamette River @ Wacker Up-Stream Background	0.25 and 2.5*	2	X	X	X	X	X
SD-11	Willamette River @ Wacker Up-Stream Background	0.25 and 2.5*	2	X	X	X	X	X
SD-12	Willamette River @ Atochem Up-Stream Background	0.25 and 2.5*	2	X	X	X	X	X
SD-13	Willamette River @ Atochem Up-Stream Background	0.25 and 2.5*	2	X	X	X	X	X
SD-14	Willamette River @ Atochem Up-Stream Background	0.25 and 2.5*	2	X	X	X	X	X
Total			**28**	**14**	**14**	**14**	**14**	**14**

NOTE: bgs = below sediment surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
PAHs = polynuclear aromatic hydrocarbons
TOC = total organic carbon
TPH = total petroleum hydrocarbons
* = one sample to be selected from oxygenated zone and one sample to be selected based on field observations

Name
Site Reconnaissance, Planning, Coordination
Stake Locations, Utility Checks
Preliminary Geophysical Survey
Install Soil Borings, Temp Well Points, and Monitoring Wells
Elevation Survey
On-Site Surface Water Investigation
Develop Monitoring Wells
Sediment Investigation
Final Geophysical Survey
1st GW Monitoring & 1st Monthly WL Monitoring
Borehole Logging of MWs
Slug Tests
Continuous WL Monitoring Test
2nd Monthly Water Level Monitoring
Phase Data Synthesis
Prepare Addendum to Work Plan
3rd Monthly Water Level Monitoring
Air Investigation (or in Phase II)
Willamette River Surface Water Investigation
Aquifer Pump Tests (or in Phase II)
2nd GW Monitoring & 4th Monthly WL Monitoring
5th Monthly Water Level Monitoring
6th Monthly Water Level Monitoring
3rd GW Monitoring
4th GW Monitoring

7/1/95 8/1/95 9/1/95 10/1/95 11/1/95 12/1/95 1/1/96 2/1/96 3/1/96 4/1/96 5/1/96 6/1/96 7/1/96 8/1/96

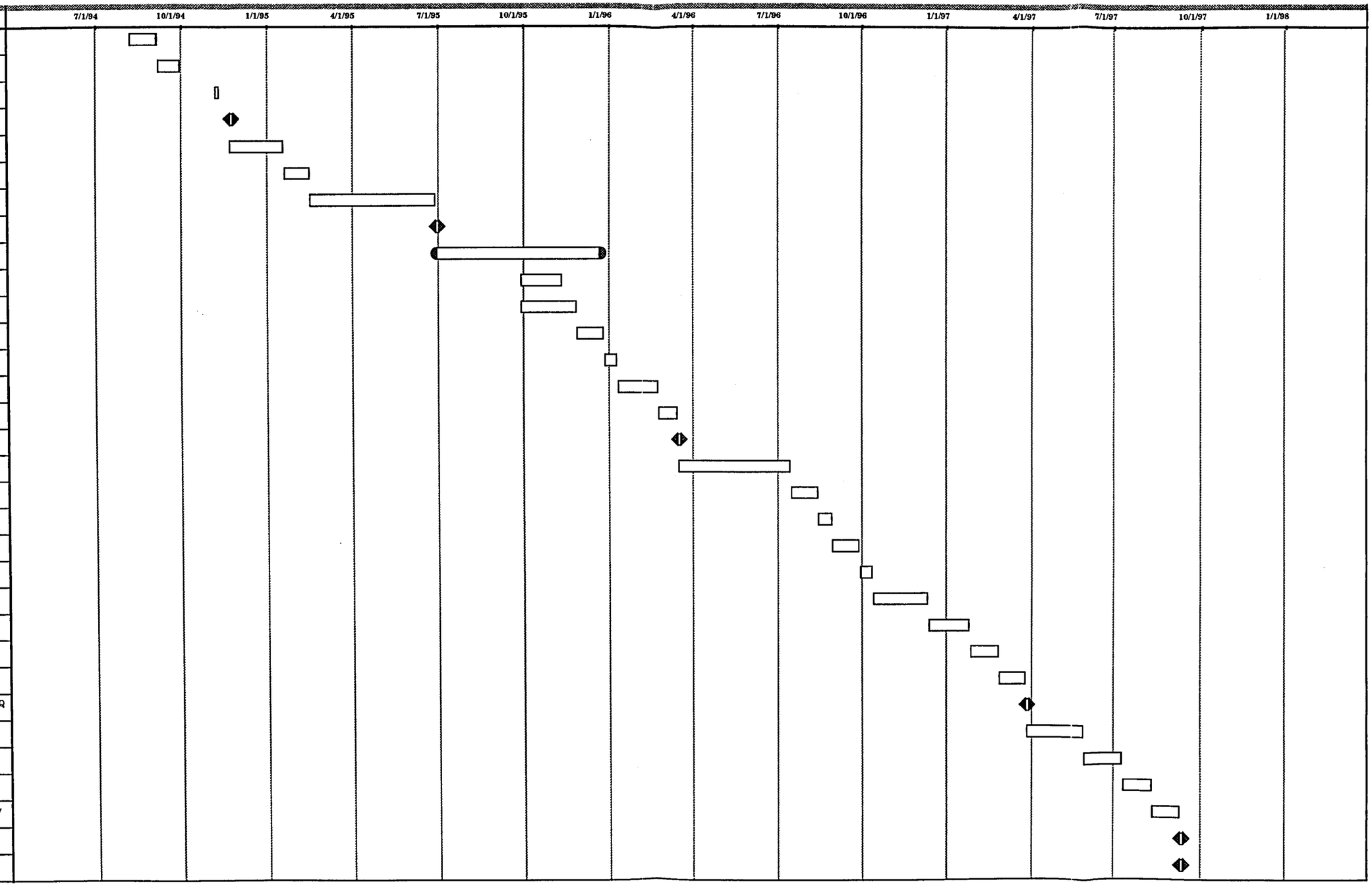
Phase I Gantt Chart



Project #2708	HAHN AND ASSOCIATES INCORPORATED	Phase I Investigation Schedule	TABLE 9
June 1995	ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 795-0717	RI/FS Work Plan NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	

NWT 003343

Name
Conceptual Work Plan (CWP) Prep
CWP Review by DEQ
CWP Meeting with DEQ
CWP Approval by DEQ
Draft RI/FS Work Plan (WP) Prep
Draft RI/FS WP Review by DEQ
RI/FS WP Revisions & Negotiations
RI/FS WP Approval by DEQ
Phase I Remedial Investigation
Preliminary Evaluation of Remedial Options
Endangerment Assessment
RI Letter Report Prep
RI Letter Report Review by DEQ
Phase II WP Addendum Prep
Phase II WP Addendum Review by DEQ
Phase II WP Approval by DEQ
Phase II Remedial Investigation
RI Letter Report Prep
RI Letter Report Review by DEQ
Draft RI Report Outline
Draft RI Report Outline Review by DEQ
Draft RI Report Prep
Draft RI Report Review by DEQ
Final RI Report Prep
Final RI Report Review by DEQ
RI Report Approval by DEQ
Draft Feasibility Study (FS) Report Prep
Draft FS Report Review by DEQ
Final FS Report Prep
Final FS Report Review by DEQ
FS Report Approval by DEQ
Begin Remedial Actions



Project #2708 June 1995	**HAHN AND ASSOCIATES INCORPORATED** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 (503) 796-0717	**RI/FS Project Schedule** RI/FS Work Plan NWNG Gasco Facility 7900 NW St. Helens Road Portland, Oregon	**TABLE** 8

TABLE 10

Sample Container, Preservation, and Holding Time Requirements

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Method Number	Technique	Sample Matrix	Sample Container	Preservation	Holding Time
SOIL & SEDIMENT SAMPLES					
DEQ Methods TPH-HCID, TPH-G, TPH-D, TPH-418.1M Total Petroleum Hydrocarbons (TPH)	GC	Soil	(1) 9-ounce glass jar	Cool to 4 C	7days
EPA Method 8020 Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX)	GC/PID	Soil	(1) 4-ounce glass jar	Cool to 4 C	14 days
EPA Method 8270 Modified Polynuclear Aromatic Hydrocarbons (PAHs)	GC/MS SIM	Soil	(1) 9-ounce glass jar	Cool to 4 C	7 days to extraction 40 days to analysis
EPA Method 8270 Phenols, Cresols	GC/MS	Soil	(1) 9-ounce glass jar	Cool to 4 C	7 days to extraction 40 days to analysis
EPA Method 6010 Total Lead	ICPES	Soil	(1) 9-ounce glass jar	Cool to 4 C	6 months
EPA Method 1311 (TCLP) & 6010 Leachable Lead	ICPES	Soil	(1) 9-ounce glass jar	Cool to 4 C	6 months
EPA Method 9010 Cyanide, Total & Amenable	SPM	Soil	(1) 9-ounce glass jar	Cool to 4 C	As soon as possible
EPA Method 415.1 Total Organic Carbon (TOC)	Oxidation IR	Soil	(1) 9-ounce glass jar	Cool to 4 C	28 days

NOTE:
C = degrees centigrade
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
GC = gas chromatography
ICPES = Inductively Coupled Plasma Emission Spectroscopy
MS = mass spectroscopy
PID = photoionization detector
SIM = selective ion monitoring
SPM = spectrophotometric
TCLP = toxicity characteristic leaching procedure

TABLE 10

Sample Container, Preservation, and Holding Time Requirements

RI/FS Work Plan

Northwest Natural Gas Company Gasco Facility

7900 NW St. Helens Road

Portland, Oregon

Project # 2708

Method Number	Technique	Sample Matrix	Sample Container	Preservation	Holding Time
WATER SAMPLES					
EPA Method 418.1 Total Petroleum Hydrocarbons (TPH)	IR	Water	(1) 1,000-ml amber glass bottle	Cool to 4 C H2SO4 pH<2	28 days
EPA Method 8020 Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX)	GC/PID	Water	(3) 40-ml VOA vials	Cool to 4 C HCl pH<2	14 days
EPA Method 8080 Chlorinated Pesticides	GC/ECD	Water	(1) 1,000-ml amber glass bottle	Cool to 4 C	7 days to extraction 40 days to analysis
EPA Method 8260 Volatile Organic Compounds (VOCs)	GC/MS	Water	(3) 40-ml VOA vials	Cool to 4 C HCl pH<2	14 days
EPA Method 8270 Modified Polynuclear Aromatic Hydrocarbons (PAHs)	GC/MS SIM	Water	(1) 1,000-ml amber glass bottle	Cool to 4 C H2SO4 pH<2	7 days to extraction 40 days to analysis
EPA Method 8270 Phenols, Cresols	GC/MS	Water	(1) 1,000-ml amber glass bottle	Cool to 4 C H2SO4 pH<2	7 days to extraction 40 days to analysis
EPA Method 200.7 Priority Pollutant Metals, Total	ICPES/AA	Water	(1) 500 ml plastic bottle	Cool to 4 C HNO3 pH<2	6 months
EPA Method 200.7 Priority Pollutant Metals, Dissolved	ICPES/AA	Water field-filtered 0.45 micron	(1) 500 ml plastic bottle	Cool to 4 C HNO3 pH<2	6 months
EPA Method 9010 Cyanide, Total & Amenable	SPM	Water	(1) 500 ml plastic bottle	Cool to 4 C NaOH pH>12	14 days
EPA Method 376.1 Sulfides	Titrimetric	Water	(1) 500 ml plastic bottle	Cool to 4 C NaOH pH>9 2 ml Zn Acetate	7 days

TABLE 10

Sample Container, Preservation, and Holding Time Requirements

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Method Number	Technique	Sample Matrix	Sample Container	Preservation	Holding Time
EPA Method 375.4 Sulfate	Turbidimetric	Water	(1) 500 ml plastic bottle	Cool to 4 C	28 days
EPA Method 200.7 Iron and Manganese	ICPES/AA	Water	(1) 500 ml plastic bottle	Cool to 4 C HNO3 pH<2	6 months
EPA Method 200.7 Hardness, Calculated	ICPES/AA	Water	(1) 500 ml plastic bottle	Cool to 4 C HNO3 pH<2	6 months
EPA Method 353.1 Nitrate and Nitrite	SPM	Water	(1) 500 ml plastic bottle	Cool to 4 C H2SO4 pH<2	2 days
EPA Method 310.1 Alkalinity	Titrimetric	Water	(1) 500 ml plastic bottle	Cool to 4 C	14 days
EPA Method 350.3 Ammonia as Nitrogen	Electrode	Water	(1) 500 ml plastic bottle	Cool to 4 C H2SO4 pH<2	28 days
EPA Method 365.2 Phosphate, ortho	SPM	Water field-filtered 0.45 micron	(1) 500 ml plastic bottle	Cool to 4 C	2 days
EPA Method 415.1 Total Organic Carbon (TOC)	Oxidation IR	Water	(1) 1,000-ml amber glass bottle	Cool to 4 C H2SO4 pH<2	28 days

NOTE:

AA = atomic absorption
C = degrees centigrade
ECD = electron capture device
EPA = U.S. Environmental Protection Agency
GC = gas chromatography
H2SO4 = sulfuric acid
HCl = hydrochloric acid
HNO3 = nitric acid
ICPES = Inductively Coupled Plasma Emission Spectroscopy
IR = infrared
ml = milliliter
MS = mass spectroscopy
NaOH = sodium hydroxide
PID = photoionization detector
SIM = selective ion monitoring
SPM = spectrophotometric
TCLP = toxicity characteristic leaching procedure
VOA = volatile organic analyses

Updated: 8/2/95 REB
File: 2708-10 Smpl Container copy

TABLE 11 - Sample Containers Required Per Sample
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Sample Matrix	Number of Containers Required	Sample Container	Preservative	Filtering Requirements	Analytical Parameters	Analytical Methods
Soil Sample	1	9-ounce glass sample jar with Teflon-lined lid	None	Not applicable	TPH PAHs Phenols	DEQ TPH Methods EPA 8270 SIM EPA 8270
	1	9-ounce glass sample jar with Teflon-lined lid	None	Not applicable	Total Lead Leachable Lead Cyanide	EPA 6010 EPA 1311 (TCLP), 6010 EPA 9010
	1	4-ounce glass sample jar with Teflon-lined lid	None	Not applicable	BTEX	EPA 8020
Sediment Sample	1	9-ounce glass sample jar with Teflon-lined lid	None	Not applicable	PAHs BTEX	EPA 8270 SIM EPA 8020
	1	9-ounce glass sample jar with Teflon-lined lid	None	Not applicable	Total Lead TOC	EPA 6010 EPA 415.1
Groundwater Sample from Temporary Well Point	3	1-liter amber glass bottle	H_2SO_4 pH<2	Unfiltered	TPH PAHs Phenols	EPA 418.1 EPA 8270 SIM EPA 8270
	3	40-ml VOA vials	HCl pH<2	Unfiltered	BTEX	EPA 8020
	1	500-ml plastic bottle	NaOH pH>12	Unfiltered	Cyanide	EPA 9010
	1	500-ml plastic bottle	NaOH pH>12 2 ml Zn Acetate	Unfiltered	Sulfides	EPA 376.1
	1	500-ml plastic bottle	None	Unfiltered	Sulfate	EPA 375.4
	1	500-ml plastic bottle	H_2SO_4 pH<2	Unfiltered	Ammonia	EPA 350.3

TABLE 11 - Sample Containers Required Per Sample
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Sample Matrix	Number of Containers Required	Sample Container	Preservative	Filtering Requirements	Analytical Parameters	Analytical Methods
Groundwater Sample from Monitoring Well	4	1-liter amber glass bottle	H2SO4 pH<2	Unfiltered	TPH	EPA 418.1
					PAHs	EPA 8270 SIM
					Phenols	EPA 8270
					TOC	EPA 415.1
	1	1-liter amber glass bottle	None	Unfiltered	Chlorinated Pesticides	EPA 8080
	3	40-ml VOA vials	HCl pH<2	Unfiltered	BTEX	EPA 8020
					VOCs	EPA 8260
	1	500-ml plastic bottle	HNO3 pH<2	Unfiltered	Total Priority Pollutant Metals	EPA 200.7
					Total Iron & Manganese	EPA 200.7
					Hardness	EPA 200.7
	1	500-ml plastic bottle	HNO3 pH<2	Field-Filtered 0.45 micron	Dissolved Priority Pollutant Metals	EPA 200.7
	1	500-ml plastic bottle	NaOH pH>12	Unfiltered	Cyanide	EPA 9010
	1	500-ml plastic bottle	NaOH pH>12 2 ml Zn Acetate	Unfiltered	Sulfides	EPA 376.1
	1	500-ml plastic bottle	H2SO4 pH<2	Unfiltered	Ammonia	EPA 350.3
					Nitrate & Nitrite	EPA 353.1
	1	500-ml plastic bottle	None	Unfiltered	Sulfate	EPA 375.4
					Alkalinity	EPA 310.1
	1	500-ml plastic bottle	None	Field-Filtered 0.45 micron	Phosphate, ortho	EPA 365.2

TABLE 11 - Sample Containers Required Per Sample
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Sample Matrix	Number of Containers Required	Sample Container	Preservative	Filtering Requirements	Analytical Parameters	Analytical Methods
Surface Water Sample	**2**	1-liter amber glass bottle	H2SO4 pH<2	Unfiltered	TPH PAHs	EPA 418.1 EPA 8270 SIM
	3	40-ml VOA vials	HCl pH<2	Unfiltered	BTEX	EPA 8020
	1	500-ml plastic bottle	HNO3 pH<2	Field-Filtered 0.45 micron	Dissolved Lead	EPA 200.7

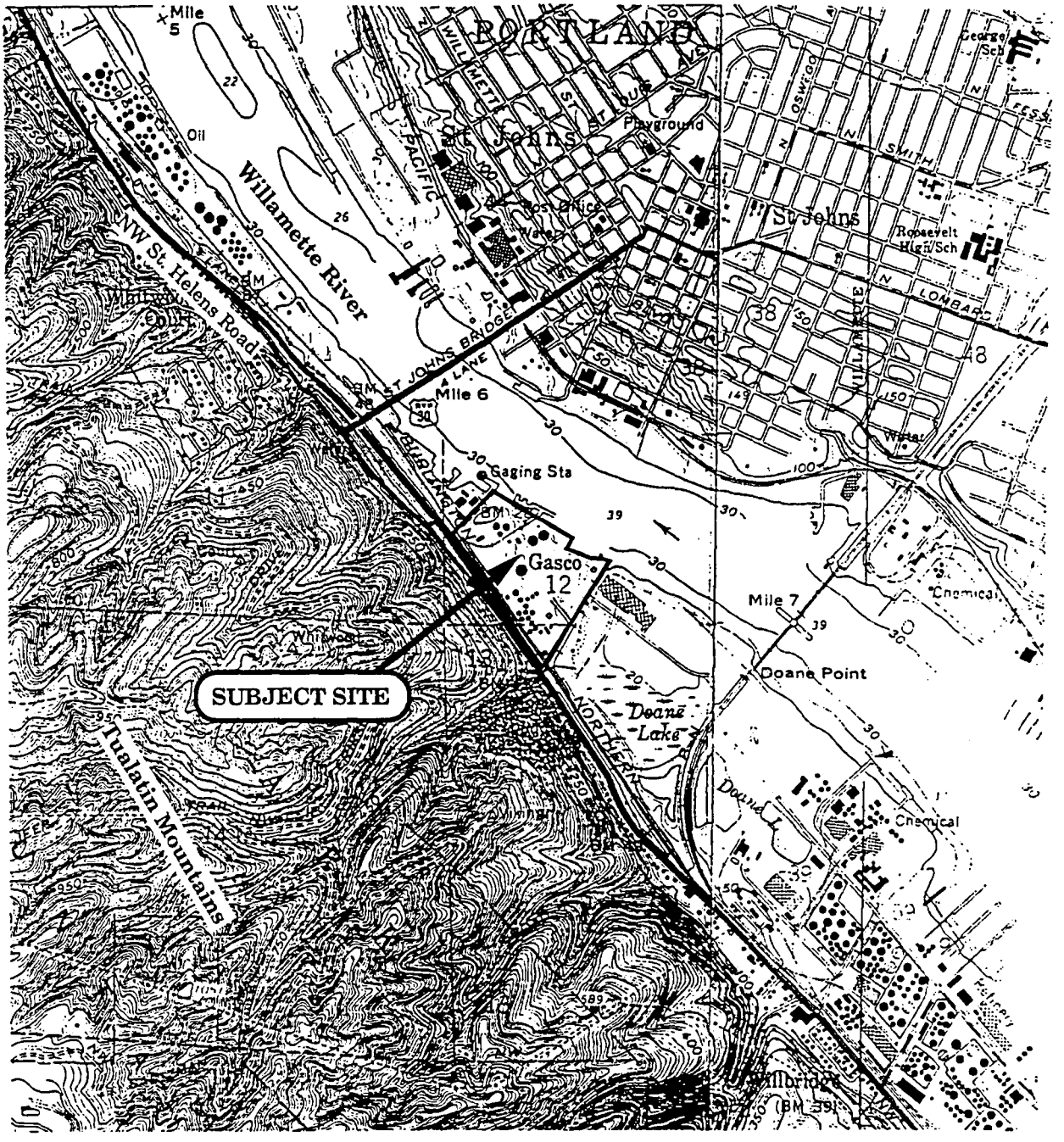
NOTE:
BTEX = benzene, toluene, ethylbenzene, and xylenes
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
H2SO4 = sulfuric acid
HCl = hydrochloric acid
HNO3 = nitric acid
ml = milliliter
NaOH = sodium hydroxide
PAHs = polynuclear aromatic hydrocarbons
SIM = selective ion monitoring
TCLP = Toxicity Characteristic Leaching Procedure
TOC = total organic carbon
TPH = total petroleum hydrocarbons
VOA = volatile organic analyses
VOCs = volatile organic compounds

TABLE 12 - Quality Control Sampling Plan
Phase I Investigation

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

Project # 2708

Media	Quality Control Samples				
	Field Duplicate	Sampling Equipment Blank	Trip Blank	Matrix Spike	Matrix Spike Duplicate
Soil	One per 20 samples	Two after sampling tar zones	One per 2 days sampling or One per sampling event	None	None
Sediment	One per 20 samples	None	One per 2 days sampling or One per sampling event	None	None
Groundwater	One per sampling event	One per sampling event	One per day of sampling or One per sampling event	One per sampling event	One per sampling event
Surface Water	One per sampling event	One per sampling event	One per day of sampling or One per sampling event	None	None



Note: Base Map from Linnton (1984) and Portland (1977), Oregon, USGS 7.5 Minute Quadrangles

HAI Project #2708 January 1995	**HAHN & ASSOCIATES, INC.** **ENVIRONMENTAL MANAGEMENT** 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209-3600 503/796-0717	**LOCATION MAP** RI/FS Work Plan Northwest Natural Gas Company Gasco Facility 7540 NW St. Helens Road Portland, Oregon	FIGURE **1**

NWT 003352

LEGEND

- Site Boundary
- Lease Boundary
- Existing Structure or Feature
- Railroad Tracks

N

0 150 300

Approximate Scale in Feet

Willamette River

Dock

Ditch

Wacker Siltronic

Pacific Northern Oil Company Lease Area

Oil Tank

Oil Tank

Oil Tank

Oil Tank

Oil Tank

PNO Office

LNG Containment Basin

LNG Tank

Pond

Pond

Pond

Pencil Pitch Storage

Storeroom

Koppers Company, Inc. Lease Area

Office

NW Natural Gas Co. LNG Plant

Gasco Office

U.S. Army Corps of Engineers

NW St. Helens Road

Figure 2

Site Map

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

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434 NW SIXTH AVENUE, SUITE 203
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503/796-0717

January 1995

Project #2708

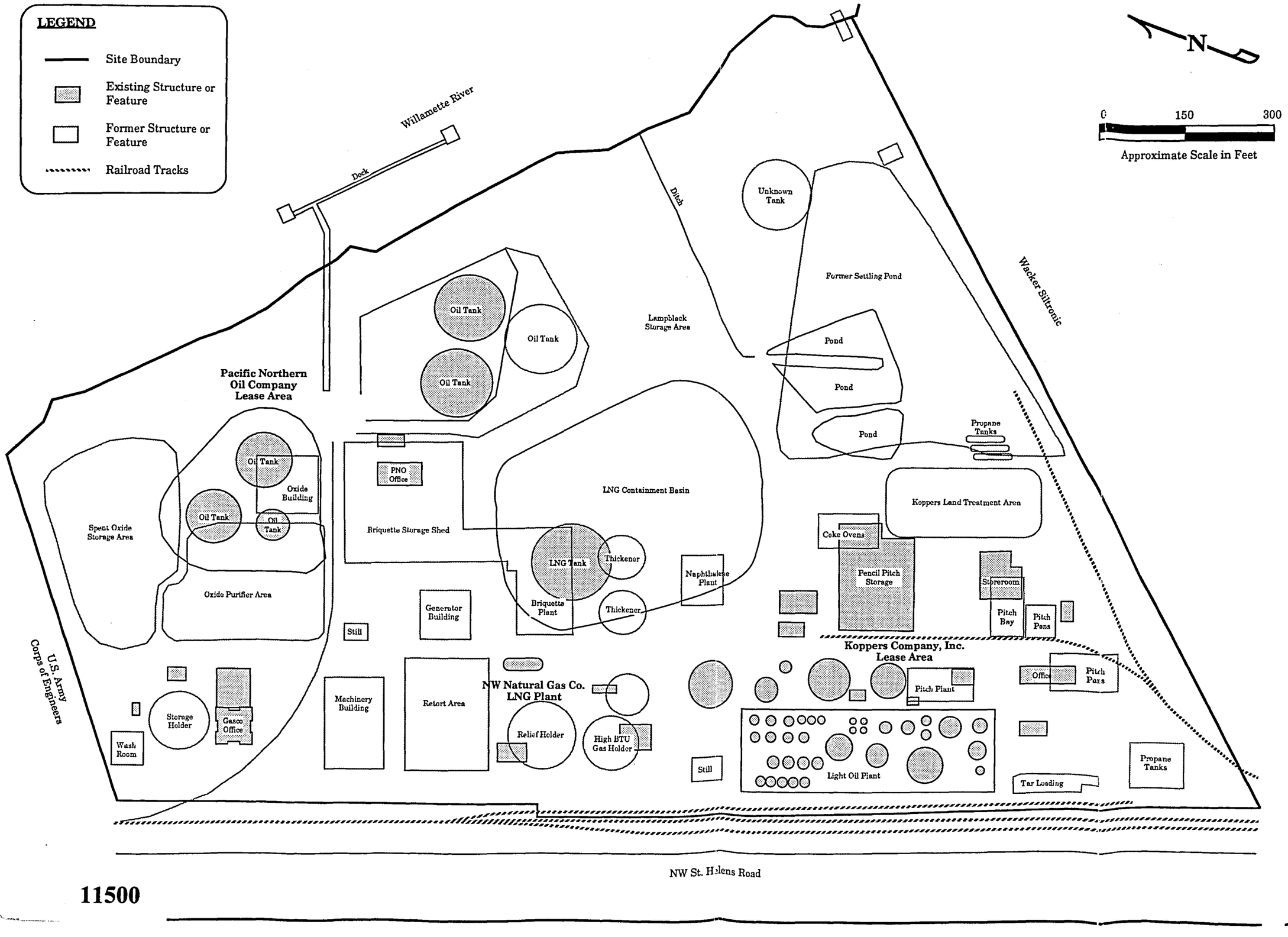

Figure 3

Historical Features Map

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

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PORTLAND, OREGON 97209
503/796-0717

January 1995

Project #2708

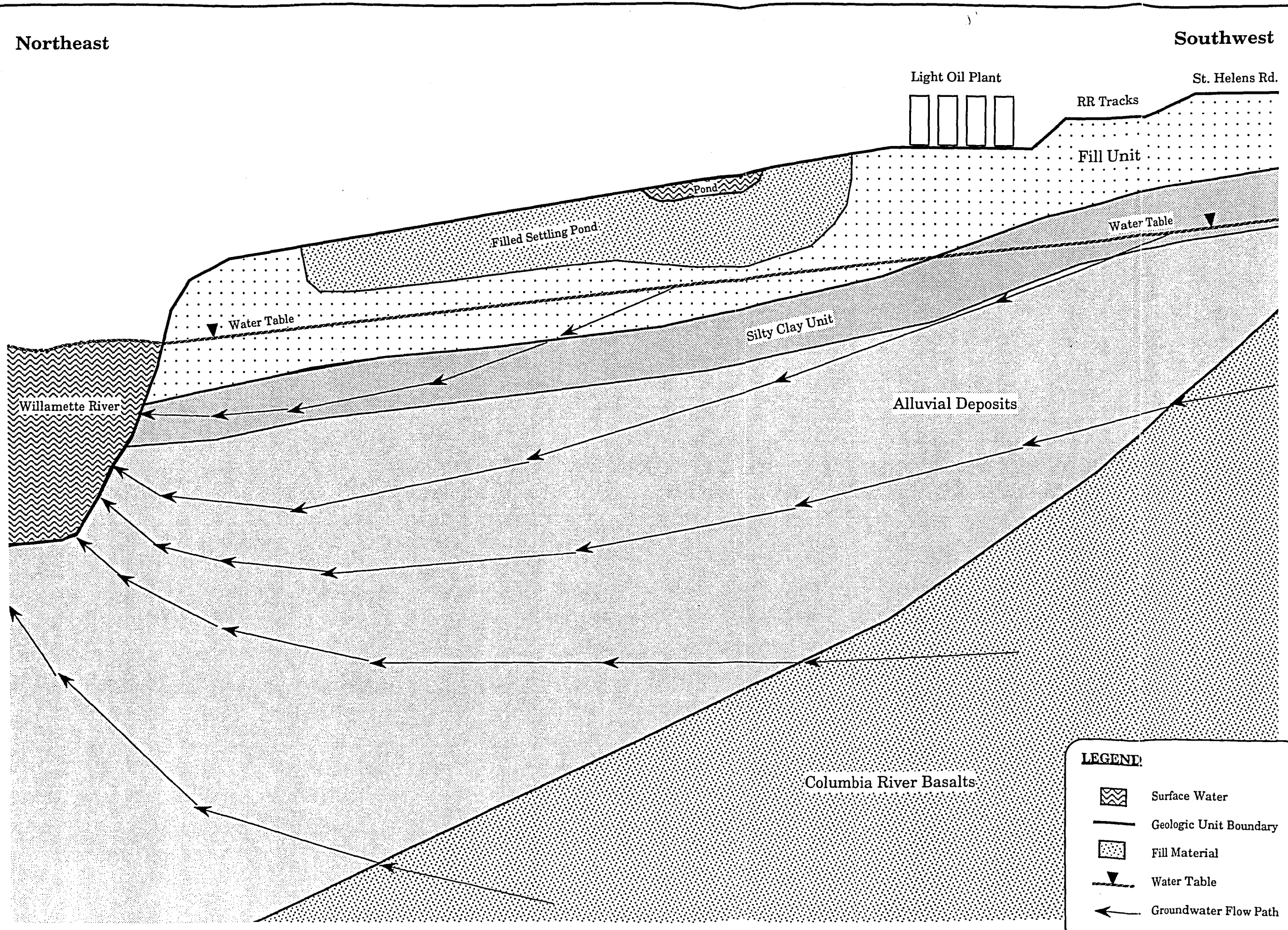

Figure 4

Hydrogeologic Conceptual Model

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon

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434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

January 1995

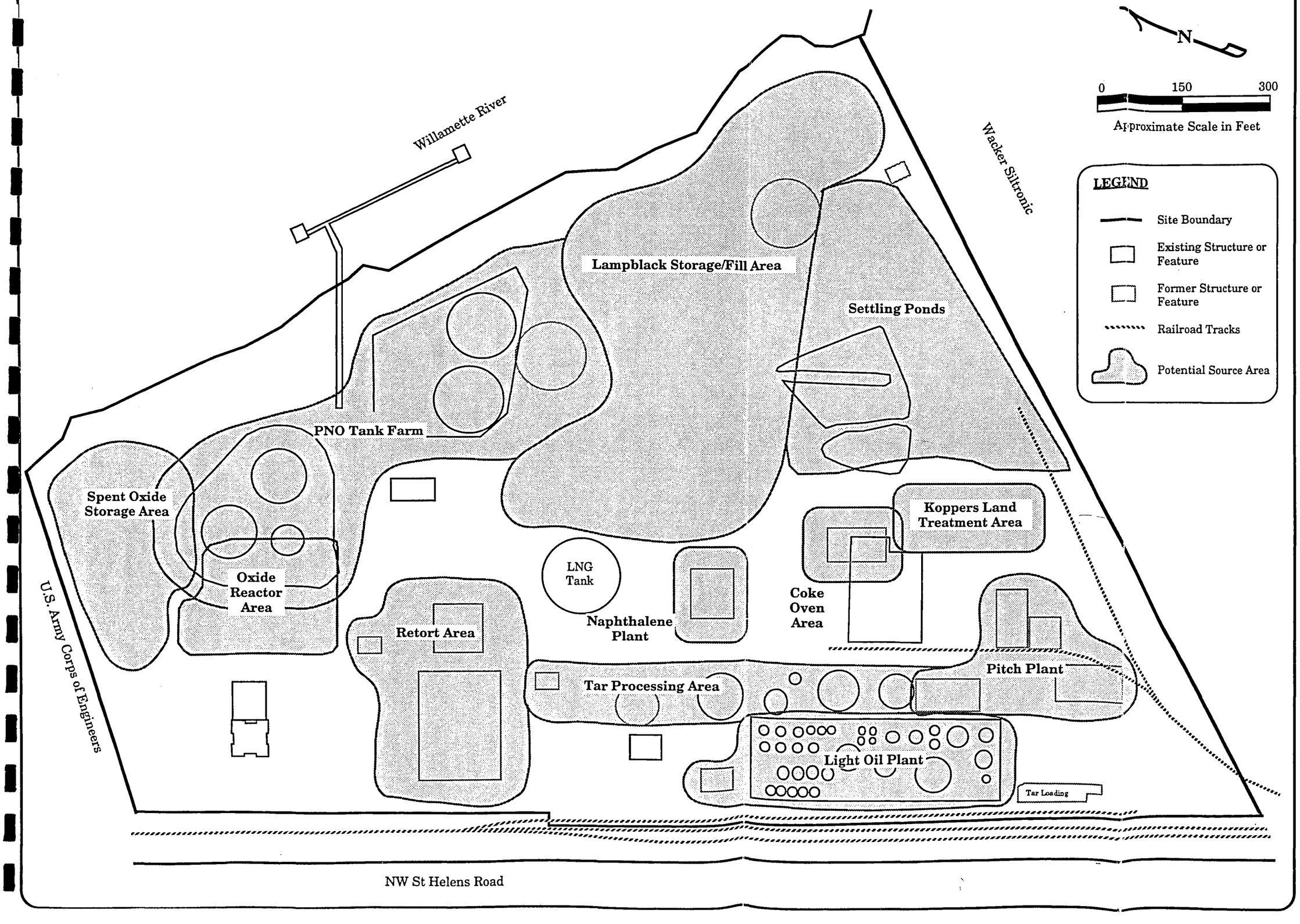
Project #2708

NWT 003355

Figure 5

Potential Source Areas

RI/FS Work Plan
Northwest Natural Gas Company Gasco Facility
7540 NW St. Helens Road
Portland, Oregon



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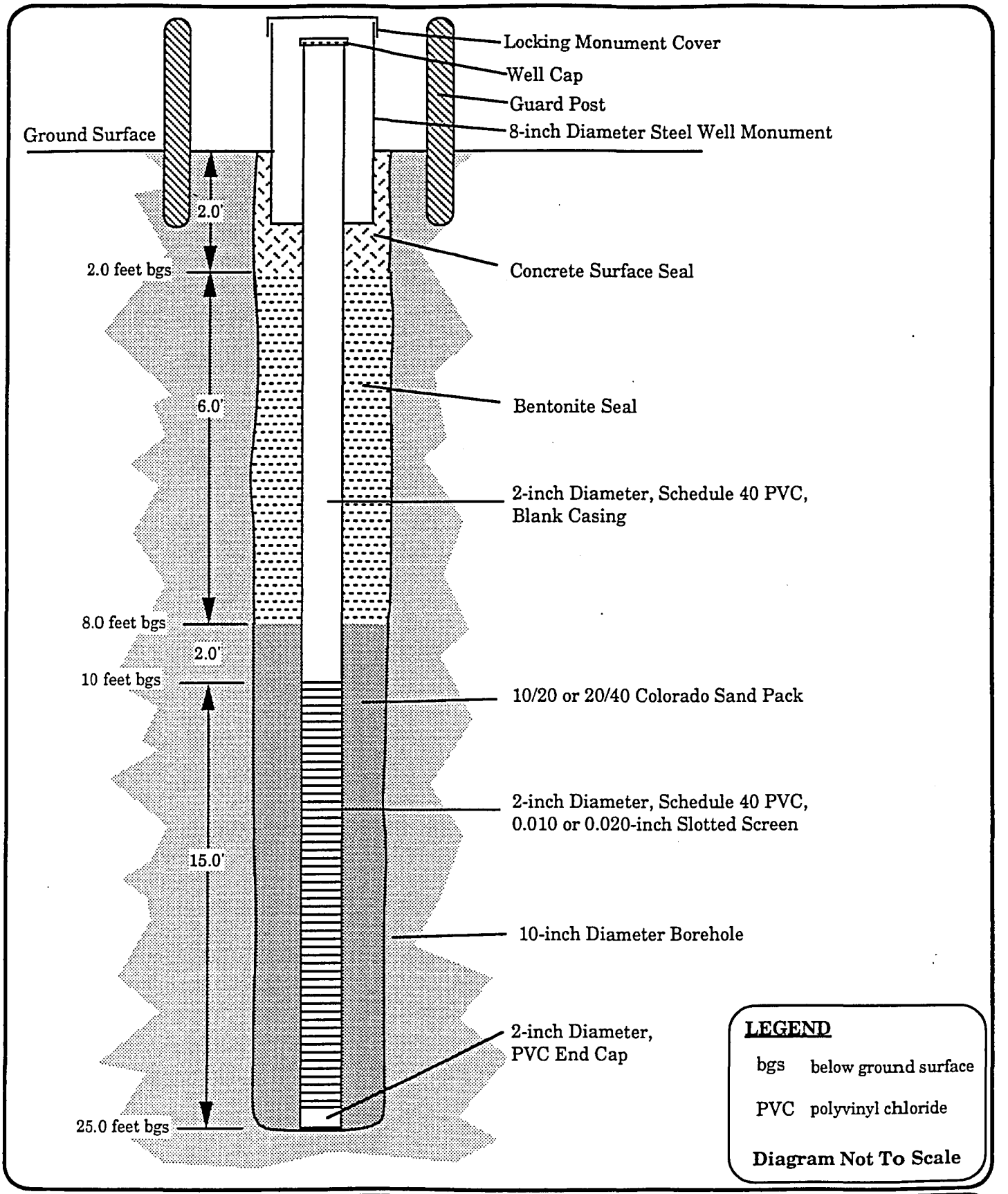
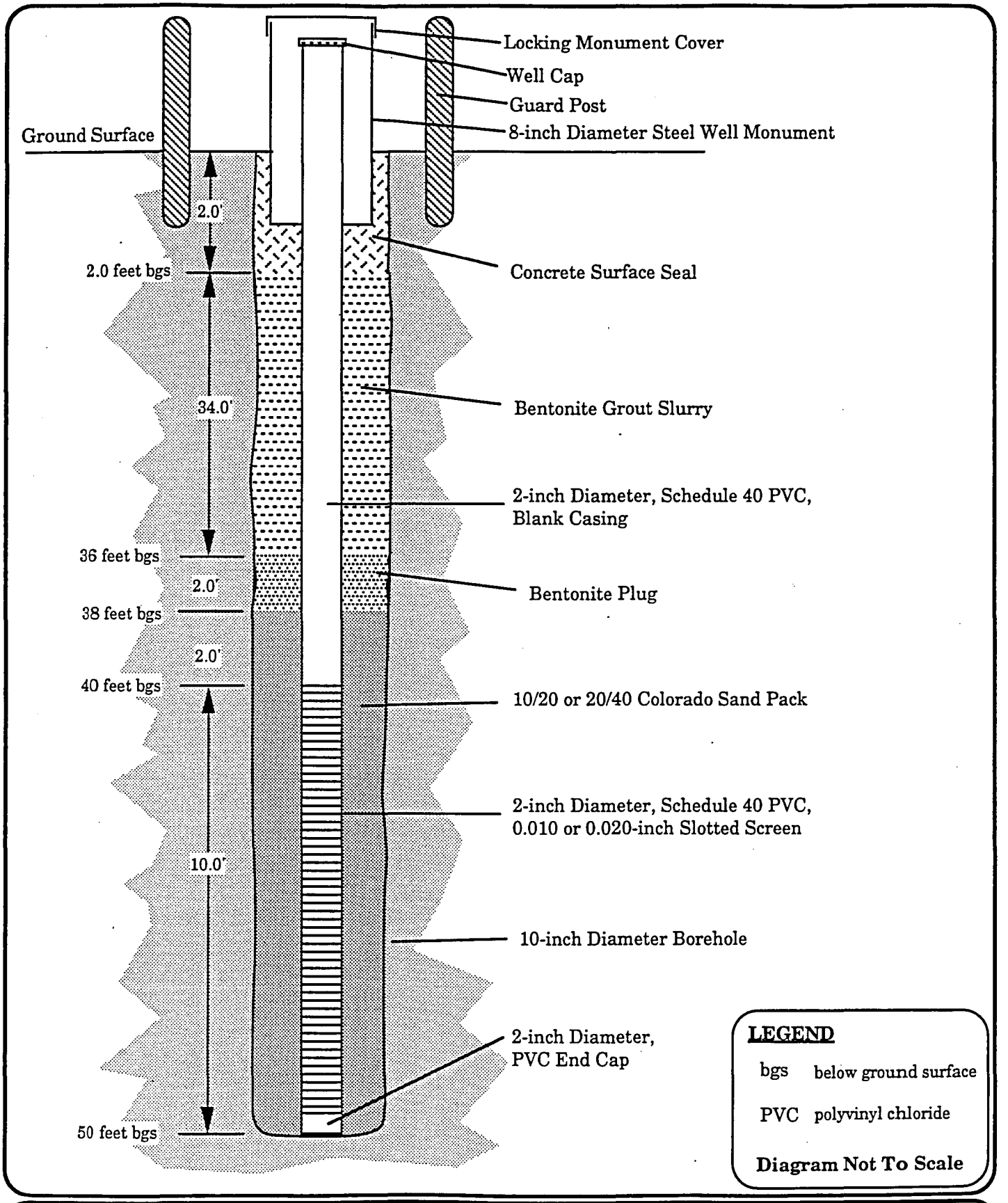
January 1995

Project #2708

NWT 003356



HAI Project #2708 January 1995	**HAHN & ASSOCIATES** **INCORPORATED** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 503/796-0717	**Shallow Monitoring Well Construction Diagram** RI/FS Work Plan Northwest Natural Gas Company Gasco Facility 7540 NW St. Helens Road Portland, Oregon	**FIGURE** 8



HAI Project #2708 January 1995	**HAHN & ASSOCIATES INCORPORATED** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 503/796-0717	**Deep Monitoring Well Construction Diagram** RI/FS Work Plan Northwest Natural Gas Company Gasco Facility 7540 NW St. Helens Road Portland, Oregon	**FIGURE 9**

APPENDIX A

Excerpts From Camp Dresser & McKee Inc. Report
Dated June 1987

NWT 003359

NORTH DOANE'S LAKE
SITE CHARACTERIZATION
WORK PLAN

JUNE 1987

Prepared by:
Camp Dresser & McKee Inc.
2300 15th Street, Suite 400
Denver, CO 80202

NWT 003360

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REFERENCES

APPENDICIES

A - Logs of borings used in simplified geologic cross-sections
B - Tentatively Identified Organic Compounds at Sample Sites

NWT 003361

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NWT 003363

2.0 EXISTING SITE CONDITION SUMMARY

2.1 SITE DESCRIPTION

2.1.1 SITE LOCATION

The location of the North Doane's Lake site is in the northwest part of Portland on the west bank of the Willamette River, northwest and downstream of the Northwest Portland industrial area. For the purposes of this study, the site includes land occupied by the former Portland Gas and Coke Company manufactured gas facility, the Northwest Natural Gas (NWNG) LNG facility; Pacific Northern Oil's petroleum terminal; the Koppers Company creosote terminal; and the Wacker Siltronic Corporation semiconductor manufacturing facility. Both Pacific Northern Oil and Koppers lease the property from NWNG. NWNG owns the northwestern part of the site and Wacker owns the southeastern part of the site. Figure 2-1 is a recent aerial photograph of the study area. Figure 2-2 identifies current day features within the study area for reference.

This study area is roughly triangular in shape, consisting of about 120 acres. The northeast boundary of the site is the Willamette River; the southeast boundary is the Burlington Northern (BN) Railroad berm along the approach to the BN Railroad Bridge; the southwest boundary is the main BN Railroad track adjacent to N.W. St. Helens Road; and the northwest boundary is the property line between NWNG property and the U.S. Army Corps of Engineers Moorings facility, which is southeast of the St. John's Bridge. The site is about 6 miles upstream of confluence of the the Willamette River with the Columbia River.

2.1.2 SITE HISTORY

This section discusses history of the site to the present. Much of the information was obtained from a site history prepared for Walker Siltronic

NWT 003364

Corporation by the Portland Development Commission (1984). Section 2.2 presents a detailed discussion of past waste product disposal practices.

In 1883, a rail line was begun between Portland and Astoria and completed in 1898. This is the line that is now owned by BN and forms the southwest boundary of the site. The railroad bridge across the Willamette River was completed in 1908. The railroad leading to the bridge bisected Doane Lake, a small shallow lake originally located partly on the southwest edge of the site.

The federal government purchased the property immediately northwest of the study area in 1903 and 1905 for moorings. Additional property was purchased in 1940. The area of 11 acres is currently used by the U.S. Army Corps of Engineers for storage and operating facilities for dredges and other floating equipment.

In 1913, the Portland Gas and Coke Company built a residual oil gasification facility, known as the GASCO facility, on the present-day NWNG property. The plant produced 570 Btu town gas and pressed lampblack briquettes, which were sold in the area as solid fuel. Beginning in 1923, the process was modified to optimize aromatic generation and light oil recovery for use as motor fuel. In 1925, tar recovery and refining were initiated to provide tar for use as road binder. During the 1930's, the plant expanded and in 1941 a coking plant began production of electrode grade coke and high Btu gas. With the availability of natural gas in the 1950's, much of the facility was shut down and dismantled. The last full year of operation was 1955. Natural gas arrived in 1956 and Portland Gas and Coke became Northwest Natural Gas Company (NWNG) in 1958. NWNG began construction of a liquefied natural gas (LNG) plant in the late 1960's and most of the old gasification plant facilities were demolished.

A small area of the southeastern part of the former plant site, including a small tank farm, was leased to Koppers Company Inc., Organic Material Division. Koppers built a plant in 1966 to make coal tar pitch for the

NWT 003365

aluminum industry. Koppers land farmed wastewater from the tar stills on the property. The coal tar pitch plant ceased operation in 1973. Koppers still leases the facility which currently serves as a terminal for distribution of creosote oils for wood treating.

During the 1960's, several large tanks at the northwest edge of the property near the river were leased to Pacific Northern Oil. Pacific Northern continues to lease and operate in this location today. Oil is received by ship, stored in the tanks, and distributed to customers.

In the 1970's, all of the remaining gas plant structures outside of the lease areas, except for the GASCO Administration Building, were demolished. Most of the spent oxide pile was taken to the Scappose, Oregon landfill. The remaining tar pond was filled with spent oxide, material from the adjacent rock quarry and overburden after action by the Coast Guard regarding leakage of oil from the tar pond to the river. Underground piping was also removed and sold as scrap. The Administration Building remains [redacted]. In the early 1980's, NWNG added a new dock, three tanks, and a new drainage system.

NWNG continues to operate the LNG plant on the property today. During 1985, NWNG contracted to have the river dredged near the docks to accommodate tankers making deliveries to Pacific Northern Oil. About 500 cubic yards of dredge material was taken to an off-site landfill. The U.S. Army Corps of Engineers (COE) dredges the Willamette periodically to maintain the channel. The river reach near the site between the St. John's Bridge and Burlington Northern bridge was last dredged in 1973.

The southeastern part of the site, which is currently owned by Wacker Siltronic Corporation, was formerly a low-lying swampy area occupying an abandoned river oxbow, that was subject to winter flooding. Several small buildings existed on the site in the 1930's on the river bank near the railroad bridge. Western Transportation had a river dock with two piers,

five buildings and two fuel tanks. The facility was used for refueling tugs, and to tie up log rafts and barges. The dock and piers were removed in the 1950's, and the buildings by 1973.

In the 1930's, Shell Oil Company built a dock and building on the river bank at the boundary of the present-day Wacker and NWNG properties, with a road following that present boundary. Shell purchased a by-product from Portland Gas and Coke and shipped it by barge from the dock. By 1957 the facility was apparently abandoned and the building destroyed by 1973.

The present-day Wacker property was purchased in 1962 from the railroad and Portland Gas and Coke. The purchasers agreed to fill the site to a minimum elevation of 30 feet by the end of 1973 and construct industrial buildings by the end of 1978. The site was filled with material from the adjacent rock quarry (Figure 2-2) and dredge material from the Port of Portland. Port of Portland records indicate that 695,522 cubic yards of dredge material was placed on the site in 1974. Total fill, including rock, was estimated to be 1,529,400 cubic yards. Settling ponds containing tar along the property line with the gasification facility were filled and the contents spread over the low lying area at this time.

In 1978, the City of Portland Development Commission purchased the site as part of an urban renewal project and sold it to the Wacker Siltronic Corporation in the same year. Construction of the Wacker plant began in October 1978. Construction was completed in December 1979, and operation began in March 1980.

Two pipelines that run parallel to the river, cross the site. The pipelines carry a variety of petroleum products and are operated by Olympic Pipeline.

NWT 003367

Ground water in the underlying Columbia River basalt exists primarily as isolated confined aquifers in the permeable fracture zones between individual basalt flows. In places, these confined aquifer units may be interconnected by vertical fractures in the basalt. Recharge to the basalt aquifers is largely from direct infiltration of precipitation on the northeastern slopes of the Tualatin Mountains, located west of the site. Flow is expected to be to the northeast, in the downdip direction toward the Willamette River, where discharge to the alluvial aquifer likely takes place.

Water use in the area is supplied principally by municipal water systems. There are several industrial supply wells which tap basalt aquifers in the area, including one 370 foot well owned by NWNG. The other deep wells, located near the Rhone-Poulenc facility to the southeast, are reportedly no longer in operation. There is no documentation of water use in the area from the unconsolidated aquifer.

2.2 CONTAMINATION PROBLEM DEFINITION

Several industrial facilities have conducted operations in the study area since initial development of the site. These include[1] gas and by-product production from residual oils by the Portland Gas and Coke Company,[2] tar distillation and creosote terminal operations by Koppers,[3] LNG operations by Northwest Natural Gas,[4] petroleum product handling by Northern Petroleum, and semiconductor manufacturing by Wacker-Siltronics. The primary facility of concern for purposes of this work plan document is the oil gasification plant due to its size and waste handling practices. Other operations associated with the Port of Portland, including dredging and historic tanker bilge pumping operations, may have also contributed hydrocarbon contamination to the adjacent river sediments, dredge spoils disposed along the river banks, and dredge spoils used for fill on the Wacker Property. Each of the facilities is described below.

2.2.1 GASCO FACILITY, PORTLAND GAS AND COKE COMPANY

The original development of the site was associated with a residual oil gasification facility, the GASCO plant, that was placed in operation in about 1913. This facility was constructed on hydraulically placed sandy fill material built up on lowland areas adjacent to the Willamette River. No information regarding site layout prior to the first available aerial photographs in 1936 is available. Published process summaries (Hall, 1941; Hall and Kohlhoff, 1952) provide information on changes in plant operations during its history. More general information on the process was obtained from Morgan (1931). Significant milestones in plant operations are summarized on Table 2-1. This facility grew to be one of the largest and most efficient oil-gas generation facilities in the west, with a generation capacity of 77,000,000 standard cubic feet of oil-gas and butane-air gas with a heating value of 570 Btu/cubic ft. The facility did extensive recovery and processing of by-products and near the end of its operation over 1/3 of the plant revenue was derived from the sale of these by-products.

The GASCO facility used two primary processes in the generation of gas for distribution, in addition to a number of refinery type processes for production of tar, pitch, and various other refined petroleum products. A technique known as the "Pacific Coast Oil Gas Process" (Morgan, 1931) was used throughout the life of the facility. This is a cyclical process whereby oil is subjected to thermal cracking at near atmospheric pressure in a cylindrical shell containing heated refractory checkerbrick. The checkerbrick is heated by combustion of oil and burning of carbon deposits on the checkerbrick to attain a temperature of about 2000°F. Heavy oils were introduced after pre-heating the reaction vessel and were thermally cracked as they moved downward through the gassifier. This cycle of alternating heating and gasification was continually repeated. This process generated the following products and by-products for each 10 gallons of 8.4 degree API oil (Hall and Kohlhoff, 1952):

NWT 003369

- o 1,000 cubic ft of 570 Btu/cubic ft oil gas
- o 28.3 lbs lampblack
- o 0.38 gallons tar
- o 0.46 gallons light oil

The gas was cooled and subjected to various cleaning processes to remove tars, light oils, and sulfur prior to distribution. Tars and light oils were removed by cooling and de-misting the gas. Sulfur was removed by passing the cooled gas with small amounts of added ammonia and air through beds of iron oxide adsorbed on wood shavings. In 1941 a coke oven was installed at the plant to generate electrode grade coke and high Btu gas for re-forming in the existing retorts. The coke ovens produced the following products for each 10 gallons of 8.4 degree API feedstock oil and 9 pounds of lampblack (Hall and Kohlhoff, 1952):

- o 540 cubic ft of 1030 Btu/cubic ft gas
- o 19.5 lbs coke
- o 3.6 gallons tar
- o 0.66 gallons light oil
- o 0.06 gallons creosote oil

Figures 2-6, 2-7, and 2-8 show respectively process flow sheets for the gas generator, coke oven and by-product refining operations. Several of these processes likely resulted in generation of waste streams that were deposited on site or were discharged to the adjacent Willamette River. It should be noted that due to the large size of this plant, economic recovery of many of the by-products typically wasted at other plants of this type was conducted and waste quantities are correspondingly smaller. During the life of the plant a total of approximately 70,000,000 barrels of petroleum feedstock were processed. Near the end of the plants operation, processing of 2,100,000 barrels of petroleum resulted in product and by-product sales on an annual basis as follows (Hall and Kohlhoff, 1952):

NWT 003370

- o 9,000,000,000 cubic ft of 570 Btu gas
- o 4,900,000 gallons light oil
- o 8,263,000 gallons tar
- o 114,000 tons lampblack and coke
- o 600,000 gallons gas oil

Due to significant changes in plant processes and site layout, waste generation is separately addressed for the pre-1941 period and post plant expansion in 1941.

Pre 1941 Period

During the initial period of operation from 1913 through 1923 only 570 Btu gas and lampblack briquettes were produced by the plant. Commencing in 1923, light oils were recovered and refined on site for use as motor fuel. In 1925 recovery and processing of tars for use primarily as road binder was initiated. The wastes generated prior to 1925 would include primarily waste water with a low level of dissolved and suspended hydrocarbons, tar and spent oxide from sulfur removal. Figure 2-9 identifies areas from the 1936 aerial photography that exhibit evidence of either tar, lampblack, or spent oxide deposition. The main area that received waste discharge was along the south side of the fuel storage tank area. This area was subsequently filled in and likely contains tar and other solids discharged from the plant. After 1925, when tar refining operations were started, the quantity of tar going to the waste discharge would only be a small percentage of the total tar generated. Most of the waste tar after 1925 would occur as suspended material and emulsions in waste water discharging from the secondary tar box. Once the discharged tar entered the active stream channel, the velocity of the water would tend to keep the material entrained and likely dispersed it in a narrow plume downstream. This tar was likely transported to an unknown distance downstream before settling.

Spent oxide from the purifiers was stockpiled on site, adjacent to the oxide purifier process units. Some of the spent oxide may have been disposed of either on or off-site.

Post 1941 Period

A major plant expansion was initiated in the late 1930s and came on-line in 1941. This expansion involved implementation of a coking plant for producing electrode grade coke, pitch, and high Btu gas for reforming in the oil gas generators. These additional process units were constructed on artificial fill potentially containing waste materials placed east of the light oil and tar tankage area. Additional pollution abatement facilities were also installed during this expansion. These abatement facilities included a series of four effluent settling basins that received water from the sewers and discharge from tar boxes and lampblack thickeners. All of the oily waste water passed through the tar separation tanks where sulfonates from the refinery were blended to aid in breaking the tar/water emulsion prior to discharge to the settling ponds. The majority of the tars that were not in aqueous solution settled out and remained in these ponds. Periodic flooding may have scoured some of the tars deposited in the ponds, but this mechanism is expected to be minor due to tar properties. Company records indicate occasional cleanout of the settling ponds was done and it is assumed that the dredged materials were disposed of in low lying areas on site. Spent oxide material continued to be stockpiled on site. Plant operations continued in this manner until the plant was shut down in 1955 with the arrival of natural gas. Removal and sale of stockpiled lampblack and possibly tar continued for several years thereafter. At the time of plant closure, a number of waste storage facilities remained on site. Figure 2-10 is a site plan near the time of plant closure. During filling of the adjacent Walker property in the late 1960s, the three smaller tar ponds along the property boundary were eliminated and the tar incorporated into the soil fill material in a low lying area paralleling the Walker property line. The Coast Guard detected an oil slick originating at the remaining tar pond in July 1970 and

initiated enforcement action. The remaining tar pond was filled with material from the spent oxide pile and with waste rock from the adjacent quarry in response to this action to stop oily discharge to the river. Spent oxide material that was not used for fill was disposed of at the Scappose landfill.

2.2.2 KOPPERS FACILITY

Koppers leased a portion of the GASCO facility that included the main light oil and tar tank farm area and the tar processing facility. Distillation of coal tars received via rail was conducted for several years, with the approximately 1,500 gallons per day of wastewater being land treated on site. This facility currently serves as a terminal for distribution of creosote oils for wood treating. Koppers records indicate that only creosotic and tar materials have been handled at this facility.

2.2.3 WACKER-SILTRONICS FACILITY

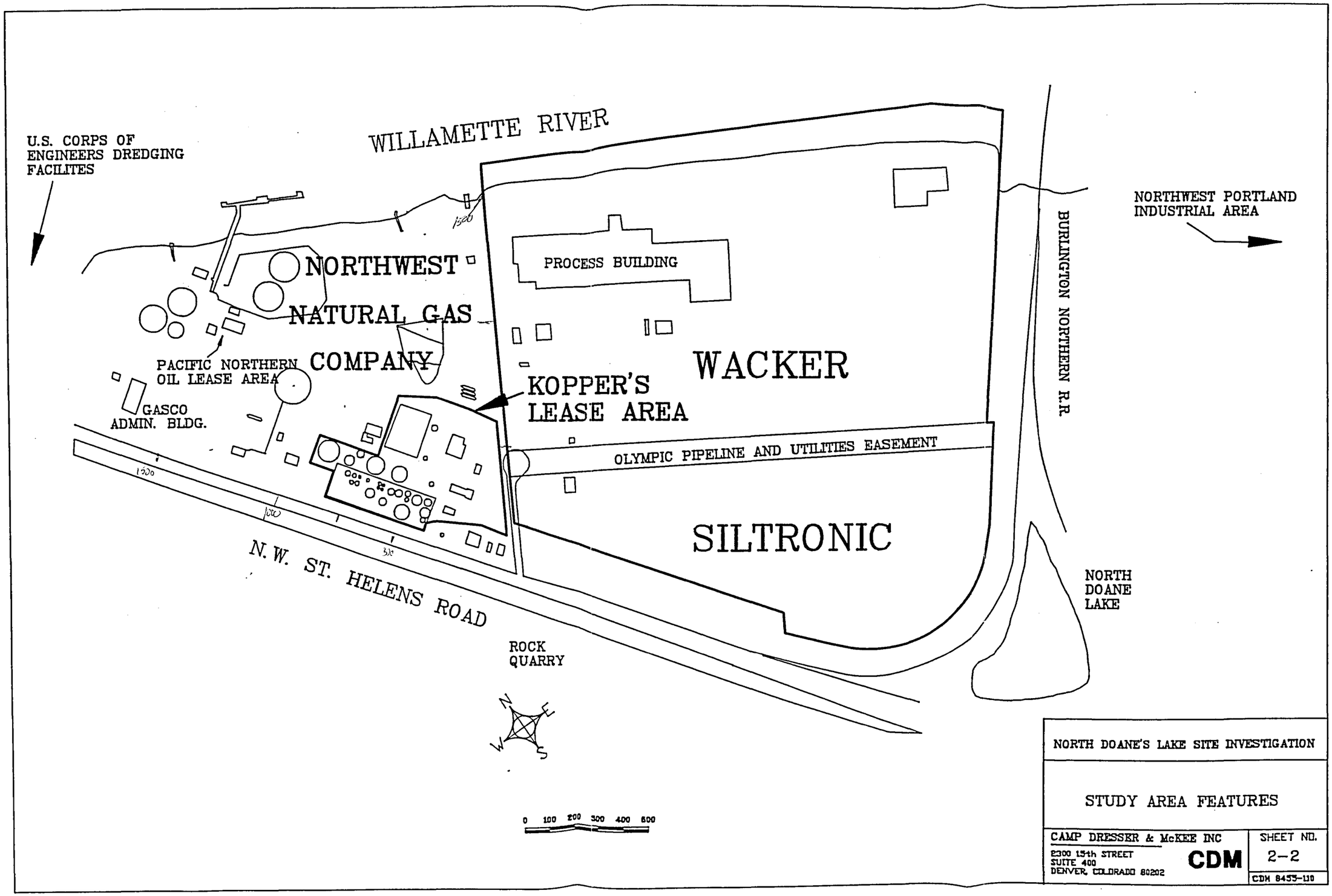
The Walker facility is constructed on fill material consisting of Port of Portland dredge spoils and waste rock from the adjacent quarry. Construction of the Wacker plant began in 1978, and the plant began operating in 1980. This facility manufactures silicon wafers that are used in semiconductor manufacturing. One small-volume TCE spill has been reported on the site but was remediated by soil removal. Site investigations were conducted for a proposed plant expansion that indicated the presence of tar-related hydrocarbons and other contaminants that may be related to upgradient facilities in both ground water and subsurface soils. It is unknown if this contamination is related to river dredge materials or to fill with tar contaminated soils. Excavations at the site during construction also indicated the presence of refractory brick that suggests some rubble or waste material originating on the adjacent gasification facility may have been used for fill.

NWT 003373

TABLE 2-1

PORTLAND GAS AND COKE PLANT HISTORY SUMMARY

1913	Plant construction completed and production of 570 Btu town gas and pressed lampblack briquettes initiated. Aromatics and tars not recovered. Waste discharge directly to river included all waste water and tars not usable as fuel.
1923	Gassification process modified to optimize aromatic generation. Light oil recovery and refining units placed in operation.
1925	Tar recovery and refining units built and placed in operation for production of road binder. Significant discharge of tars in waste water probable since no emulsion breaking agents used.
1935	Plant modified to use high carbon feedstock.
1941	Coke over installed to produce high Btu gas and electrode grade coke. Settling ponds constructed to treat waste water discharge.
1947	Plant capacity increased. Electrode pitch process line added.
1956	Plant production ceased.



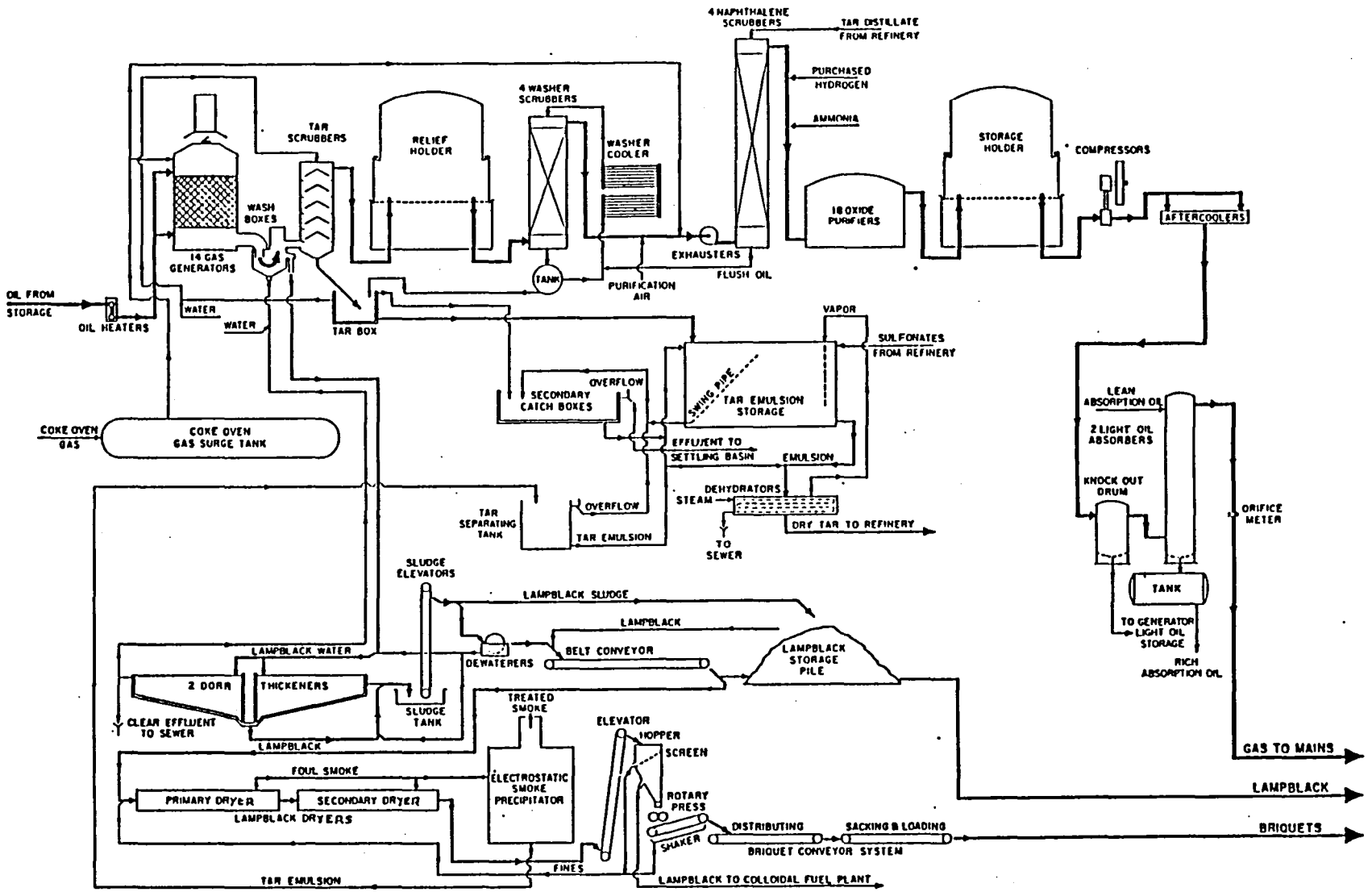
NORTH DOANE'S LAKE SITE INVESTIGATION

STUDY AREA FEATURES

CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202
CDM

SHEET NO. 2-2

CDM 8455-110



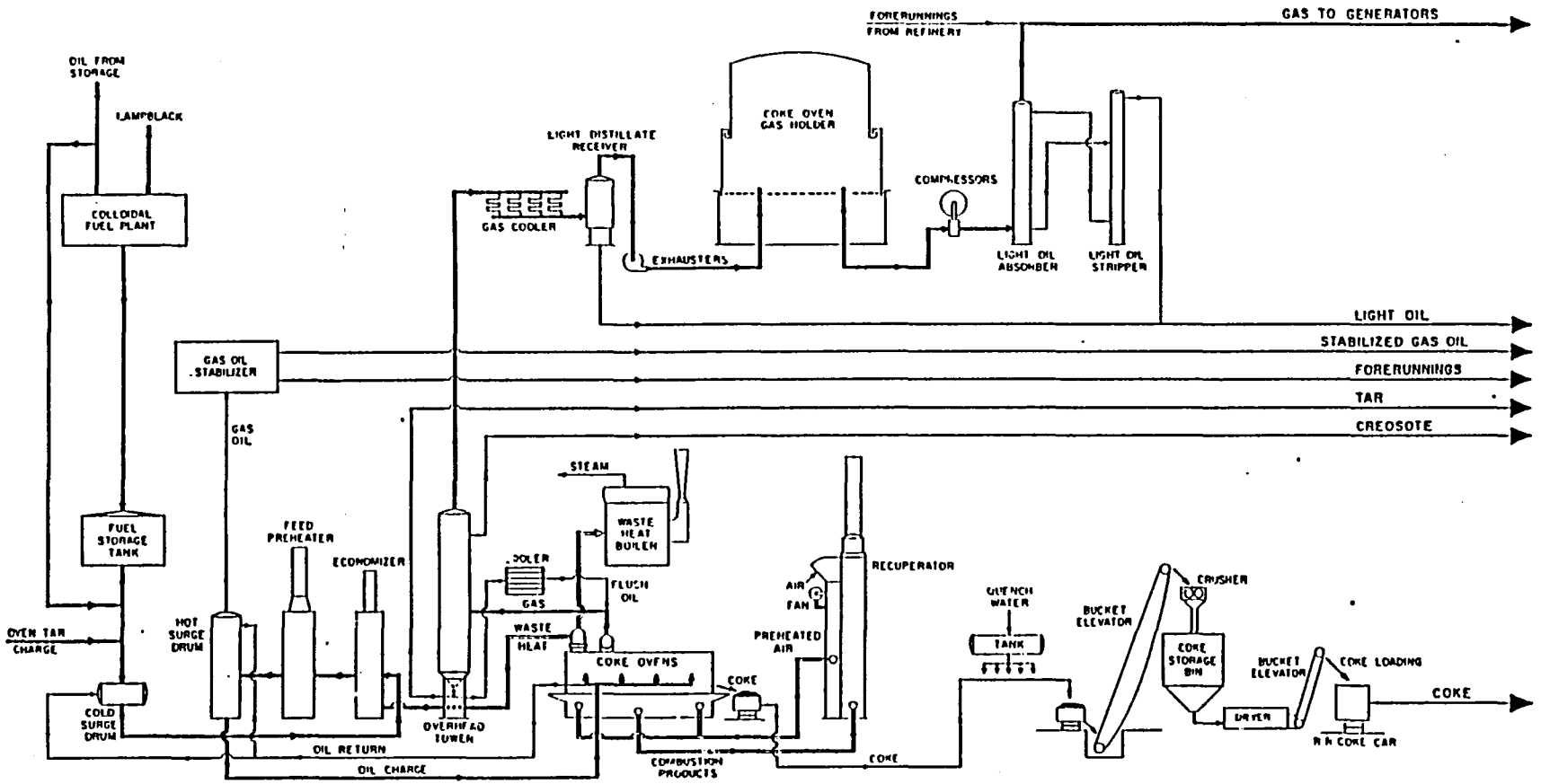
Source: Hull and Kohlhoff (1952)

Figure 2-6 Flow Sheet – Generator Gas Production

CDM

environmental engineers, scientists, planners, & management consultants

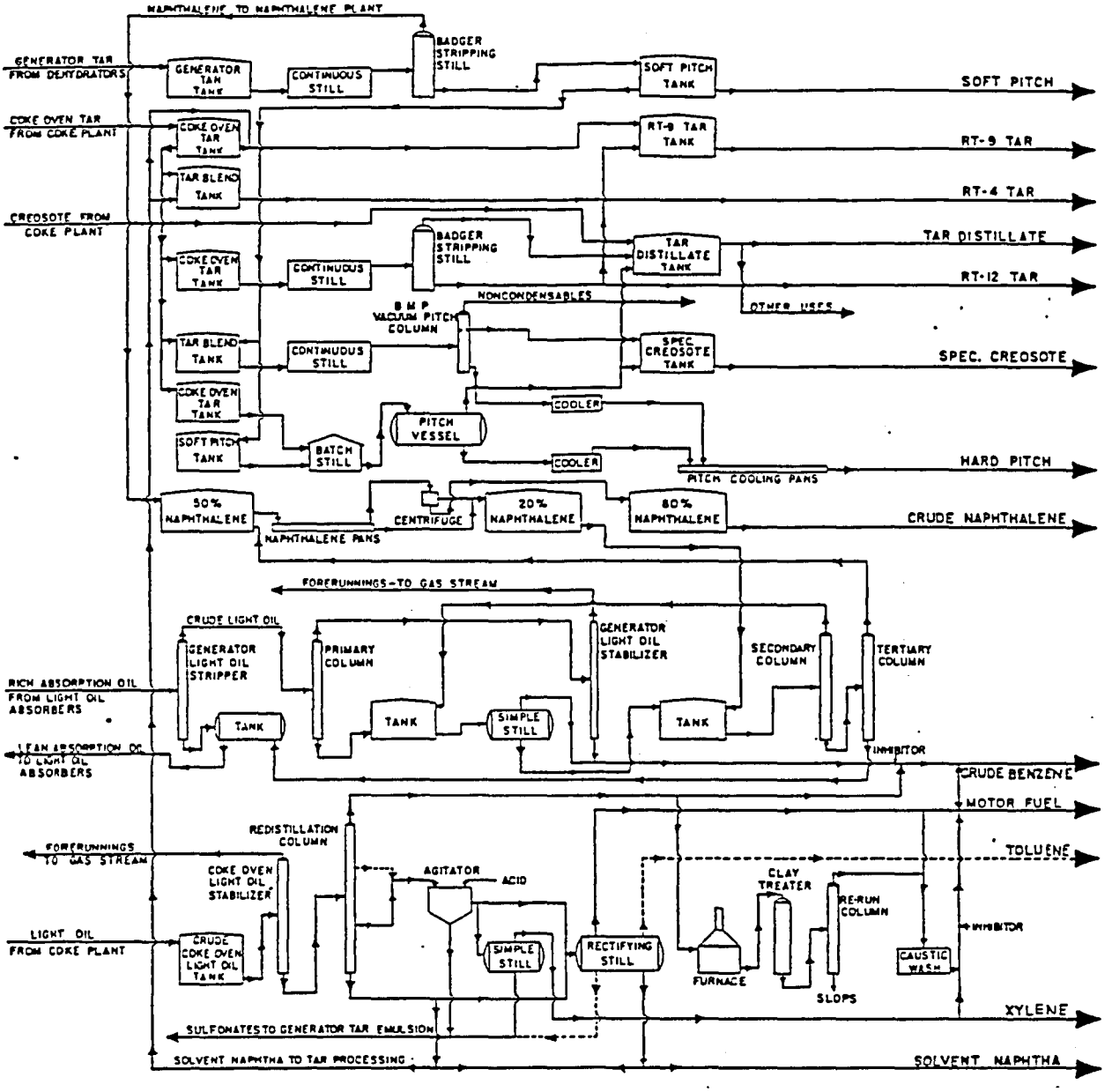
NWT 003376



Source: Hull and Kohlhoff (1952)

Figure 2-7 Flow Sheet – Coke Oven Gas Production

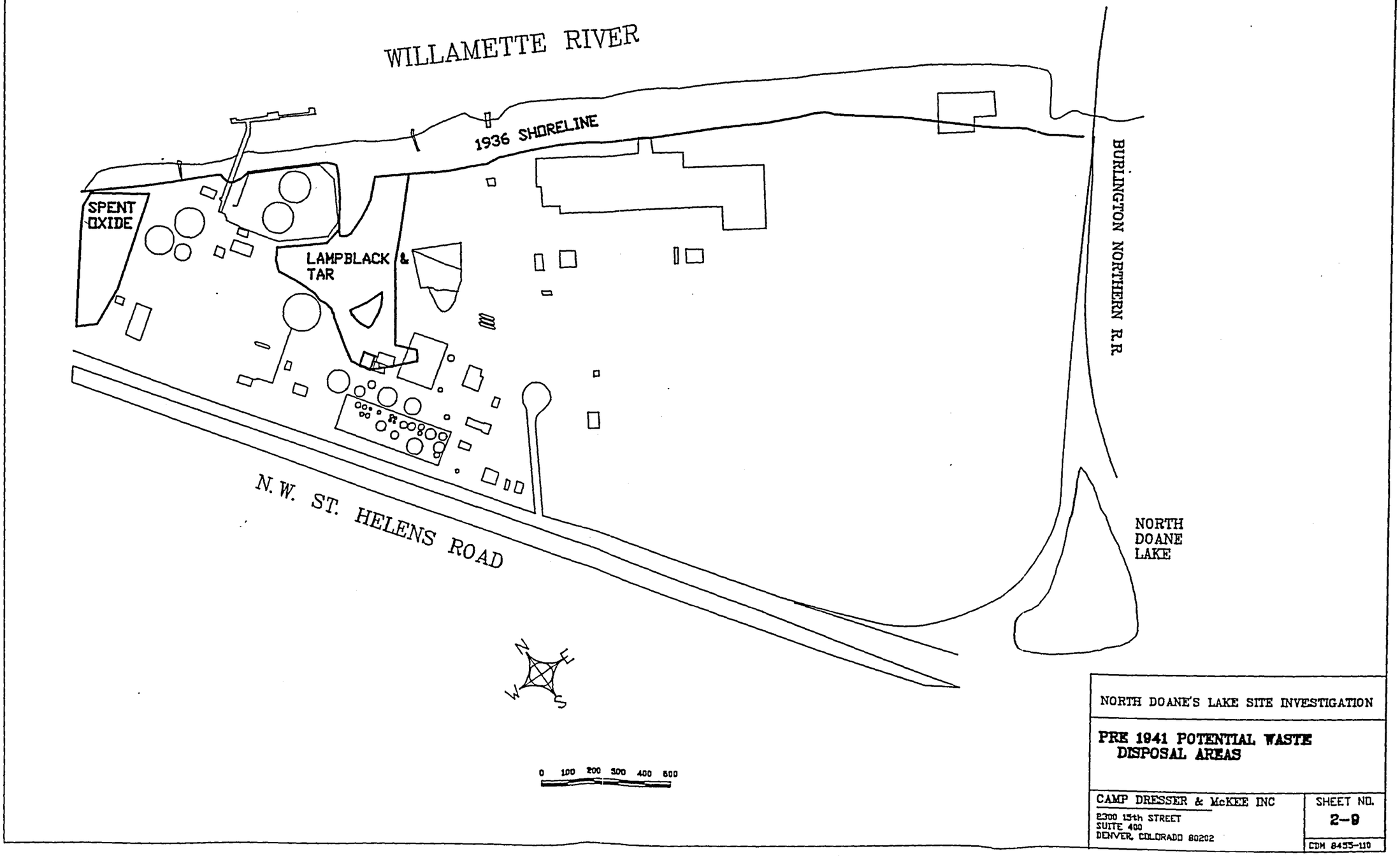
CDM
environmental engineers, scientists, planners, & management consultants



Source: Hull and Kohlhoff (1952)

Figure 2-8 Flow Sheet - By-Products Refining

CDM
environmental engineers scientists planners & management consultants



NORTH DOANE'S LAKE SITE INVESTIGATION

PRE 1941 POTENTIAL WASTE DISPOSAL AREAS

CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202

SHEET NO. 2-9

CDM 8455-110

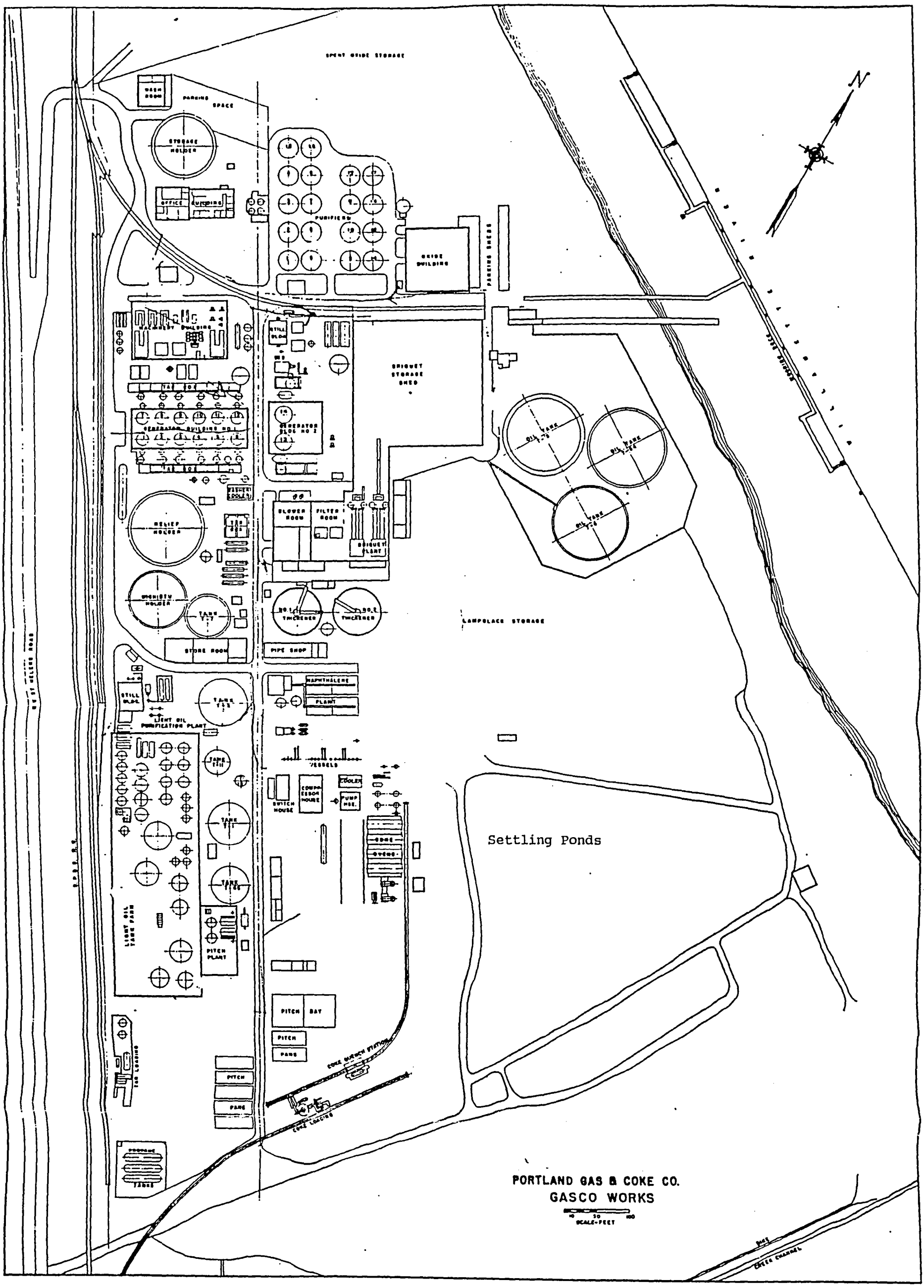
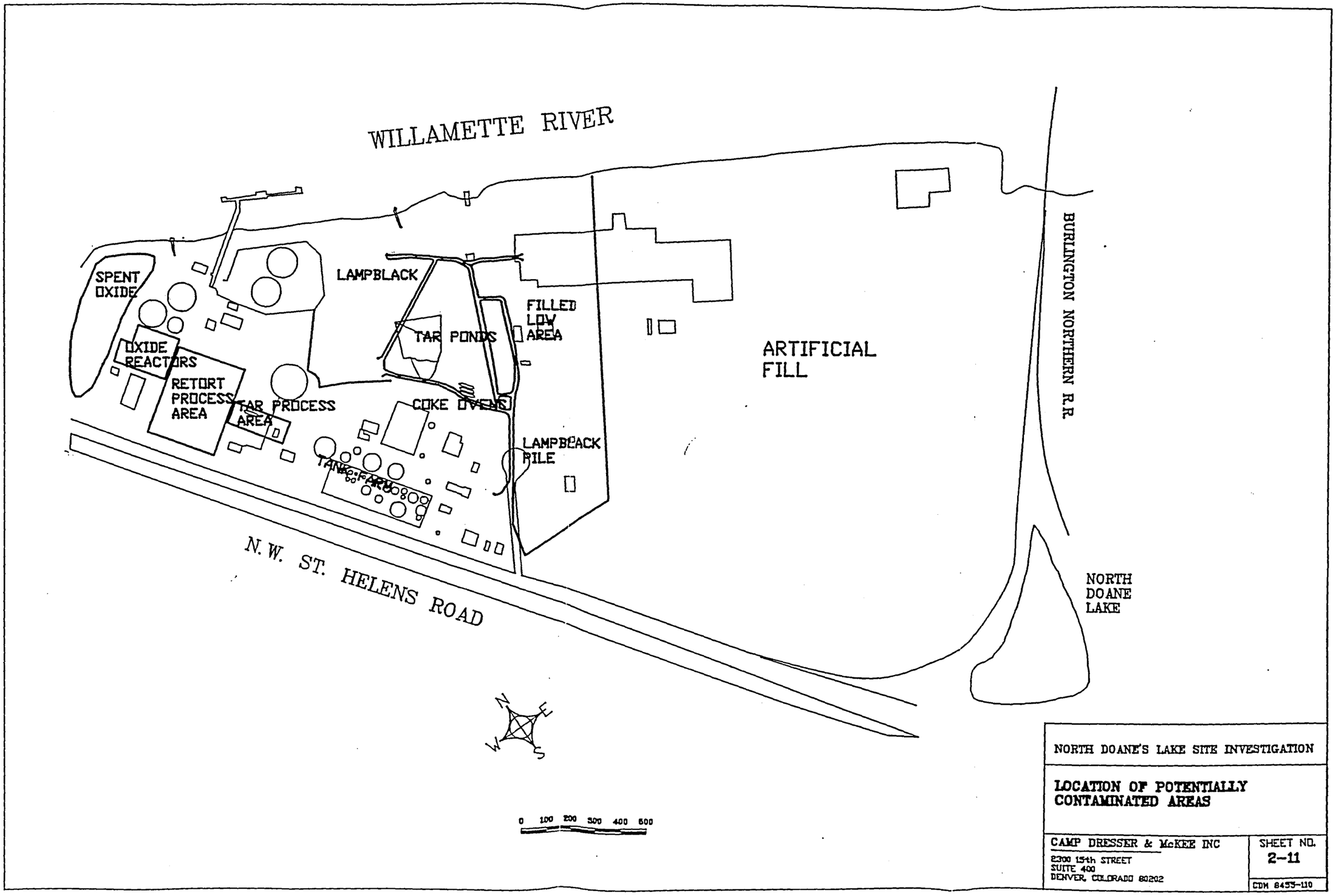


FIGURE 2-10: Plant Layout at Closure



NORTH DOANE'S LAKE SITE INVESTIGATION

LOCATION OF POTENTIALLY CONTAMINATED AREAS

CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202

SHEET NO. 2-11

CDM 8455-110

APPENDIX B

Oregon Department of Environmental Quality File Summary Review Memo
Dated April 20, 1994

Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHWEST REGION

April 21, 1994

Ms. Sandra Hart
Senior Engineer
Northwest Natural Gas Company
220 N.W. Second Avenue
Portland, OR 97209

Re: Voluntary Cleanup Letter Agreement for Northwest Natural Gas Company - GASCO Site

Dear Ms. Hart:

Enclosed is a copy of the file review summary memo prepared for the former GASCO facility located at 7900 N.W. St. Helens Road in Portland, Oregon. I apologize for the delay in getting this summary prepared. It is expected that the recommendations presented in this memo will be utilized in the planning of the investigation of the former GASCO facility.

Please contact me at 229-6802 if you have any questions.

Sincerely,

Eric L. Blischke
Project Manager, Voluntary Cleanup Section
Northwest Region

EB:eb

Enclosure

cc: Mike Rosen, NWR/DEQ (w/enclosure)
Karla Urbanowicz, NWR/DEQ (w/enclosure)
Tom Roick, NWR/DEQ (w/enclosure)
Rich Sedman, NWR/DEQ (w/enclosure)
Jill Kiernan, WMCD/DEQ (w/enclosure)

2020 SW Fourth Avenue
Suite 400
Portland, OR 97201-4987
(503) 229-5263 Voice/TDD

DEQ-1

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY INTEROFFICE MEMORANDUM

TO: File April 20, 1994

FROM: Eric Blischke

SUBJECT: **Northwest Natural Gas - North Doane Lake**

Several documents were reviewed including DEQ Regional Office and Hazardous and Solid Waste files for the Koppers, Wacker Siltronic, Doane Lake Study Area and Northwest Natural Gas sites. A list is provided as Attachment 1.

SUMMARY OF AVAILABLE INFORMATION

Site Background

From 1913 until 1956, the Northwest Natural Gas Company (NWNG), then known as the Portland Gas and Coke Company (GASCO) operated an oil gasification plant on an approximately 120 acre parcel of land located along the west bank of the Willamette River in northwest Portland (a site location map is included as Attachment 2). NWNG currently operates a liquified natural gas (LNG) plant on 47 acres of the original parcel. The property currently owned by NWNG comprises the northern third of the original GASCO site, and includes the location of the former GASCO plant operations. The southern portion of the former GASCO facility consisting of approximately 73 acres is currently owned by Wacker Siltronics Corporation (Wacker). This portion of the property was primarily vacant during operating life of the GASCO facility. The Wacker parcel was sold by NWNG in 1962 to V. Rosenfeld and H. Anderson. In 1978, this parcel was purchased by the Portland Development Commission who in turn sold it to Wacker in August of the same year. Wacker began construction of their silicon wafer manufacturing plant in October, 1978. The plant was completed in December 1979 and operation began in March 1980. NWNG currently leases a portion of their current property to Koppers Company, Incorporated, Organic Material Division (Koppers) and Pacific Northern Oil Company (Pacific Northern). A site layout map showing the location of the Wacker property, the Pacific Northern lease area and the Koppers Lease area is included as Attachment 3.

The Portland Gas and Coke Company purchased the 120 acre parcel from Security Savings and Trust, Inc. in 1910. In 1913, the Portland Gas and Coke Company built a residual oil gasification facility on the present property owned by NWNG. A plant layout map at the time of closure (1956) is included as Attachment 4. The facility was constructed on hydraulically placed sandy fill material built up on lowland area adjacent to the Willamette River. The facility grew to be one of the largest oil-gas generation facilities in the west with a generation capacity

of 77,000,000 standard cubic feet of oil-gas and butane-air gas. The plant originally produced 570 BTU town gas and pressed lampblack briquettes. In 1923, the process was modified to optimize aromatic generation and light oil recovery for use as a motor fuel. In 1925, tar recovery and refining were initiated to provide tar for use a road binder. During the 1930's, the plant expanded and in 1941, a coking plant began production of electrode grade coke and high BTU gas. Due to the availability of natural gas, the facility was shut down in 1956. In 1958, Portland Gas and Coke became Northwest Natural Gas Company. In the late 1960's, NWNG began construction of the LNG facility which continues to operate on-site. The LNG facility consists primarily of above ground piping and a large LNG storage tank. Natural gas is received via pipeline, cooled and piped to the storage tank.

In 1966, Koppers leased a small tank farm from NWNG and built a coal tar pitch distillation plant in the southeastern portion of the leased property. In 1973, the coal tar pitch distillation plant was closed. In 1977, Koppers notified DEQ that no unprocessed coal tar remained at the site. Koppers currently operates a creosote oil distribution center at the facility. Pencil pitch, a by-product of coke production, is received in solid form. The pitch is fed into a large tank, heated to 450 F and piped into railroad cars or, less frequently, trucks for shipment. Additives, such as naphthalene, are stored on site and used to keep the liquid pitch within specifications. The loading area contains a berm and catch basin to contain potential spills. Spills are routed to a storage tank.

During the 1960's NWNG also began leasing several large storage tanks located along the Willamette River in the northwest corner of the property to Pacific Northern. Pacific Northern currently operates an oil storage, receiving and distribution facility at the site. According to representatives of NWNG, Pacific Northern primarily handles Bunker C fuel oil.

The only structures remaining from the former GASCO facility are the old office building located on the northern portion of the NWNG property, two oil storage tanks utilized by Pacific Northern, the storage tanks utilized by Koppers, concrete pads and an unknown underground structure located in the southeast portion of the site. The majority of the site has been extensively filled and regraded. With the exception of the Pacific Northern storage tanks and the Koppers facility, there is little evidence of the former GASCO plant operations. The majority of the site is vacant and is covered with either concrete pads or grasses. The site is well maintained; grasses are regularly mowed as a fire precaution. An underground fire main and the Olympic pipeline cross the site. Other, unknown, underground pipelines associated with the former GASCO facility may also be present at the site. During a 1994 site visit, a chain-link fence was being installed to prevent access to the site by boaters on the Willamette River.

The NWNG site is part of the Doane Lake Industrial area in Northwest Portland. This area includes numerous other industrial properties which have also resulted in contaminated soil and groundwater including Rhone Poulenc and the Gould Superfund site. These other properties are located south (upstream) from the NWNG property. The location of these facilities is presented in Attachment 5.

Waste Disposal Practices

Much of the information regarding waste disposal practices was obtained from the North Doane's Lake Site characterization Work Plan prepared by Camp Dresser and McKee (CDM). A brief summary is presented below.

Pre-1941 Waste Disposal Practices: From 1913 to 1923, only 570 BTU gas and lampblack briquettes were produced by the plant. Aromatic hydrocarbons and tars were not recovered during the production process and all wastewater and tars not usable as fuel were discharged directly to the Willamette River. The discharge of wastewater to the river continued until the construction of 4 sedimentation ponds in 1941. Tar present as emulsions likely settled out of the waste stream as it migrated downstream. In 1923, the process was modified to optimize aromatic generation and recover light oils for use as motor fuel. In 1925, tar recovery and refining units were installed. Wastes generated prior to 1925 included tar, wastewater containing dissolved and suspended hydrocarbons, and spent oxide generated during sulfur removal. CDM indicated that the spent oxide was disposed of along the northern border of the site while lampblack and tar were disposed of in a low area along the Willamette River. A 1936 aerial photograph depicts a large waste disposal area located adjacent to the Willamette River south of the storage tanks currently leased by Pacific Northern. After 1925 when tar recovery began, the majority of waste tar was likely contained in the wastewater stream and discharged to the river, however some land disposal of tar likely continued to occur. A pre-1941 waste disposal map is included as Attachment 6.

Sedimentation Ponds: As part of a major expansion completed in 1941, four sedimentation ponds were constructed east of the current Koppers lease area. According to the CDM work plan, extensive quantities of tar were present in the four on-site sedimentation ponds. Wastewater from the process sewers, lampblack filtration effluent and tar box were discharged to these ponds to allow tar containing emulsions to settle. Wastewater entered a series of tar separation tanks where sulfonates were added as a de-emulsifier prior to discharge to the settling ponds. The settling ponds were excavated periodically and the dredged material disposed of in low lying areas on site. The exact location of these disposal areas is unknown. The three smaller ponds located south of the larger pond were estimated to contain 700,000 gallons of dry tar. The contents of the three ponds are thought to have been blended with soil material and spread over a low lying area separating the present Wacker and NWNG properties. The largest pond was inventoried in 1971. The pond was estimated to be 2.5 acres in size and found to contain approximately 6 million gallons of tar and tar/water emulsions. The total dry tar content was estimated at 3.9 million gallons. Depth and tar thickness soundings made at that time indicated that an average of 10 feet of tar was present in the 2.5 acre pond. In 1970, the Coast Guard observed an oil slick originating from the remaining 2.5 acre pond and took enforcement action. As a result, the 2.5 acre tar pond was subsequently filled in with rubble and iron oxide waste between 1971 and 1973. The resulting tar/soil mixture was spread out over the southeastern portion of the site and covered with random fill material. It is unknown if any of this material was deposited on the Wacker property. During a 1994 site visit, two small

remnants of the ponds were observed. These ponds reportedly go dry during the dry summer months and refill during the winter. A post-1941 waste disposal map is included as Attachment 7.

Lampblack Storage Area: Lampblack was one of the products produced by the oil gasification plant for sale. Lampblack is defined in the Merck Index (1989) as amorphous carbon obtained by burning various fats, oils resins, etc. under suitable conditions. Significant quantities of lampblack were stored on site during operations and following plant closure. Primary stockpiles were located in an area bounded by the former location of the settling ponds, the bulk oil tanks currently leased by Pacific Northern Oil Company, the LNG containment basin and the Willamette River. A smaller stockpile was located along the railroad spur adjacent to the current Wacker/NWNG property boundary. Lampblack was likely entrained in the waste stream resulting in the discharge of significant quantities of lampblack to the Willamette River and sedimentation ponds. Following shutdown of the plant, accumulated lampblack was hauled to an unknown off-site disposal location. A 1994 site visit found no evidence of the former lampblack storage area. The entire area was vacant and had been extensively regraded.

Spent Oxide Storage Area: Sulfur was removed from the coal gas by adding small amounts of ammonia and air and passing the cooled gas through beds of iron oxide adsorbed on wood shavings. Iron oxide no longer capable of regeneration (spent oxide) was placed on a waste pile adjacent to the oxide reactors at the north end of the NWNG property. At the time of plant closure, it is estimated that 41,000 cubic yards spent oxide was stockpiled on site. Due to the presence of nitrogen in the coal gas and the addition of ammonia during the removal process, oxide wastes may be contaminated with cyanide. However, due to the low nitrogen content in the coal gas and the low ammonia feed rate, the potential for the presence of elevated cyanide concentrations was estimated by CDM as low. In addition, hydrogen sulfide may also be present in the spent oxide. As previously mentioned, the spent oxide material was utilized as fill material for the large tar pond. Spent oxide material not utilized as fill was reportedly disposed of at the Scappose landfill. A 1994 site visit found no evidence of the spent oxide storage area. As with the former lampblack storage area, the spent oxide storage area was vacant and had been extensively regraded.

Koppers Land Treatment Area: During operation, the Koppers coal tar distillation facility generated approximately 1500 gallons of wastewater per day. The wastewater was reportedly land treated on site. This material is thought to have been treated and disposed of in a small area located in the southeast corner of the property leased by Koppers. The location of Koppers' waste disposal area is presented in Attachment 8.

Other wastes such as plant demolition rubble, tank bottom sludges and other miscellaneous wastes may have been disposed of in low lying areas on site.

Investigative History

A chronological summary of environmental investigations conducted in the North Doane Lake area is provided below. Although limited analytical data has been obtained from the current NWNG site, wastes generated by the GASCO facility have likely been deposited on the Wacker property. Consequently this file review includes a summary of the Wacker site in addition to the NWNG site. It is expected that the nature of contamination detected on the Wacker property is similar to what is present at the NWNG site.

In August, 1977, three soil test borings and penetrometer probes were installed on the Wacker parcel. The sampling was conducted by CH2M Hill and submitted in a September 1977 Geotechnical and Vibration Monitoring Investigation report to Wacker prior to their purchase of the property. Each boring log had multiple references to bitumen, a generic term applied to natural inflammable substances of variable color, hardness, and volatility composed principally of a mixture of hydrocarbons.

In February 1979, DEQ personnel were called to the Wacker Siltronic facility during its construction to determine the origin of a petroleum release found on the property. An initial sample collected on March 1, 1979 from an undefined clarifier was found to contain 40 hydrocarbon components in the C_{10} to C_{22} range with a peak maximum at C_{15}. A sample of diesel fuel obtained from the Olympic Pipeline Company was also analyzed and found to match the sample collected from the clarifier. Another sample collected from an exploratory pit above the pipeline on March 12, 1979 was found to contain hydrocarbons in the C_8 to C_{19} range with a peak maximum at C_{12}. The DEQ laboratory concluded that this sample did not match the sample obtained from the Olympic Pipeline Company (Olympic). Although the above results were inconclusive, Olympic apparently determined that the pipeline had leaked and made the appropriate repairs.

In 1982, four monitoring wells of unknown origin surrounding the former Koppers land treatment area were sampled by Department of Environmental Quality (DEQ) personnel and analyzed for total phenols. Results of this sampling event detected low levels (0.13 - 34 mg/l) of total phenolic compounds. The monitoring wells were resampled by DEQ personnel in December 1984 and analyzed for semivolatile organic compounds (SVOCs). The 1984 groundwater analysis detected presence of various PAHs. Although only a semivolatile analysis was conducted, elevated levels of xylene and ethylbenzene were detected as tentatively identified compounds. No phenolic compounds were detected although three of the four samples required dilution prior to analysis. A sample location map and summary of analytical data obtained from water samples collected at the NWNG site including data obtained from the Koppers monitoring wells is provided in Attachment 9.

In September, 1984 and again in December, 1984, sediment samples were collected by DEQ personnel from the NWNG LNG containment basin. Semivolatile analysis detected 1100 and 3120 mg/kg of PAHs respectively. A sediment sample collected from the Koppers storm drain

was found to contain 3080 mg/kg of PAHs. DEQ sediment sample results are provided in Attachment 10. Aqueous samples collected from the NWNG sump pump and oil-water separator were also found to contain low levels (0.134 - 2.29 mg/l) of PAHs. These results are presented in Attachment 9.

In April 1985, CH2M Hill conducted a soil investigation at the Wacker facility. Wacker was concerned that contamination on their property would prevent or hinder the planned expansion of their facility. Seven soil borings were installed in the vicinity of a proposed polysilicon plant in western portion of the Wacker property. The borings were installed to depths ranging from 31.5 to 41.5 feet and were completed as monitoring wells. Soil samples were analyzed for oil and grease, phenols, volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs) and pesticides, herbicides and metals according to the extraction procedure - toxicity (EP-Tox) methodology.

Analysis of the soil boring samples detected the presence of chlorinated and aromatic volatiles, various phenolic compounds including pentachlorophenol and elevated concentrations of PAHs. EP-Tox analysis detected low concentrations of barium (below the regulatory threshold) and levels of 2,4-dichlorophenoxy acetic acid (2,4-D) above the regulatory threshold. Oil and grease levels ranged from 0.03% to 0.34%. A summary of these results is provided in Attachment 11.

Groundwater samples were collected from the newly installed monitoring wells in July and August 1985 as part of the investigation. Analysis detected the presence of aromatic VOCs (benzene, ethylbenzene and xylene); acetone and methylene chloride (which may represent laboratory contaminants); PAHs; cyanide and low levels of metals. United States Environmental Protection Agency (EPA) Drinking Water Maximum Contaminant Level (MCLs) were exceeded for many of the carcinogenic PAHs, benzene, lead and cyanide. A summary of these results is presented in Attachment 12.

In September 1985, two water samples were collected by DEQ personnel from seepage pits excavated on NWNG property adjacent to the Willamette River. One pit was excavated 20 yards south of the south end of the NWNG LNG dock while the other pit was excavated 10 yards north of the north end of the LNG dock. Elevated levels of PAHs were detected in each of the seep samples. The southern seep sample was found to contain 56.5 mg/l of PAHs while the northern seep sample was found to contain 6.6 mg/l of PAHs. Carcinogenic PAHs were detected in each sample. These results are presented in Attachment 9.

In 1990, Geraghty and Miller conducted a Hydrogeological Investigation of the Doane Lake Area in northwest Portland. The primary purpose of the study was to evaluate the hydrogeologic conditions in the vicinity of the Gould Superfund site, calculate the zone of influence of potential Gould remedies and asses the impact that groundwater quality in the Doane Lake area could have on potential Gould site remedies.

As part of the investigation, two monitoring wells on the Wacker property were sampled. These included the existing MW-7 installed by CH2M Hill in 1985 and a newly installed intermediate depth well (MW-3I) installed adjacent to the existing MW-3. MW-3I was screened from 55 to 60 feet while the existing MW-3 was screened from 12 to 27 feet. Low levels of phenol (0.003 mg/l) and PAHs (0.215 mg/l total PAHs) were detected in MW-3I while even lower levels of contamination (.016 mg/l total PAHs) were detected in MW-7. These results are included in Attachment 12. Three of the Koppers wells were located during the investigation. However, the wells were found to be dry and were not sampled. Geraghty and Miller noted that the wells appeared to have been sealed off.

In July, 1990, two soil samples were collected from geotechnical borings installed as part of a proposed expansion by Wacker. Wacker was considering constructing an additional manufacturing building - FAB 2 - on their property. The soil samples were found to be saturated with a black oily viscous substance. Elevated levels of BTEX, styrene, chlorobenzene and PAHs were detected. Total PAH concentrations detected in the two samples were 10,000 mg/kg and 6,100 mg/kg respectively. These results are presented in Attachment 10.

In October 1990, CH2M Hill conducted a soil gas and groundwater investigation for Wacker to determine whether the Olympic pipeline was the source of subsurface hydrocarbon contamination previously detected on-site. This investigation was conducted in conjunction with Wacker's proposed expansion plans. Groundwater and soil gas samples were collected along a 600 foot length of the utility corridor adjacent to the proposed FAB 2 building site. CH2M Hill concluded that groundwater samples were more reliable than soil gas samples. Consequently, the investigation concentrated on the collection of groundwater samples with the soil gas probes. Groundwater samples were collected just below the water table at a depth of approximately 25 feet. All samples were field analyzed for BTEX and TPH. A limited number of samples were sent to a laboratory for confirmatory analysis.

The results of the investigation detected elevated levels of BTEX and TPH in groundwater. Benzene concentrations ranged from non-detect to 23.3 mg/l. TPH concentrations ranged from 0.012 to 89.1 mg/l (see Attachment 13 for a summary of the analytical results). The highest concentrations of TPH and benzene were detected at a point south of and immediately adjacent to the pipeline utility corridor. Benzene and TPH concentrations correlated with one another. CH2M Hill concluded that the concentrations of benzene detected in groundwater samples are typical of those associated with a gasoline spill or leak. They further concluded that the location of the highest detected concentrations may be an indication of source of the BTEX contamination. In addition to the BTEX contamination, the soil borings installed by CH2M Hill detected the presence of a black viscous substance thought to be associated with coal tar wastes. The visual observations of oil also correlated with the maximum BTEX and TPH concentrations. As a result, CH2M Hill was not able to ascertain the source of the BTEX contamination.

Based on the results of this investigation, Olympic pipeline excavated and pressure tested the pipeline to 250 psi. No obvious signs of contamination were observed and the pressure test was

inconclusive. An additional pressure test was conducted by Marmac in February 1991. The test resulted in a failure of the pipeline. It is unclear whether the test caused the failure of the pipeline or whether a leak was present in the pipeline prior to the test. As a result of the leak, Olympic replaced approximately 2000 feet of the pipeline in March, 1991.

In November, 1993, NWNG observed a sheen on water within the LNG containment basin. NWNG subsequently collected a sample of the water and had it analyzed for BTEX and PAHs. Benzene was detected at a concentration of 8.3 mg/l. Total carcinogenic and non-carcinogenic PAHs were detected at concentrations of 0.116 and 1.44 mg/l respectively (see Attachment 9). NWNG described this sample as representative of surface run-off from the site and groundwater recharge. During a 1994 site visit, a visible sheen was observed on groundwater entering the containment basin. Based on field observations and analytical results, it appears that significant groundwater contamination exists at the site.

Waste Characteristics

Numerous waste products were generated and disposed of on-site during the operation of the oil gasification plant. According to the CDM work plan, the wastes include tars, pitch, sludges, tank bottoms, spent oxide and lampblack. Releases of these wastes may have occurred in the vicinity of the process areas. These include the oxide reactors, tar process area and the retort process area. Geotechnical borings indicate the presence of liquid hydrocarbons at levels near saturation in the former plant process area. More significant releases of waste to the environment have occurred in the waste disposal areas. These include the tar ponds, the spent oxide pile, the filled area along the current Wacker-NWNG property boundary and the coke oven process area that were filled in the late 1930's. Additional waste products may have been disposed of on the Wacker property when it was filled in during the early 1970's.

Four samples of residual tar were collected in 1971 and analyzed for bulk tar content and physical properties. The samples were found to contain an average tar content of 69.2 % on a wet weight basis and 93.5 % on a dry weight basis. The average naphthalene content was found to be 2.2 % on a wet weight basis and 2.9% on a dry weight basis. A summary of these results is provided in attachment 14.

Analysis of soil and groundwater collected from the Wacker and NWNG properties indicated the presence of contaminants typically associated with petroleum products. These include carcinogenic and non-carcinogenic PAHs, and volatile aromatic hydrocarbons such as benzene, toluene, ethylbenzene and xylene (BTEX). Alkyl substituted benzenes, naphthalenes and phenanthrenes, not included as standard analytes, have been detected in semivolatile analyses as tentatively identified compounds (TICs). Other compounds detected include chlorinated and non-chlorinated phenols, cyanide and miscellaneous pesticides. Concentrations of metals in soil are generally low, however lead has been detected in groundwater at levels above the federal drinking water maximum contaminant level (MCL).

PAHs, which are typically associated with residues from oil gasification plants, are the predominant contaminant at the site. Soil samples collected by CH2M Hill from soil borings installed on the Wacker Siltronics property detected PAHs at concentrations up to 10,000 mg/kg (1.0 %). PAH concentrations of greater than 1000 mg/kg were detected on NWNG property in sediments in the LNG containment basin and from the Koppers facility storm drain.

The primary PAHs detected were naphthalene, anthracene and phenanthrene. These PAHs are comprised of two and three ring aromatic structures. They are considered non-carcinogenic, relatively mobile and are expected to biologically degrade in the environment. Carcinogenic PAH concentrations were significantly below non-carcinogenic PAH concentrations. Carcinogenic PAHs include: Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene. The maximum carcinogenic PAH concentration detected in soil samples was 600 mg/kg. Carcinogenic PAHs are typically comprised of 4,5 and 6 ring aromatic structures. In addition to being more toxic, these PAHs are also less mobile and more resistant to environmental degradation than non-carcinogenic PAHs. A summary of the physical properties of PAHs is presented in Attachment 15.

Groundwater samples collected from the Wacker property also revealed the presence of PAHs. Non-carcinogenic PAH concentrations ranged from 0.016 mg/l to 7.89 mg/l. Although each of the eight monitoring wells installed on the Wacker property contained non-carcinogenic PAHs, only three wells were found to contain detectable levels of carcinogenic PAHs. Carcinogenic PAH concentrations in these samples ranged form 0.037 to 3.08 mg/l. The highest concentrations of PAHs were detected in MW-2 on the Wacker property which is located in the central portion of the property southwest of the location of the Olympic Pipeline. A total carcinogenic PAH concentration of 0.116 mg/l was detected in the LNG containment basin. This sample is considered indicative of current groundwater conditions on the NWNG property.

Hydrogeology

Extensive characterization of the Doane Lake area was conducted by Geraghty and Miller as part of the Doane Lake Hydrogeological Study. Although this characterization included a portion of the Wacker property, it did not extend to NWNG property due to the absence of construction details for the monitoring wells installed at the Koppers site.

The geology of the Doane Lake area is comprised of five primary units. Although details regarding the thickness and/or extent of these units on the NWNG property is currently unknown, it is likely that each of the five units is present to some degree beneath the NWNG property. A summary of each unit is provided below:

Columbia River Basalt: The underlying unit in the Doane Lake area is comprised of Columbia River Basalts. The Columbia River Basalt Group is composed of multiple flows of solidified lava which erupted from volcanic fissures in eastern Washington. These fissures were active

approximately 12 to 16 million years ago. Columbia River basalts extend over much of eastern Washington and northern Oregon into what is now the Portland Basin. Columbia River basalts were encountered at depths of 47 to 101 feet below ground surface (bgs) in the Doane Lake area.

Troutdale Formation: The upper member of the Troutdale formation consisting of sandstone and cemented gravels was encountered variously above the basalt formation within the Doane lake study area. Although the Troutdale formation serves as an important aquifer in parts of the Portland area, due to its discontinuous nature, Geraghty and Miller concluded that it was not of major importance to the Doane Lake Hydrogeological Investigation. The work plan prepared by CDM does not mention the Troutdale Formation.

Catastrophic Flood Deposits: Two types of alluvial deposits are present in the Doane Lake area. These include catastrophic flood deposits from glacial Lake Missoula and Lake Bonneville and fluvial deposits resulting from the meandering Willamette River. The ancient flood deposits from Lake Missoula and Lake Bonneville resulted in erosional scouring of the Troutdale formation and the deposition of large quantities of fine grained soils comprised primarily of silts and clayey silt facies. Geraghty and Miller noted that the silt unit occurred at intermediate depths of 20 to 50 feet bgs and is thickest beneath the Wacker property. The silt unit was described as containing varying amounts of very fine-grained sand, moderately plastic clay and carbonized organic fragments. A Hydraulic conductivity for the silt unit was determined from slug testing conducted on MW-3I on the Wacker site and calculated as 3.22×10^{-5} cm/sec. This result indicates that the silt unit on the NWNG site is not highly conductive.

Willamette River Deposits: The Willamette river deposits were described by Geraghty and Miller as a sand unit composed of sand and silty sand facies. The sand unit was encountered at shallow to intermediate depths of 8 to 25 feet bgs. The sand and silty sand facies were found to contain very fine to medium sized sand grains, some mica flakes and organic fragments. Hydraulic conductivity values calculated from slug test data obtained from the sand unit range from 8.36×10^{-5} to 8.59×10^{-4} cm/sec. Since the sand unit is likely the result of deposition by the Willamette River, it is important to note that an aerial photograph from 1936 shows a distinct meander which stretches from the southeast corner of the NWNG property, across much of the Wacker property and back east towards the railroad bridge.

Fill Material: The uppermost unit present in the Doane Lake area is comprised of fill material. The exact depth of the fill material at the site cannot always be determined because the dredge material is similar to the natural sediments. The thickness of the fill material in the Doane Lake area was estimated by Geraghty and Miller as 10 to 20 feet in most places. Although no lithological data is available for NWNG property, it is likely that fill material of a similar thickness is present at the site. Low lying areas present at the site have typically been filled in. This includes the low lying area in the southeast corner of the site which is the former location of the sedimentation basins and the former location of the lampblack disposal area in the central portion of the site adjacent to the Willamette River. The Wacker site has been extensively filled

in. The purchasers of the property from NWNG agreed to fill the site to a minimum elevation of 30 feet by the end of 1973 and construct industrial buildings by the end of 1978. The site was filled with dredge material from the Port of Portland and material from the adjacent rock quarry. Port of Portland records indicate that 695,000 cubic yards of dredge material was placed on the site in 1974. Total fill was estimated at 1.5 million cubic yards. A 1974 aerial photo shows the Wacker property almost completely filled in. As described in other sections of this memo, fill material included rubble from the rock quarry located across St. Helens Road, dredged material from the Port of portland and spent oxide. Rubble for the demolition of the former GASCO facility as well as waste from the tar ponds may also have been used as fill material.

Relevant cross-sections, fence diagrams and contour maps of various units found in the Doane Lake area is provided in Attachment 16.

Groundwater: Two principal underground water-bearing zones are present in the study area, an upper alluvial aquifer in the flood and river deposits and a lower confined aquifer zone in the underlying Columbia River basalt. The alluvial aquifer is recharged primarily by direct infiltration of precipitation and discharge from the basalt aquifer. Monitoring wells indicate a general groundwater flow north-northeast towards the Willamette River under varying horizontal gradients. Deviations from the general flow direction and gradient consistently occur near the West Doane Lake remnant located adjacent to the Wacker property in the triangle formed by the Burlington Northern Railroad tracks.

Monitoring wells on the Wacker Property indicate a water table between two and fifteen feet bgs with a flow direction towards the western remnant of Doane Lake. Water level fluctuations in these wells of five to ten feet have been observed and appear to be related to the water stage of the Willamette River. Surface water levels respond more quickly to recharge events than groundwater levels. In addition, Doane lake elevations do not respond as quickly as the Willamette River. Groundwater at the site is likely directly connected to the Willamette River, consequently shallow contamination migrating through groundwater is expected to enter the river. This is confirmed by the detection of contaminants in the two seepage pits excavated adjacent to the Willamette River and the LNG containment basin. Although the alluvial aquifer is unconfined, the presence of river deposited clays may result in confined conditions in some locations. In addition, these clay lenses may inhibit the downward migration of contaminants.

Groundwater in the underlying Columbia River basalt exists primarily as isolated confined aquifers in the permeable fracture zones between individual basalt flows. Recharge to the basalt aquifer is largely from direct infiltration of precipitation. Flow is expected to be to the northeast. Discharge to the alluvial aquifer likely takes place.

As part of the Doane Lake Hydrogeological Investigation, numerous aquifer tests were conducted including slug tests, pump tests and a capture zone analysis. This information is well summarized in the Geraghty and Miller report and will not be addressed in this document.

Exposure Pathways

The majority of contamination resulting from operations at the former GASCO facility lies beneath approximately 10 feet of fill material and is in direct contact with groundwater. Based on borings installed on the adjacent Wacker property, an black, viscous, oily substance is present on top of the water table. In addition, analysis of groundwater samples have detected the presence of elevated levels of PAHs and aromatic VOCs as described above. However, groundwater in the vicinity of the NWNG site is not used for domestic drinking water purposes. The Geraghty and Miller hydrogeologic investigation describes the overall quality of groundwater in the West Portland business district as of naturally low quality (Brown, 1963). The majority of wells in the area have naturally elevated levels of calcium, magnesium and sodium. In addition, contamination originating from neighboring sites further impacts the overall quality of the shallow aquifer.

Due to the lack of groundwater receptors and the depth of the contaminated material, human heath exposures due to groundwater ingestion or direct contact with contaminated soils is expected to be low. The primary human health exposure pathway is via the Willamette River. Contaminants entering the Willamette River from the site may impact recreational users of the river such as water skiers or fishermen.

The primary impact from the site is through environmental exposure pathways. In the early years of its operation, the GASCO facility discharged waste water directly to the Willamette River. As described previously, this waste water likely contained elevated levels of tars and lampblack. Following the construction of the sedimentation basins, more soluble components of the waste stream such as aromatic VOCs and two and three ring PAHs have likely seeped into the river. This seepage likely continues to occur. Periodic flooding along the river also likely resulted in releases to the Willamette River. Contamination entering the river likely impacts fish and wildlife which use the river as habitat. It should be noted that Sauvie Island, prime waterfowl and bird habitat is located only a short distance downstream.

Under future site conditions, excavation activities may result in worker exposure to contaminants. Workers may become exposed to contaminants during the excavation activities themselves or following excavation activities if contaminated soil is brought to the surface. Exposures to on-site groundwater may also occur under future use scenarios. Process water obtained from the upper aquifer could result in inhalation exposures for workers at a future manufacturing facility at the site. In addition, groundwater at the site could also be used to provide drinking water to on-site workers resulting in additional exposure.

Regulatory History

In 1987, a Preliminary Assessment (PA) was prepared by Ecology and Environment (E&E) for the EPA on the Koppers Company site. Although the PA recommended no further action under the EPA pre-remedial action program, it did recommend that the site continue to be addressed

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as part of the Doane Lake investigation. The PA concluded that the Koppers site has a low potential to cause human health problems since residual contaminants present at the Koppers site are unlikely to influence the local drinking water source or air quality. However, the PA noted the potential for environmental damage through surface and subsurface migration of contaminants to the Willamette River. EPA has not conducted a PA for the Northwest Natural Gas site.

A PA was also completed on the Wacker site for EPA by E&E in 1987. Although the PA agreed with DEQ's recommendation that a comprehensive study is needed to characterize the extent of contamination at the Wacker Siltronic site and North Doane Lake area, it did not recommend further action under the EPA's pre-remedial program due to the lack of human receptors.

In November, 1988, DEQ notified Wacker that they had been identified as an owner/operator with regard to the Gould Superfund site. In a March 24, 1989 response to this notification, Wacker claimed they had no legal responsibility to pay for any remedial action costs pertaining to their property. This claim was based on the premise that Wacker had no knowledge or reason to suspect the existence of contamination on their property. However, based on a review conducted by DEQ and the Department of Justice, DEQ determined that Wacker did "not appear to have undertaken all appropriate inquiry into the previous ownership and uses of the property it purchased, as necessary to satisfy the so-called "innocent landowner provision" of ORS 466.567 (1) (b) and (2) (b) as described in ORS 466.567." This finding was based in part on the observance of "bitumen" in three soil borings installed on the Wacker property in August, 1977, and was presented in a letter from Fred Hansen dated January 22, 1990.

In September, 1993, a DEQ strategy recommendation prepared for the NWNG site was sent to NWNG, Wacker, Koppers and Pacific Northern. A DEQ strategy recommendation was also prepared for the Wacker site. Based on a review of available information, DEQ determined that further action was required at both the Wacker and NWNG sites. The letter and strategy recommendation prepared for the NWNG site recommended characterization of the extent of soil and groundwater contamination caused by disposal of coal tars by Portland Gas and Coke Company. DEQ anticipated that the investigation would involve sampling on the Wacker property as well as property leased to Koppers and Pacific Northern. The strategy recommendation noted that although there was extensive contamination on the NWNG property, it did not present an immediate threat to human health. The NWNG site was also recommended for listing on the DEQ Confirmed Release List (CRL) and Inventory of sites requiring further action. The site was given a high priority.

The letter and strategy recommendation prepared for the Wacker site also recommended further action and indicated that although sampling would focus on the NWNG site, the Wacker property would require sampling. DEQ noted that the majority of the contamination on the Wacker property resulted from the disposal of coal tars by Portland Gas and Coke Company and recommended that NWNG should lead the investigation and cleanup. DEQ also recommended

that further actions at Wacker be coordinated with NWNG and that the investigation and cleanup of coal tar contamination on the NWNG site should include contamination on the Wacker property.

A separate letter was also sent to Koppers along with the strategy recommendation prepared for the NWNG site. DEQ noted that in addition to coal tars deposited by Portland Gas and Coke Company, a disposal pit containing creosote and pitch from Koppers' operations was present and required further investigation.

RCRA Considerations

Portland Gas and Coke Company ceased operations in 1956. All waste disposal operations occurred prior to that date. NWNG is not currently listed as a generator of hazardous waste. It does not appear that any unregulated solid waste management units have been created by NWNG since 1980.

Koppers Company ceased their disposal operations in 1973 and no longer generates hazardous waste. A letter sent to Koppers in 1984 by the EPA stated that they have no reason to believe that Koppers ever stored, generated or disposed of hazardous waste on the Koppers property. As a result neither a Part A nor Part B permit was required by EPA. Koppers is currently classified as a small quantity generator of hazardous waste. No unregulated solid waste management units are known to have been created since 1980.

Although Wacker is classified as a large quantity generator of hazardous waste and generates hazardous waste from a wastewater treatment plant, these operations are not expected to impact the investigation of contamination resulting from operations at the former GASCO facility.

Investigative and/or cleanup activities may generate significant quantities of contaminated material. This material will be subject to analytical testing to determine if it meets the definition of a Resource Conservation and Recovery Act (RCRA) hazardous waste. If RCRA hazardous wastes are generated during site activities, they must be managed appropriately.

DATA GAPS AND RECOMMENDATIONS

Data Gaps

Despite the presence of four monitoring wells located on the Koppers portion of the site, groundwater at the site has not been adequately characterized. These monitoring wells represent only a small portion of the 47 acre NWNG site. In addition, the construction details for these wells are unknown and, due to their age, likely do not conform to current standards. Although representatives of Koppers indicate that the monitoring wells are still viable, Geraghty and Miller was unable to collect groundwater samples and suggested the wells had been sealed off.

Groundwater seepage samples are also inadequate to characterize groundwater conditions at the site.

Based on a review of operations and waste disposal practices at the former GASCO facility, it is likely that significant subsurface soil contamination exists at the NWNG site. This is confirmed in part by the elevated levels of PAHs and BTEX detected in soil borings installed on the adjacent Wacker property. However, no subsurface soil data has been collected to date from the NWNG site.

During the early years of operation, wastes from the GASCO facility were routinely discharged to the Willamette River. In addition, contamination from the site may still be entering the river due to groundwater discharge. However, no surface water or sediment samples have been collected from the Willamette River.

During the operation of the Portland Coke and Gas Company, large quantities of waste were generated and disposed of on-site. Although the location of most of the disposal areas are known, filling operations that took place at the NWNG site and adjacent Wacker site likely resulted in the transfer of waste material to unknown locations.

Summary and Recommendations

Based on the limited data presented in this memo, significant groundwater and subsurface soil contamination is likely present at the NWNG site. Four groundwater samples collected from monitoring wells located on the Koppers site detected elevated concentrations of PAHs and ethylbenzene above risk-based drinking water standards. In addition, water samples collected from two seepage pits excavated on NWNG property along the Willamette River detected the presence of PAHs and petroleum hydrocarbons. This indicates that contaminants from the NWNG site are likely entering the Willamette River. A recent water sample collected from the LNG containment basin detected concentrations of carcinogenic PAHs, naphthalene, toluene and benzene above health based standards.

Soil borings installed on the adjacent Wacker site detected the presence of a black oily viscous substance floating on the water table. Since it is likely that waste from the former GASCO facility are present on the Wacker property, similar conditions are expected to exist on the NWNG site. Consequently, the investigation should include an evaluation of the extent of non-aqueous phase liquid (NAPL) contamination.

Due to the large size of the NWNG site (47 acres) and the large volume of waste generated and disposed of on-site by the former GASCO facility, a comprehensive remedial investigation and feasibility study is required for the NWNG site. A thorough background review and comprehensive effort to locate all waste disposal areas should occur as an initial step in the overall investigation in order to focus the sampling effort. The investigation should focus primarily on contaminants typically associated with oil gasification facilities such as volatile

aromatic hydrocarbons, petroleum hydrocarbons and PAHs. In addition, due to the presence of lead in groundwater above the MCL and the potential for cyanide and hydrogen sulfide formation during sulfur removal, the investigation should also focus on inorganic contaminants such as metals, cyanide and hydrogen sulfide.

With the exception of the Koppers facility and abandoned GASCO office building, little evidence of the former GASCO facility exists on-site. The majority of the site has been extensively filled and regraded. During a 1994 site visit, no visible evidence of surface contamination was apparent. As a result, the investigation should focus primarily on subsurface soil and groundwater contamination. In addition, since wastes were routinely discharged to the Willamette River and since subsurface contamination may continue to impact the river, the investigation should include an assessment of its overall impact (past and current) on the river.

DEQ believes that the investigation should also include property owned by NWNG and leased to Pacific Northern and Koppers. However, since Koppers disposed of creosote and coal tar pitch in on-site ponds, it may be difficult to determine which contamination can be attributed to the former GASCO facility and which is a result of operations at the Koppers facility. Consequently, it is recommended that Koppers participate in the investigation and cleanup of their facility. Although Koppers Industries was founded in December, 1988, as stated in their response to DEQ's September 1993 letter, they are still considered liable for contamination caused by their predecessor Koppers Company.

DEQ believes contamination from the former GASCO site is likely present on the Wacker facility, Consequently, remedial actions selected for the NWNG site may be ineffective if contamination present on the Wacker site is not included in the overall remediation scheme. As a result, DEQ also encourages NWNG to work with Wacker to resolve issues regarding contamination on the Wacker property. Although Wacker does not consider itself liable for pre-existing contamination under the innocent landowner provision (ORS 465.255 (2)(a)), DEQ has determined that Wacker should have reasonably known of the release at the time of purchase and is consequently liable for previous contamination at the Wacker site.

Due to size of the investigation required and the length of time it may take, it is recommended that NWNG enter an RI/FS Agreement with DEQ as soon as practicable.

Attachment 1
(In Chronological Order)

1) Date Unknown - Summary of Koppers Company, Inc. data prepared by DEQ

2) Date Unknown - North Doane Lake Site History Summary prepared by DEQ

3) 9/77 - Preliminary and Supplemental Site Investigation Report prepared by CH2M Hill

4) 2/12/79 - Memo from DEQ regarding Wacker oil release

5) 3/7/79 - Memo from Wayne Hanson, CH2M Hill regarding Wacker oil release.

6) 2/8/80 - Memo from Fred Bromfeld, DEQ, regarding Doane Lake Study

7) 8/2/84 - Letter from NWNG to Charles Gray, DEQ.

8) 6/85 - Preliminary Report - Soil Investigation for Proposed Polysilicon plant. Prepared for Wacker Siltronics by CH2M Hill

9) 6/19/85 - Memo from Fred Hansen to Governor Vic Atiyeh regarding the history of the Doane Lake Industrial district.

10) 6/24/85 - Oregonian Article regarding proposed Wacker Siltronics expansion.

11) 8/6/86 - Memo from Neil Mullane, DEQ regarding Northern Doane Lake investigation strategy.

12) 6/87 - North Doane Lake Site Characterization Work Plan prepared by Camp Dresser and McKee.

13) 10/87 - Preliminary Assessment report for the Wacker Siltronics site. Prepared for EPA by Ecology and Environment.

14) 10/87 - Preliminary Assessment report for the Koppers site. Prepared for EPA by Ecology and Environment.

15) 7/20/88 - PRP 104(e) Response Records Compilation - Final Report, Doane Lake Area. Prepared for EPA by Ecology and Environment.

16) 3/24/89 - Letter to Fred Hansen from James H. DiSorbo, President, Wacker Siltronics Corporation.

17) 6/9/89 - Memo to Fred Hansen regarding Wacker Siltronics past practices.

18) 6/18/89 - Memo to Fred Hansen regarding Wacker Siltronics past practices.

19) 8/15/89 - Memo to Larry Edelman, Oregon Department of Justice, from Rick Malin, DEQ regarding Doane Lake.

20) 11/6/89 - Telephone memo documenting conversation between Sarah Anderson of DEQ and Larry Edelman, DOJ regarding Wacker innocent landowner defence.

21) 12/14/89 - Memo to Governor Neil Goldschmidt from Fred Hansen regarding Wacker legal liabilities.

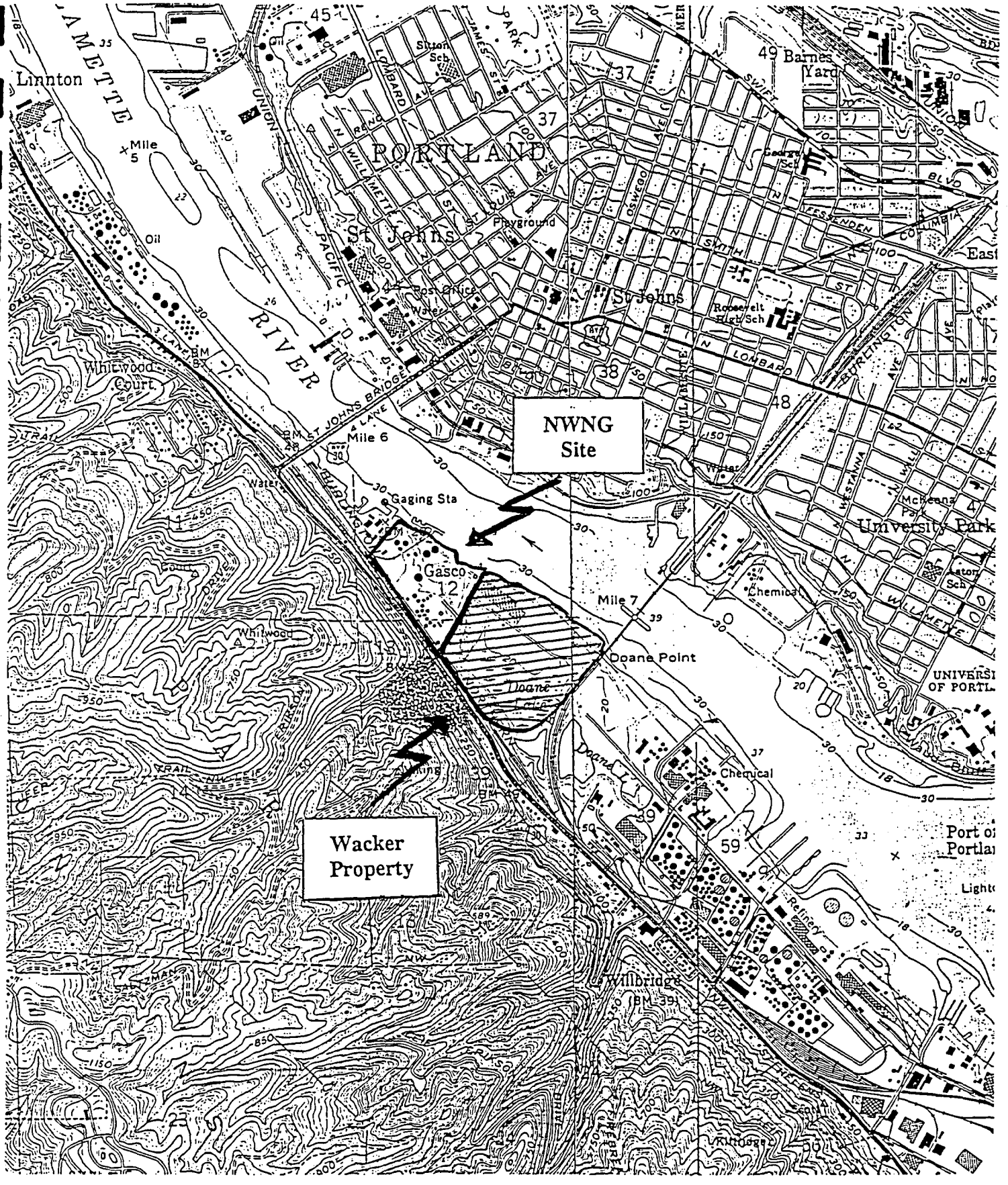
22) 1/22/90 - Letter from Fred Hansen to James DiSorbo, President, Wacker Siltronics Corporation.

23) 12/90 - Findings Report - Groundwater and Soil Gas Investigation. Prepared by CH2M Hill for Wacker Siltronics Corporation.

23) 2/91 - Hydrogeological Investigation of Doane Lake Area - prepared by Geraghty and Miller

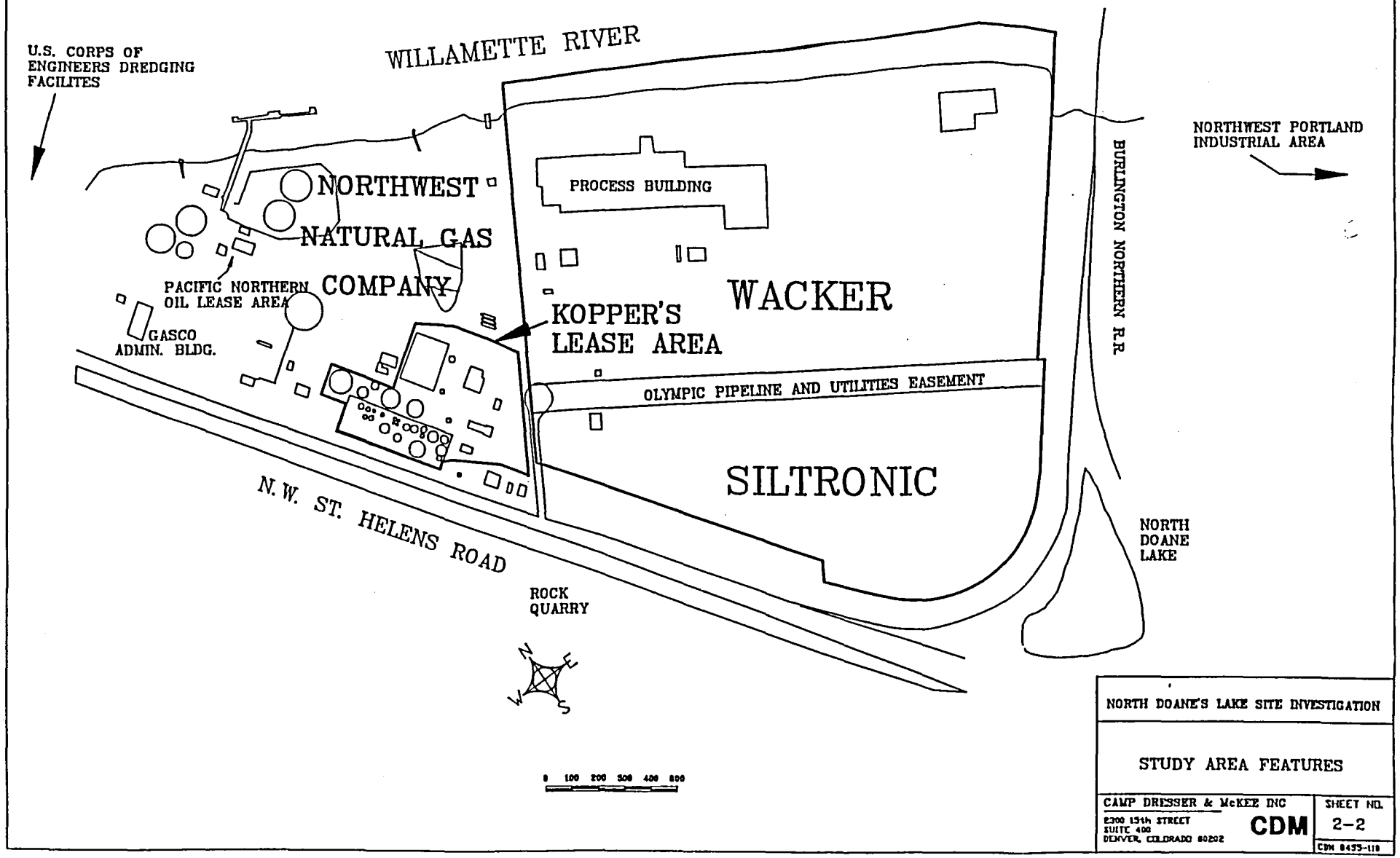
ATTACHMENT 2

SITE LOCATION MAP


NWNG
Site
Wacker
Property
PORTLAND
St Johns
Linnton
Whitwood Court
Gasco
Doane Point
Willbridge
University Park
Barnes Yard
Mile 5
Mile 6
Mile 7
Gaging Sta
Chemical
Oil
Water
Playground
Post Office
Roosevelt High Sch
Sitton Sch
Port of Portland
Refinery
Kittridge

ATTACHMENT 3

SITE LAYOUT MAP


U.S. CORPS OF ENGINEERS DREDGING FACILITES
WILLAMETTE RIVER
NORTHWEST PORTLAND INDUSTRIAL AREA
BURLINGTON NORTHERN R.R.
NORTHWEST NATURAL GAS COMPANY
PROCESS BUILDING
PACIFIC NORTHERN OIL LEASE AREA
GASCO ADMIN. BLDG.
KOPPER'S LEASE AREA
WACKER
OLYMPIC PIPELINE AND UTILITIES EASEMENT
SILTRONIC
N.W. ST. HELENS ROAD
NORTH DOANE LAKE
ROCK QUARRY
N
E
W
S
0 100 200 300 400 800
NORTH DOANE'S LAKE SITE INVESTIGATION
STUDY AREA FEATURES
CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202
CDM
SHEET NO.
2-2
CDM 8455-118

ATTACHMENT 4

GASCO PLANT LAYOUT MAP

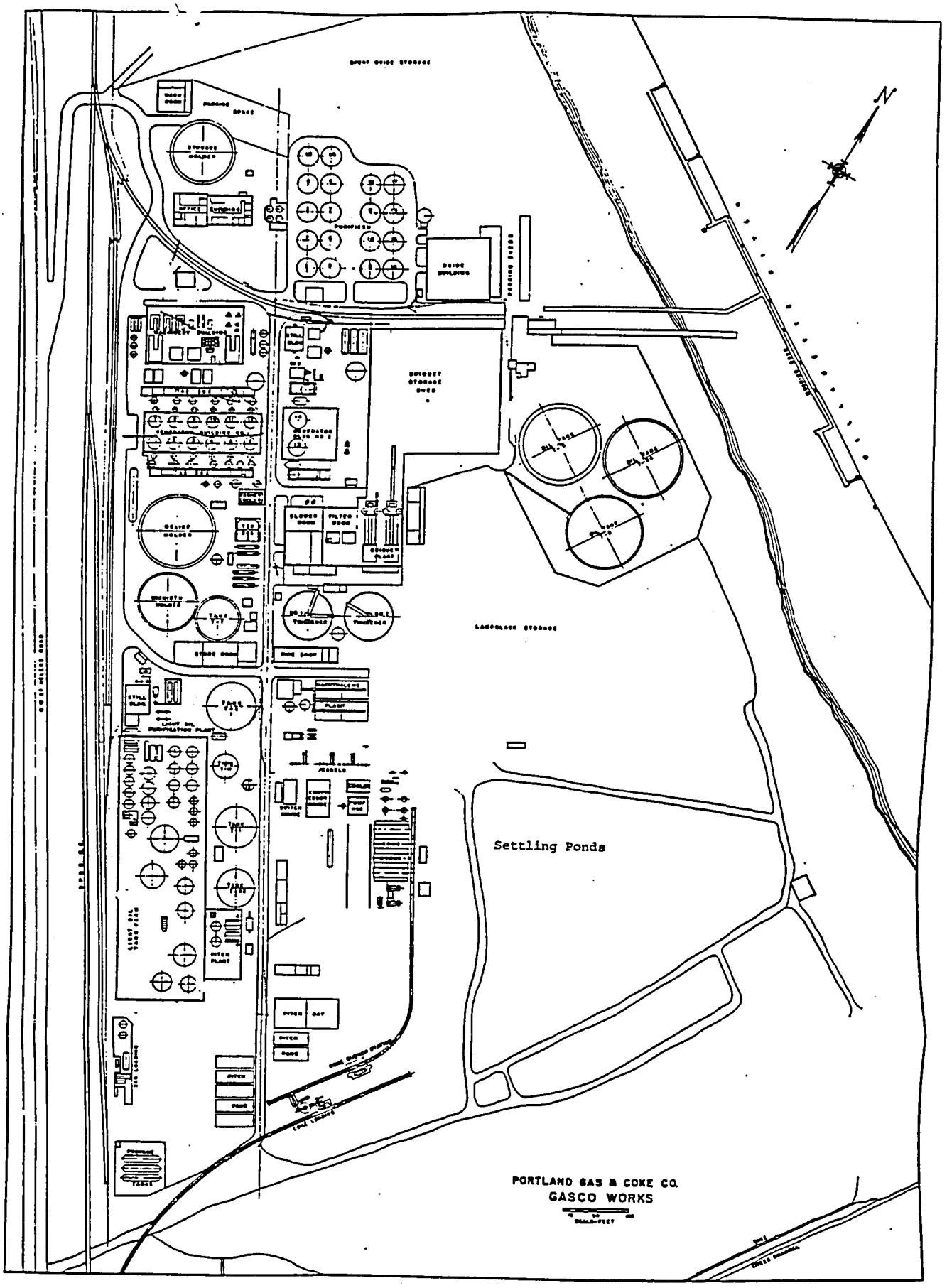
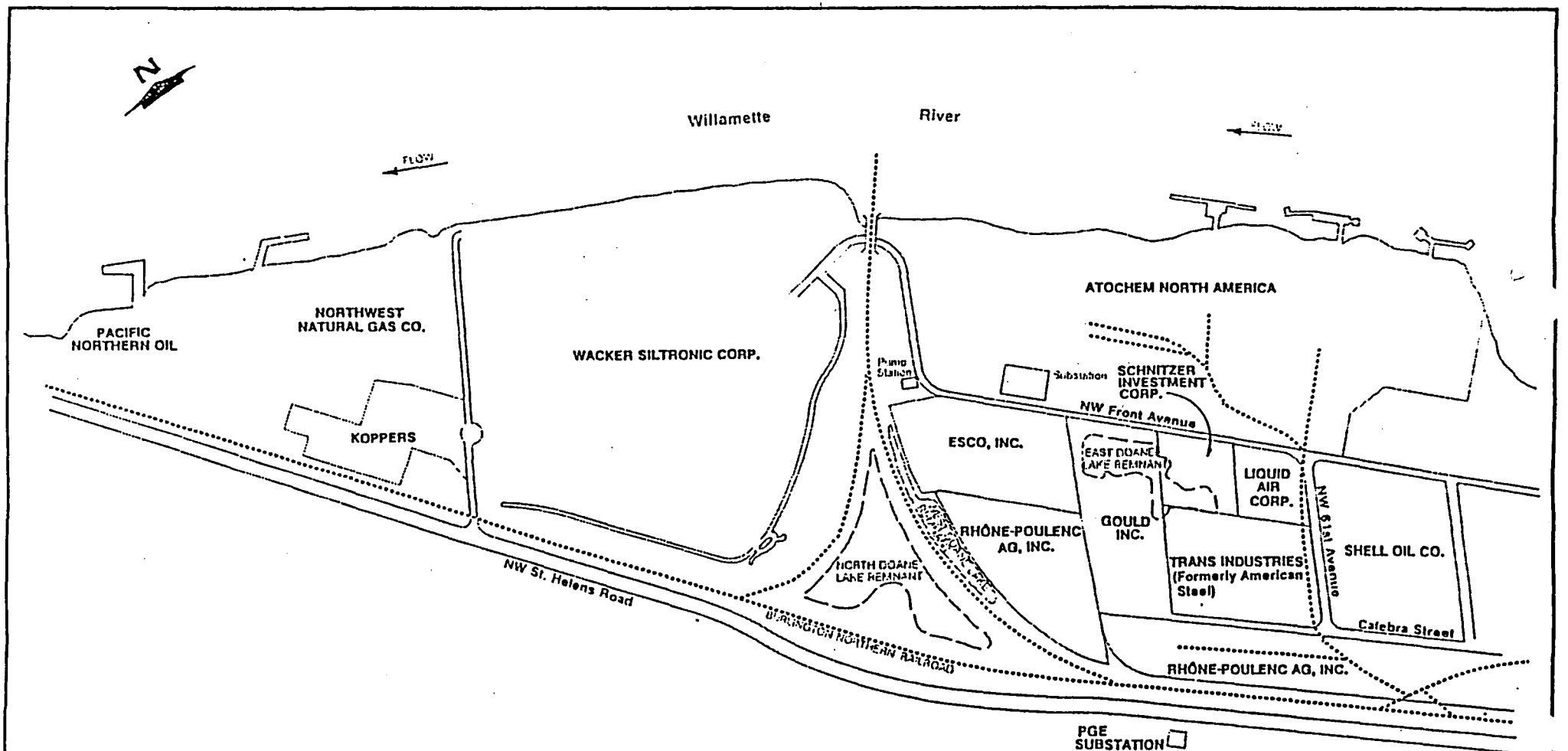


FIGURE 2-10: Plant Layout at Closure

ATTACHMENT 5

DOANE LAKE AREA MAP



GERAGHTY & MILLER, INC.
Environmental Services

SITE PLAN

Doane Lake Area
Portland, Oregon

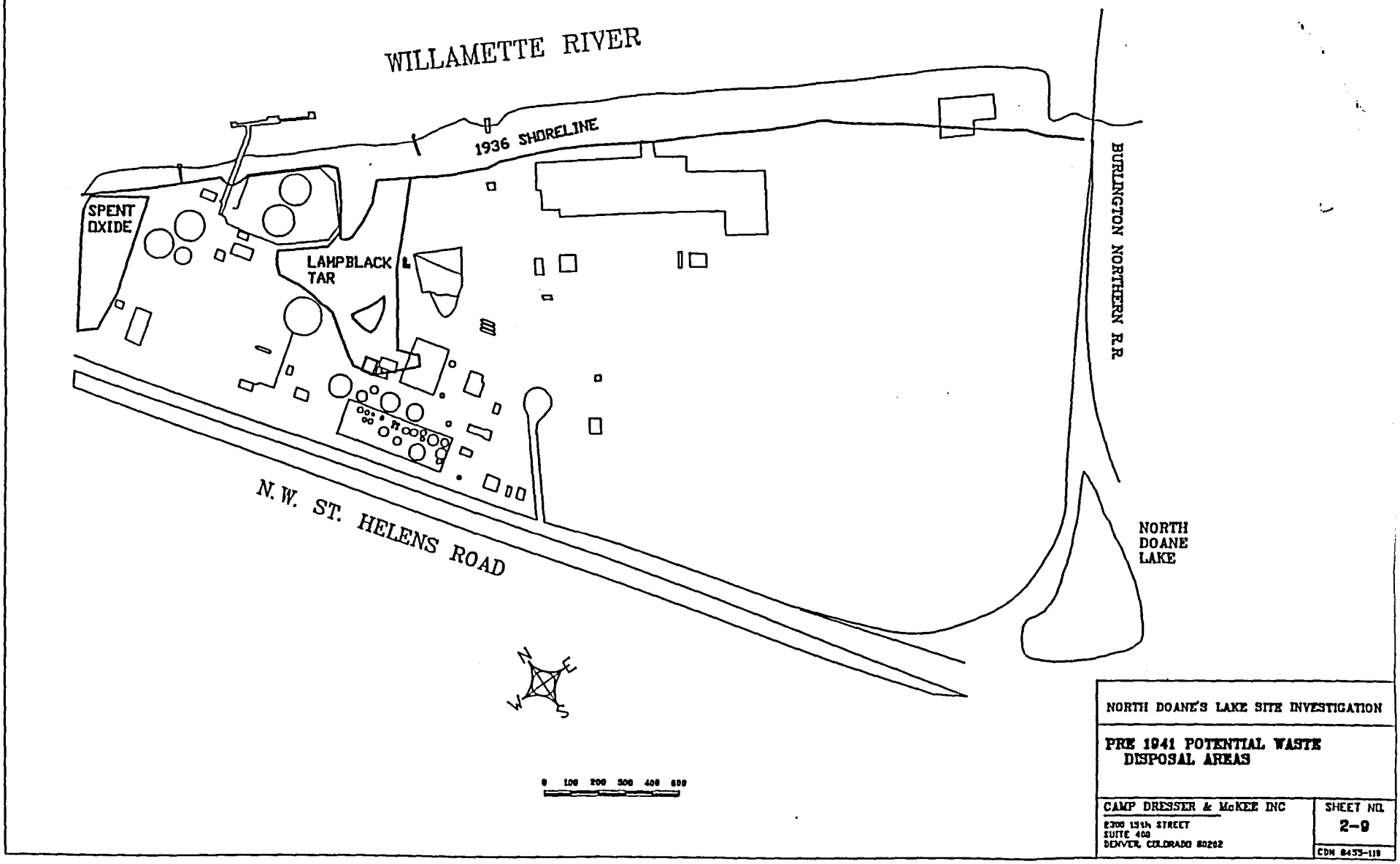
DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA103.01

FIGURE 1-2

NWT 003409

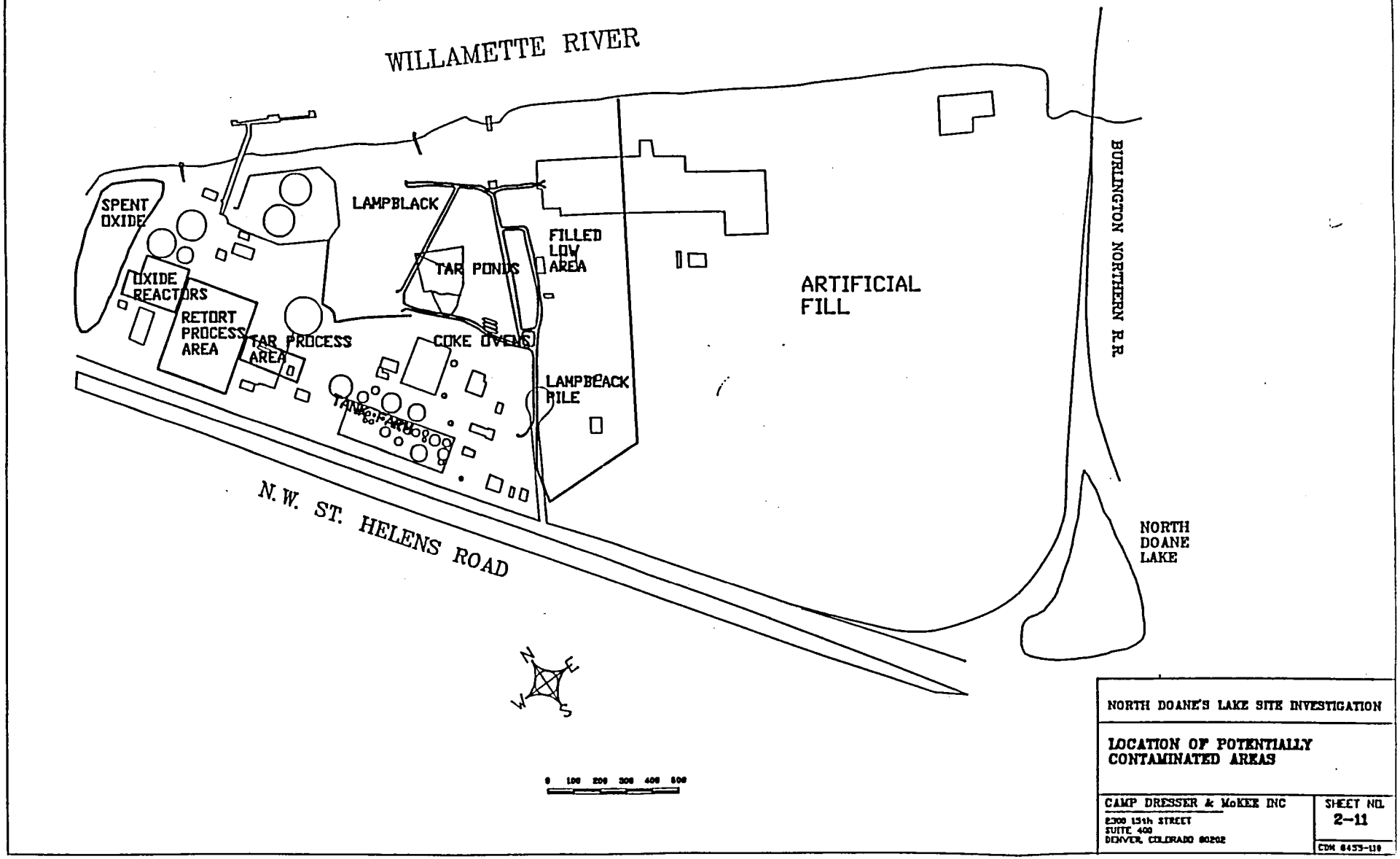
ATTACHMENT 6

PRE-1941 DISPOSAL AREAS


WILLAMETTE RIVER
1936 SHORELINE
SPENT OXIDE
LAMPBLACK & TAR
BURLINGTON NORTHERN R.R.
N.W. ST. HELENS ROAD
NORTH DOANE LAKE
N
E
W
S
0 100 200 300 400 600
NORTH DOANE'S LAKE SITE INVESTIGATION
PRE 1941 POTENTIAL WASTE DISPOSAL AREAS
CAMP DRESSER & McKEE INC
8300 13th STREET
SUITE 400
DENVER, COLORADO 80202
SHEET NO.
2-9
CDM 8455-118

ATTACHMENT 7

POST-1941 DISPOSAL AREAS



NORTH DOANE'S LAKE SITE INVESTIGATION

LOCATION OF POTENTIALLY CONTAMINATED AREAS

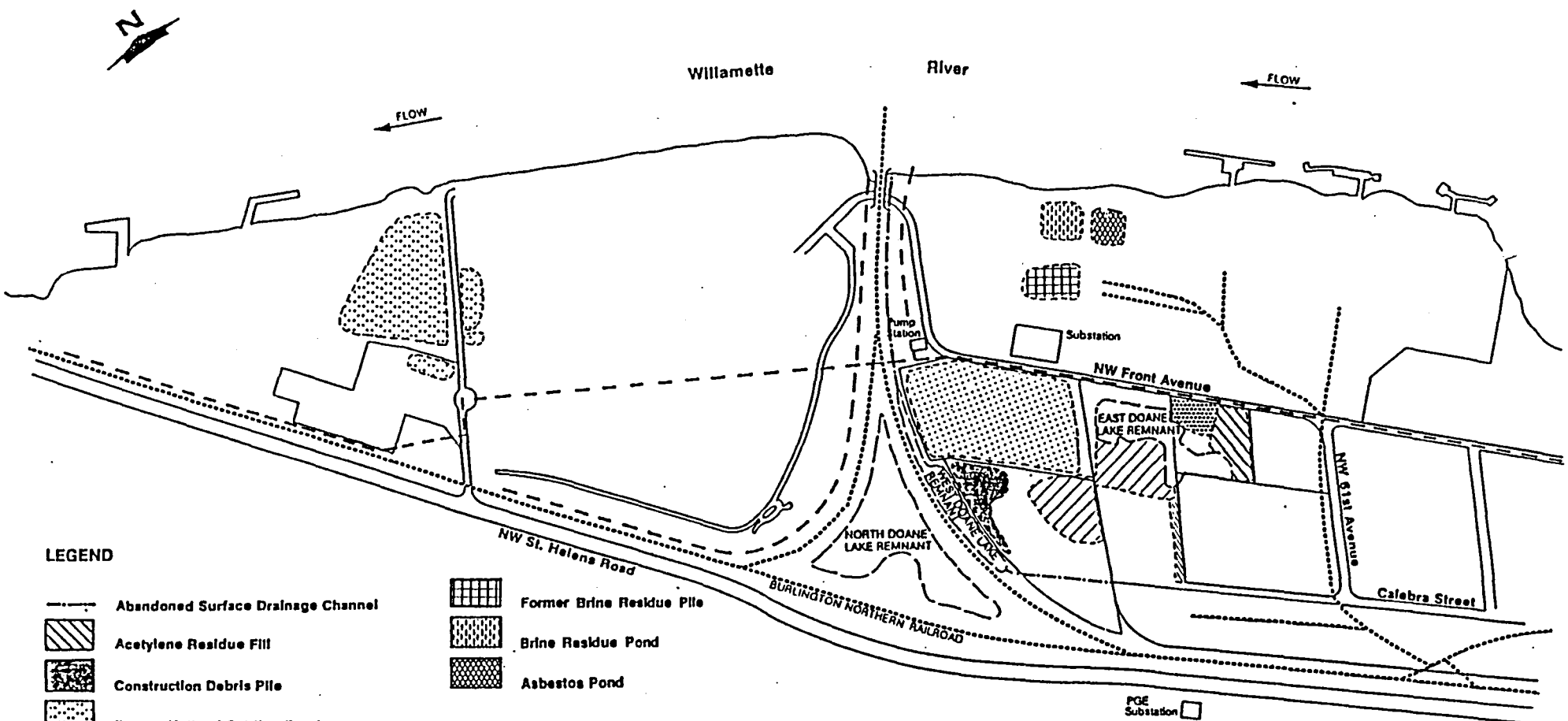
CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202

SHEET NO. 2-11

CDM 8453-110

ATTACHMENT 8

GENERAL WASTE DISPOAL AREAS



GERAGHTY & MILLER, INC.
Environmental Services

APPROXIMATE WASTE DISPOSAL LOCATIONS IN FILL

Doane Lake Area
Portland, Oregon

DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA103.01

FIGURE 3-12

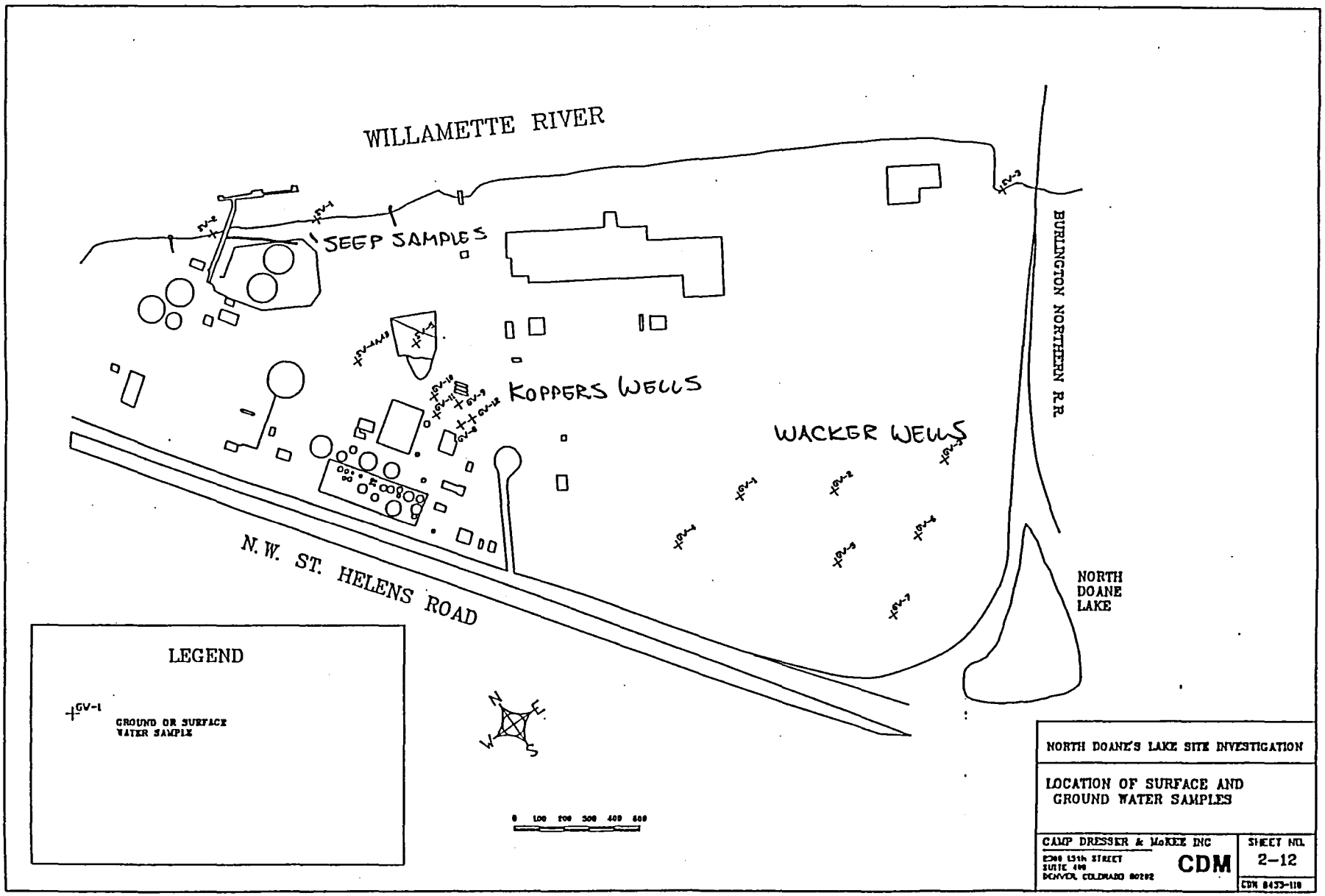
NWT 003415

Attachment 9 - Groundwater and Other Aqueous Data - Northwest Natural Gas Site (mg/l)
(Koppers and NWNG Data)

	Koppers GW-8 (12/84)	Koppers GW-9 (12/84)	Koppers GW-10 (12/84)	Koppers GW-11 (12/84)	NWNG Sump (9/84)	Koppers Separator (12/84)	NWNG Seep 1 (9/85)	NWNG Seep 2 (9/85)	NWNG LNG Basin (11/93)
Volatile Organic Compounds									
Benzene							NA	NA	8.3
Toluene						0.02	NA	NA	2.5
Ethylbenzene	380		24	51		0.06	NA	NA	0.26
Xylene (Total)	2600	3.4	160	22		0.11	NA	NA	0.62
Semivolatile Organic Compounds									
Phenol									
2,4-Dimethylphenol									
2-Methylnaphthalene		0.3	8	14		0.14			
Acenapthene	45	3		1.2	0.03	0.02	1	0.3	0.016
Acenaphthylene					0.03	0.023			0.014
Anthracene	330	9	47			0.006	1.6	0.3	0.0047
Benzo(a)anthracene				0.3		0.001	1.6	0.4	0.014
Benzo(a)pyrene							2.4		0.019
Benzo(b)fluoranthene							2.6		0.024
Benzo(ghi)perylene									0.013
Benzo(k)fluoranthene									0.0054
Chrysene		3	2	0.5		0.001	2.4	0.7	0.023
Dibenzo(ah)anthracene									0.0034
Dibenzofuran		0.1	6	8					
Fluoranthene	110	4	3	1.8		0.007	6.4	1.4	0.031
Fluorene	65	3	3	1.9	0.02	0.018	1.4	0.3	0.0098
Indeno(123-cd)pyrene									0.014
Naphthalene	48	3	2	4.2	2.24		22	0.1	1.3
Phenanthrene	240	11	9	5.5	0.06	0.051	10	1.1	0.038
Pyrene	88	3	2		0.01	0.007	5.1	2	0.028
Carcinogenic PAHs	0	3	2	0.8	0	0.002	9	1.1	0.1158
Non-Carcinogenic PAHs	926	36.4	80	36.6	2.39	0.272	47.5	5.5	1.4415
Total Metals									
Lead	235	22	23	47		NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	0.005	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	0.06	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	0.1	NA	NA	NA	NA

Note: Some VOC and 2-methylnapthalene results were detected as tenatively identified compounds (TICs)

[redacted]


WILLAMETTE RIVER
SEEP SAMPLES
KOPPERS WELLS
WACKER WELLS
BURLINGTON NORTHERN R.R.
NORTH DOANE LAKE
N.W. ST. HELENS ROAD
LEGEND
GV-1
GROUND OR SURFACE WATER SAMPLE
N
E
W
S
0 100 200 300 400 600
NORTH DOANE'S LAKE SITE INVESTIGATION
LOCATION OF SURFACE AND GROUND WATER SAMPLES
CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202
CDM
SHEET NO.
2-12
CDM 8453-110

Attachment 10 - Miscellaneous Soil Data - Northwest Natural Gas Site (mg/kg)

	Koppers Storm Basin Sed SS-8 (9/84)	NWNG Contain Basin Sed SS-9 (9/84)	NWNG Contain Basin Sed SS-10 (12/84)	Wacker Soil Boring B201 (7/90)	Wacker Soil Boring B202 (7/90)
Volatile Organic Compounds					
Benzene	NA	NA	NA	29	1
Chlorobenzene	NA	NA	NA	1.4	0.37
Ethybenzene	NA	NA	NA	55	3.6
Styrene	NA	NA	NA	1.3	0.49
Toluene	NA	NA	NA	26	2.8
Xylene	NA	NA	NA	57	6.8
Semivolatile Organic Compounds					
Acenapthene	150	15	90	450	120
Acenaphthylene		15	80	170	240
Anthracene	1350		70	430	250
Benzo(a)anthracene	30		20	210	190
Benzo(a)pyrene			90	210	240
Benzo(b)fluoranthene				140	180
Benzo(ghi)perylene				140	120
Benzo(k)fluoranthene				120	190
Chrysene	30	10	40	280	260
Dibenzo(ah)anthracene					
Dibenzofuran				52	28
Fluoranthene	140	30	140	780	760
Fluorene	280	15	120	350	210
Indeno(123-cd)pyrene					160
2-Methylnaphthalene				900	330
Naphthalene	140	920	1750	3000	840
Phenanthrene	840	60	560	1900	1200
Pyrene	120	35	160	890	800
Total Carcingenic PAHs	60	10	150	960	1220
Total Non-carcinogenic PAHs	3020	1090	2970	9062	4898

[redacted]

ATTACHMENT 11

Table 1
WACKER SILTRONIC, POLYSILICON PLANT SOILS INVESTIGATION
SOURCE: COFFEY LABORATORIES, INC./APRIL 30, 1985
RESULTS OF SOILS ANALYSIS

Chemical Compounds	MW-1, S-3 (15-16.5 ft)	MW-2, S-4 (20-21.5 ft)	MW-3, S-5 (25-26.5 ft)	MW-4, S-1 (5-6.5 ft)	MW-4, S-7 (35-36.5 ft)	MW-5, S-2 (10-11.5 ft)	MW-6, S-3 (15-16.5 ft)	MW-7, S-5 (25-26.5 ft)	MW-7, S-8 (40-41.5 ft)	Detection Limits	Reference Criteria
Organic Analyses											
o Volatile Compounds											
1,1,1-Trichloroethane	0.01	BD	BD	BD	BD	BD	BD	BD	BD	0.01	pp, PDW (*)
1,2-Dichloroethane	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.01	pp, PDW (*)
1,1,2,2-Tetrachloroethylene	2.2	11	BD	BD	BD	0.14	BD	BD	BD	0.05	
Toluene	1.2	20	0.11	BD	BD	0.20	BD	BD	BD	0.1	pp
Chlorobenzene	0.04	BD	BD	BD	BD	BD	BD	BD	BD	0.04	pp
Ethyl Benzene	17	5.4	BD	BD	BD	BD	BD	BD	0.05	0.04	pp
Xylene	146	116	BD	BD	BD	1.5	BD	2.8	1.2	1.0	
o Acid Extractables											
Phenol	0.35	3.1	0.20	0.30	0.17	0.07	0.05	0.06	0.08	NR	pp, SW
2-Chlorophenol	ND	7.8	0.08	0.26	ND	ND	0.13	ND	0.14	NR	pp, SW
2-Nitrophenol	ND	0.20	ND	ND	ND	ND	ND	ND	ND	NR	pp, SW
2,4-Diethylphenol	ND	3.1	ND	ND	ND	0.22	0.17	ND	ND	NR	pp, SW
2,4-Dichlorophenol	ND	2.7	ND	ND	ND	0.24	ND	ND	ND	NR	pp, SW
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	0.22	ND	ND	ND	NR	pp, SW
2,4-Dinitrophenol	ND	ND	ND	ND	ND	0.81	ND	ND	ND	NR	pp, SW
Pentachlorophenol	ND	ND	ND	ND	0.31	6.9	5.1	ND	ND	NR	pp, SW, SW
o Base Neutral Extractables											
Naphthalene	6.7	360	BD	BD	BD	230	BD	BD	BD	1	pp
Acenaphthalene	5.6	230	BD	BD	BD	24	BD	BD	BD	1	pp
Acenaphthene	8.0	560	BD	BD	BD	28	BD	BD	BD	1	pp
Fluorene	5.0	290	BD	BD	BD	20	BD	BD	BD	1	pp
Phenanthrine-Anthracene (***)	32	1,400	3	BD	BD	150	BD	1.6	BD	1	pp
Fluoranthene	16	530	BD	BD	BD	50	BD	1.1	BD	1	pp
Pyrene	18	550	BD	BD	BD	57	BD	1.2	BD	1	pp
Chrysene	12	92	BD	BD	BD	36	BD	1.7	BD	1	pp
Benzo (b) + Benzo (k) Fluoranthene (***)	8	120	BD	BD	BD	200	BD	BD	BD	1	pp
Benzo (a) pyrene	19	120	BD	BD	BD	100	BD	BD	BD	1	pp
Indeno (1,2,3-CD) Pyrene + Dibenzo (a,b) Anthracene (***)	BD	270	BD	BD	BD	7	BD	BD	BD	1	
Benzo (ghi) Perylene	BD	360	BD	BD	BD	25	BD	BD	BD	1	pp
o Pesticides (EP Toxicity)											
Gamma BHC (Lindane)	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.04	pp, SW, PDW
Endrin	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.002	pp
Toxaphene	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	pp

P08956.031.1

NWT 003419

ATTACHMENT 11.

Table 1 (Continued)

Chemical Compounds	MW-1, S-3 (15-16.5 ft)	MW-2, S-4 (20-21.5 ft)	MW-3, S-5 (25-26.5 ft)	MW-4, S-1 (5-6.5 ft)	MW-4, S-7 (35-36.5 ft)	MW-5, S-2 (10-11.5 ft)	MW-6, S-3 (15-16.5 ft)	MW-7, S-5 (25-26.5 ft)	MW-7, S-8 (40-41.5 ft)	Detection Limits	Reference Criteria
Inorganic Analyses (EP Toxicity)											
Arsenic	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	pp,SHW,SWQ,PDW
Barium	0.05	0.11	0.05	0.09	BD	0.05	0.11	0.08	0.15	0.05	SHW, SWQ
Cadmium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	pp,SHW,SWQ,PDW
Chromium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	pp,SHW,SWQ,PDW
Lead	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	pp,SHW,SWQ,PDW
Mercury	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	pp,SHW,PDW
Selenium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	pp,SHW,PDW
Silver	BD	BD	BD	BD	BD	BD	BD	ND	BD	0.05	pp,SHW,PDW
Miscellaneous Analysis											
o non-PP Phenols/Cresols											
3 & 4-Chlorophenol	0.44	17.5	0.06	ND	ND	1.7	0.32	ND	ND	NR	SHW, SWQ
2,4,5-Trichlorophenol	ND	1.9	ND	ND	ND	ND	ND	ND	ND	NR	SHW, SWQ
2,3,4,5-Tetrachlorophenol	4.9	256	ND	0.40	ND	0.23	4.7	0.06	0.25	NR	SHW, SWQ
2,3,4,6-Tetrachlorophenol	0.24	ND	ND	ND	ND	ND	ND	1.0	ND	NR	SHW, SWQ
2,3,5,6-Tetrachlorophenol	ND	4.0	ND	0.58	0.11	0.33	0.55	ND	0.46	NR	SHW, SWQ
o-Cresol	0.04	3.4	ND	0.02	ND	0.19	0.05	ND	ND	NR	
m- and p-Cresol (***)	0.006	ND	ND	0.08	ND	ND	ND	ND	ND	NR	
o Non-PP Pesticides (EP Toxicity)											
Methoxychlor	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.1	SHW, PDW
2,4-D	BD	BD	BD	BD	BD	10.0	160.0	BD	BD	10	SHW, PDW
2,4,5-TP (Silvex)	BD	BD	BD	BD	BD	BD	BD	BD	BD	1	SHW, PDW
o Misc. Constituents/Parameters											
Oil and Grease	0.340%	0.1498%	0.0587%	0.914%	0.0304%	0.190%	0.0539%	0.0650%	0.0586%		

Unless otherwise specified, all units are mg/kg (mg/L).

pp Priority Pollutant
PDW National Interim Primary Drinking Water Regulations
PDW(*) Proposed N.I.P.D.W.R.
SHW State of Oregon Hazardous Waste Administrative Rules
SWQ State of Oregon Water Quality Administrative Rules
BD Parameter detected, but below analytical quantification limits.
ND Analyzed, but not detected.
NR Not reported.
(***) Reported as sum of two compounds.

PDR956.031.2

Attachment 12 - Groundwater Data - Northwest Natural Gas Site (mg/l)
(Wacker Siltronic Data)

	GW-1 (8/85)	GW-2 (8/85)	GW-3 (8/85)	GW-3I (10/90)	GW-4 (8/85)	GW-5 (8/85)	GW-6 (8/85)	GW-7 (8/85)	GW-7 (10/90)
Volatile Organic Compounds									
Benzene	1.1	0.1	0.39				1.2		
Toluene									
Ethylbenzene	0.41						0.35		
Xylene (Total)	1.2	0.032			0.015		0.43		
Semivolatile Organic Compounds									
Phenol				0.003					
2,4-Dimethylphenol	0.027								
2-Methylnaphthalene		0.26	0.067		0.019	0.012	0.041		
Acenapthene	0.27	0.94	0.086	0.093	0.35	0.054	0.2	0.019	0.002
Acenaphthylene	0.088	0.2		0.002		0.031	0.032		
Anthracene	0.039	0.63		0.002					
Benzo(a)anthracene	0.031	0.48						0.012	
Benzo(a)pyrene	0.04	0.76						0.01	
Benzo(b)fluoranthene	0.024	0.4							
Benzo(ghi)perylene	0.025	0.37							
Benzo(k)fluoranthene		0.12							
Chrysene	0.036	0.65						0.015	
Dibenzo(ah)anthracene									
Dibenzofuran	0.077	0.075		0.004			0.024		0.003
Fluoranthene	0.073	1.38		0.005				0.023	0.003
Fluorene	0.095	0.44	0.013	0.022	0.053	0.012	0.035		0.003
Indeno(123-cd)pyrene	0.02	0.3							
Naphthalene		1.9	0.6	0.77	0.35	0.058	2.1		0.005
Phenanthrene	0.19	0.63	0.013	0.006	0.028	0.021	0.056		
Pyrene	0.081	1.43		0.004	0.014	0.01	0.01	0.011	
Carcinogenic PAHs	0.176	3.08	0	0	0	0	0	0.037	0
Non-Carcinogenic PAHs	0.913	7.885	0.779	0.908	0.814	0.198	2.498	0.053	0.016

Attachment 12 - Groundwater Data - Northwest Natural Gas Site (mg/l)
(Wacker Siltronic Data)

	GW-1 (8/85)	GW-2 (8/85)	GW-3 (8/85)	GW-3I (10/90)	GW-4 (8/85)	GW-5 (8/85)	GW-6 (8/85)	GW-7 (8/85)	GW-7 (10/90)
Chlorinated Pesticides									
Alpha-BHC					0.24		0.06		
4,4'-DDT							0.28		
Endrin						0.02			
Dissolved Metals									
Lead	0.052	0.04	0.025		0.049	0.028	0.03	0.02	
Arsenic	0.005		0.005				0.01		
Cadmium	0.003	0.002	0.001		0.003	0.002	0.002		
Chromium	0.01	0.008	0.005		0.009	0.006	0.008	0.004	
Copper	0.002	0.007	0.001		0.002	0.02	0.001	0.004	
Nickel	0.01	0.007	0.005		0.011	0.006	0.006	0.003	
Zinc	0.026	0.016	0.017		0.05	0.011	0.011	0.047	0.0256
Cyanide	0.18	0.058	0.13	0.107	0.93	0.13	0.04	0.033	0.0314

ATTACHMENT 13

MOBILE LABORATORY ANALYTICAL TEST RESULTS
GROUNDWATER AND SOIL GAS SAMPLES

Sample Location Number	Sample Collection Date	Benzene (µg/L)	Toluene (µg/L)	Ethyl-Benzene (µg/L)	M,P - Xylene (µg/L)	O - Xylene (µg/L)	TPH (µg/L)
GW-01	10/10/90	221.00	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
GW-02	10/10/90	181.00	< 0.10	< 0.10	< 0.10	< 0.10	131.00
GW-03	10/11/90	13.50	1.80	1.50	3.30	2.30	43.60
GW-04-A(a)	10/11/90	391.00	< 0.10	68.00	23.00	22.00	406.00
GW-04-B	10/11/90	384.00	7.10	75.00	30.00	25.00	397.00
SG-05 (b,c)	—	—	—	—	—	—	—
GW-06	10/11/90	59.80	4.60	196.00	4.10	13.80	657.00
GW-07	10/11/90	17,560.00	13.10	126.00	124.00	52.60	17,000.00
GW-08	10/11/90	285.00	< 0.10	129.00	33.10	32.30	369.00
GW-09	10/11/90	371.00	13.10	74.40	34.20	32.40	791.00
GW-10	10/12/90	1,820.00	23.90	471.00	240.00	187.00	5,090.00
GW-11-A	10/12/90	18,100.00	3,910.00	2,520.00	2,380.00	1,130.00	56,500.00
GW-11-B	10/12/90	23,300.00	5,960.00	4,680.00	4,450.00	2,000.00	89,140.00
GW-11-C	10/12/90	18,470.00	5,590.00	4,510.00	4,372.00	2,050.00	88,240.00

ATTACHMENT 13
(Continued)

Sample Location Number	Sample Collection Date	Benzene (µg/L)	Toluene (µg/L)	Ethyl-Benzene (µg/L)	M,P - Xylene (µg/L)	O - Xylene (µg/L)	TPH (µg/L)
SG-12(c)	10/12/90	500.00	58.20	279.00	237.00	70.80	1,760.00
SG-13(c)	10/13/90	1.28	< 0.01	< 0.01	< 0.01	< 0.01	687.00
GW-14	10/12/90	8.60	< 0.10	< 0.10	< 0.10	< 0.10	74.70
GW-15	10/12/90	23.20	< 0.10	75.90	< 0.10	21.30	1,330.00
GW-16	10/13/90	12,600.00	214.00	1,680.00	1,180.00	738.00	21,400.00
GW-17-A	10/13/90	11,300.00	662.00	1,680.00	1,690.00	768.00	24,900.00
GW-17-B	10/13/90	10,930.00	574.00	1,370.00	1,410.00	632.00	19,400.00
GW-18	10/13/90	250.00	20.40	64.20	58.50	28.80	623.00
GW-19	10/13/90	52.40	< 0.10	13.00	12.60	8.00	148.00
GW-20-A	10/13/90	2,920.00	80.60	1,690.00	1,230.00	673.00	16,600.00
GW-20-B	10/13/90	3,120.00	85.60	1,720.00	1,230.00	667.00	14,500.00
GW-21	10/13/90	2,510.00	349.00	37.60	66.60	33.00	3,140.00
GW-22-A	10/14/90	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	12.10
GW-22-B	10/14/90	1.00	0.70	< 0.10	< 0.10	< 0.10	18.10
GW-23	10/14/90	335.00	< 0.10	419.00	67.30	24.60	635.00
GW-24	10/14/90	4,780.00	594.00	926.00	1,050.00	500.00	6,330.00
GW-25-A	10/15/90	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	26.80
GW-25-B	10/15/90	3.70	< 0.10	< 0.10	1.70	1.90	25.30

ATTACHMENT 13
(Continued)

Sample Location Number	Sample Collection Date	Benzene (µg/L)	Toluene (µg/L)	Ethyl-Benzene (µg/L)	M,P - Xylene (µg/L)	O - Xylene (µg/L)	TPH (µg/L)
GW-26	10/15/90	5,920.00	910.00	584.00	580.00	301.00	12,040.00
GW-27-A	10/15/90	10,300.00	627.00	1,220.00	1,250.00	597.00	16,300.00
GW-27-B	10/15/90	11,400.00	320.00	1,340.00	1,430.00	656.00	20,800.00
GW-28	10/15/90	349.00	9.70	< 0.10	6.20	16.20	328.00
GW-29	10/16/90	541.00	< 0.10	263.00	< 0.10	19.40	735.00

(a) The letters "A," "B," and "C" following the sample location number indicate duplicate analysis.
(b) Sample was too concentrated for instrument calibration setting.
(c) Groundwater sample not collected at this location.

Notes:
GW = groundwater sample; SG = soil gas sample.
Detection Limits for groundwater = 0.10 µg/L; Soil gas detection limits = 0.01 µg/L.
< = Analyte not detected at concentration posted.

All groundwater samples collected at 25 feet below ground surface.
All samples analyzed by Hydro Geo Chem Mobile Lab, using modified EPA Method 8015.

ATTACHMENT 13

QUALITY CONTROL ANALYTICAL TEST RESULTS

Sample Location Number	Analytical Laboratory	Sample Collection Date	Benzene (µg/L)	Toluene (µg/L)	Ethyl-Benzene (µg/L)	M,P - Xylene (µg/L)	O - Xylene (µg/L)	Total Xylenes (µg/L)	TPH (µg/L)	TFH(b) GAS (µg/L)
GW-04-A(a)	HYDRO GEO CHEM	10/11/90	391.00	< 0.10	68.00	23.00	22.00	45.00	406.00 (a)	
GW-04-B		10/11/90	384.00	7.10	75.00	30.00	25.00	55.00	397.00	
GW-04	CH2M HILL	10/11/90	280.00	9.80	80.00	N/A	N/A	70.00		1,300.00
GW-07	HYDRO GEO CHEM	10/11/90	17,560.00	13.10	126.00	124.00	52.60	176.60	17,000.00	
GW-07	CH2M HILL	10/11/90	8,400.00	100.00	770.00	N/A	N/A	540.00		19,000.00
GW-27-A	HYDRO GEO CHEM	10/15/90	10,300.00	627.00	1,220.00	1,250.00	597.00	1,847.00	16,300.00	
GW-27-B		10/15/90	11,400.00	320.00	1,340.00	1,430.00	656.00	2,086.00	20,800.00	
GW-27 **	CH2M HILL	10/15/90	18,000.00	280.00	1,070.00	N/A	N/A	490.00		40,000.00

(a)The letter "A" following the sample location number indicates field sample; "B" indicates a duplicate sample.

(b)CH2M HILL analyzed for TFH Gas and was recorded in mg/L units. This unit was converted to ug/L for comparison purposes (where 1.0 mg/L = .001 µg/L).

Notes:

** Due to the concentration of target compounds, GW-27 was diluted at 1:50 and then again at 1:100. Reporting limits have been adjusted accordingly.

< = analyte not detected at concentration posted.

All groundwater samples collected at 25 feet below ground surface.

CH2M HILL Lab samples analyzed using EPA Method 8015/8020. Hydro Geo Chem Mobile Lab samples analyzed using MODIFIED EPA Method 8015.

Detection Limits for Hydro Geo Chem groundwater samples = 0.10 µg/L.

N/A = Lab did NOT ANALYZE for this compound.

ATTACHMENT 14

RESIDUAL TAR PROPERTIES SUMMARY

Collection Date: 1970 and 1971 (4 samples)

Bulk Tar Analysis (weight percent)

	Wet	Dry
Tar	69.2	93.5
Water	26.0	.1
Ash	1.8	2.4
Naphthalene	2.2	2.9
Sulfur	0.8	1.1

Specific Gravity wet 1.225
dry 1.28

Viscosity range (cp) 28,000-67,200

Fraction soluble in CCl_4 46%
Fraction soluble in Acetone 50%

Bulk Tar Distilation Data

Temperature °C	Cumulative % Vaporized	
141	0	initial boiling point
141-170	.93	
170-270	10.86	
270-300	21.34	
over 300	78.66	solids and high boiling liquids

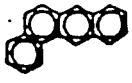
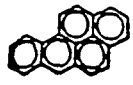
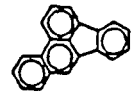
Acetone Soluble Fraction Distilation Data

Temperature °C	Cumulative % Vaporized	
145		initial boiling point
225-236	16.3	
236-280	22.1	
280-295	40.2	
295-310	58.3	
310-365	66.6	
over 365	33.4	solids and high boiling liquids

ATTACHMENT 15

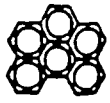
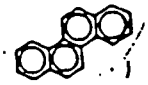
PAH DATA

	Acenaphthene	Acenaphthylene	Anthracene
Synonyms	1,2-dihydroacenaphthylene; 1,8-dihydroacenaphthaline; 1,8-ethylenenaphthalene; 1,2-dihydroacenaphthylene	Cyclopenta[de]naphthalene	Anthracin; green oil; paranaphthalene (b) Tetra olive NZG (c) Anthracene oil
Trade names	No data	No data	No data
emical formula	$C_{12}H_{10}$	$C_{12}H_8$	$C_{14}H_{10}$ (b)
emical structure			
sweasar	No data	No data	L C666J
lentification numbers:			
CAS Registry	83-32-9	208-96-8	120-12-7 (b)
NIOSH RTECS	AB1000000	AB1254000	CA 9350000
EPA Hazardous Waste	No data	No data	No data
OHM/TADS	8200126	No data	8200122
DOT/UN/NA/IMCO shipping	No data	No data	No data
HSDB	2659	2661	702
NCI	No data	No data	No data
STCC	No data	No data	No data
lecular weight	154.21	154.20	178.2 (f)
lor	Orthorhombic bipyramidal needles from alcohol, white Needles	Prisms from ether; plates from alcohol	Tablet or monoclinic prism when pure (f) Colorless with violet fluorescence when pure; yellow with green fluorescence when impure
ysical state	Solid (needles)	Solid (prism/plate)	Solid (tablet or prism) (f)
lting point	95°C	92-93°C	218°C (f)
iling point	96.2°C	265-275°C	342°C (f) 340°C (b)
nsity	1.225 at 0°C 1.0242 at 0°/4°C (b)	0.8988 at 16°C/2°C	1.25 at 27°/4°C 1.283 at 25°/4°C (b)
Odor	No data	No data	Weak aromatic odor
or threshold:	Threshold odor concentration [TOC] in water at room temperature	No data	No data
Water	0.08 ppm, range 0.02-0.22 ppm	No data	No data
Air	$8.0x10^{-2}$ ppm	No data	No data
lubility:			
Water	Insoluble	3.93 mg/L water	Virtually insoluble in water (f)
Organic solvents	Soluble in alcohol, methanol, propanol, chloroform, benzene, toluene, glacial acetic acid	Alcohol, ether, benzene	Benzene, carbon disulphide, carbon tetrachloride, chloroform, ether, ethanol, methanol toluene (f) Acetone (b)
rtition coefficients	$K_{ow} = 9.6x10^3$, $K_{oc} = 4.6x10^3$ (c)	log K_{ow} = 4.07 $K_{ow} = 3.3x10^3$; K_{oc} = 2.5x10 (c)	log K_{ow} = 4.45 $K_{oc} = 1.4x10^4$; $K_{ow} = 2.8x10^4$ (c)
apor pressure:	$4.47x10^{-3}$ mmHg (d)	0.029 torr (20°C) (c)	1 mm at 145°C (f) $1.7x10^{-5}$ torr at 25°C (c)
enry's law constant	No data	$1.45x10^{-3}$	$8.6x10^{-5}$ (c)
utoignition temperature	No data	No data	540°C 1004°F (g)
Flashpoint	No data	No data	250°F
lammability limits	Dust is moderately flammable (e)	No data	No data
onversion factors	No data	No data	No data

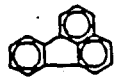
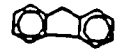
	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
ynonyms	Benz(a)anthracene 1,2-benzanthracene; benzo(b)-phenanthrene; 2,3-benzophenanthrene; tetraphene (d) BA (e)	Benzo[def]chrysene; 3,4-benzopyrene, 3,4-benzpyrene; benz[a]pyrene; BP; B[a]P (b)	3,4-Benz(e)acephenanthrylen 2,3-benzfluoranthene; 3,4-benzfluoranthene; 2,3-benzofluoranthene; 3,4-benzofluoranthene; benzo(e)fluoranthene B(b)f (b)
rade names	No data	No data	No data
emical formula	$C_{18}H_{12}$	$C_{20}H_{12}$ (b)	$C_{20}H_{12}$ (b)
emical structure			
weswer	L D6 B66 J	L D6 B6666 2AB TJ	L C 65 K666 1A TJ
entification numbers:			
AS Registry	56-55-3	50-32-8	205-99-2 (b)
NIOSH RTECS	CV 9275000 (e)	DJ3675000	CU 1400000 (c)
EPA Hazardous Waste	U018	U022	No data
OHM/TADS	8001123	8200129	No data
OT/UN/NA/IMCO shipping	No data	No data	No data
HSDB	4003	2554	4035
NCI	No data	No data	No data
STCC	No data	No data	No data

Molecular weight	228.29 (h)	252.3 (f)	252.3 (f)
Color	Plates with yellow-blue fluorescence (recrystallized from glacial acetic acid or ethane) (b)	Pale yellow; fluoresces (f) yellow-green in ultraviolet light (i)	Colorless needles (f) Needles recrystallized fr benzene (b)
Physical state	Solid (plates)	Plates or needles (i) (recrystallized from benzene/ligroin)	Solid (needles) (b)
Melting point	158-159°C (h) 162°C (b)	179-179.3°C (i)	168.3°C (f)
Boiling point	400°C (g) 435°C sublimes (i)	310-312°C (at mm Hg) (i) 495°C (at mm Hg) (j)	No data
Density	1.274 (20°C)	1.351	No data
Odor	No data	Unknown	No data
Odor threshold:			
Water	No data	No data	No data
Air	No data	No data	No data
Solubility:			14 µg/L (c)
Water	Virtually insoluble (9-14 µg/L) (f)	$3.8x10^{-6}$ g/L (c)	Virtually insoluble in water
Organic solvents	Slightly soluble in acetic acid and hot ethanol; soluble in acetone and diethyl ether; very soluble in benzene (f)	Sparingly soluble in ethanol and methanol; soluble in benzene, toluene, xylene, and ether (f)	Slightly soluble in benzene, acetone (f)
Partition coefficients	$K_{ow} = 4.1x10^5$, $K_{oc} = 2x10^5$ (c)	$k_{ow} = 1.55x10^6$ (c) $\log k_{ow} = 6.06$ $k_{oc} = 3.5x10^6$ (c)	$K_{ow} = 1.1x10^6$; $K_{oc} = 5.5x10^5$
Vapor pressure:	$2.2x10^{-8}$ torr (20°C)	$5.6x10^{-9}$ mm Hg (c)	10^{-11}-10^{-6} torr at 20°C
Henry's law constant	$1x10^{-6}$	$4.9x10^{-7}$ atm-m^3/mol (c)	$1.22x10^{-5}$ (c)
Autoignition temperature	No data	Unknown	No data
Flashpoint	No data	Unknown	No data
Flammability limits	No data	Unknown	No data
Conversion factors	No data	1 ppm = 10.32 mg/m^3 (1)	No data

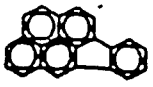
NWT 003430

	Benzo(b)fluoranthene	Benzo(ghi)perylene	Chrysene
Synonyms	8,9-benzfluoranthene; 8,9-benzofluoranthene; 11,12-benzofluoranthene; 2,3,1,8-binaphthylene; dibenzo(bjk)fluorene (b)	1,12-benzoperylene (d)	1,2-Benzophenanthrene; benzo(a)phenanthrene; 1,2-benzphenanthrene; benz(a)phenanthrene; 1,2,5,6-dibenzonaphthalene
Trade names	No data	No data	Not applicable (b)
Chemical formula	$C_{20}H_{12}$ (b)	$C_{22}H_{12}$ (d)	$C_{18}H_{12}$ (b)
Chemical structure			
Fiswesser	No data	No data	No data
Identification numbers:			
CAS Registry	207-08-9 (b)	191-24-2 (d)	218-01-9 (b)
NIOSH RTECS	DF 6350000 (e)	DI 6200500 (e)	GC 0700000 (e)
EPA Hazardous Waste	No data	No data	U050 (e)
OHM/TADS	No data	8200129	No data
DOT/UN/NA/IMCO shipping	No data	No data	No data
HSDB	No data	No data	2810
NCI	No data	No data	No data
STCC	No data	No data	No data

Molecular weight	252.3 (f)	276.34 (h)	228.3 (f)
Color	Pale yellow needles (f)	No data	Colorless with blue fluorescence; othorhombic bipyramidal plates (recrystallized from benzene) (f) Red with blue fluorescence (recrystallized from benzene or acetic acid) (b)
Physical state	Solid (needles)	No data	Solid (plates) (b)
Melting point	215.7°C (f)	273°C (h)	255-256°C (f)
Boiling point	480°C (f)	222°C (c)	448°C (f)
Density	No data	No data	1.274 (g)
Odor	No data	No data	No data
Odor threshold:			
Water	No data	No data	No data
Air	No data	No data	No data
Solubility:		$2.6x10^{-4}$ g/L 25°C (c)	
Water	Virtually insoluble (f)		Virtually insoluble in water (1.5-2.2 µg/L) (f)
Organic solvents	Soluble in benzene, acetic acid, ethanol (f)	No data	Slightly soluble in acetone, carbon disulphide, diethyl ether, ethanol (1 g/1300 ml ethanol), glacial acetic acid toluene 10.24 parts/100 parts at 18°C 1 g/480 ml at 20°C; 5% at 100°C), hot xylene. Soluble in benzene. (f) Moderately soluble in boiling benzene (g)
Partition coefficients	$K_{ow} = 1.15x10^{-6}$; $K_{ow} = 5.5x10^{5}$ (c)	$K_{ow} = 3.2x10^{6}$; $K_{oc} = 1.6x10^{6}$ (c)	$K_{ow} = 4.1x10^{5}$; $K_{oc} = 2x10^{5}$ (c)
Vapor pressure:	$5x10^{-7}$ (20°C) torr (c)	$1.03x10^{-10}$ (25°C) torr (c)	$6.3x10^{-9}$ mmHg (25°C) (c)
Henry's law constant	$3.87x10^{-5}$ (c)	$1.44x10^{-7}$ (c)	$1.05x10^{-6}$ (c)
Autoignition temperature	No data	No data	No data
Flashpoint	No data	No data	No data
Flammability limits	No data	No data	No data
Conversion factors	No data	No data	No data

	Dibenz(a,h)anthracene	Fluoranthene	Fluorene
nonyms	1,2,5,6-Dibenz(a,h)anthracene (d) Dibenzo(a,h)anthracene, DB(a,h)A; DBA; 1,2:4,6-dibenz(a,h)anthracene; 1,2:5,6-dibenz(a)anthracene (b)	1,2-(1,8-Naphthylene)benzene; 1,2-benzacenaphthene; 1,2-(1,8-naphthalenediyl)benzene; benzo(jk)fluorene	ortho-Biphenylene methane; diphenylenemethane; 2,2-methylene biphenyl (b) 2,3-benzidene (f)
ade names	No data	No data	No data
emical formula	$C_{22}H_{14}$ (b)	$C_{16}H_{10}$	$C_{13}H_{10}$ (b)
hemical structure			
Iswesser	L G6 B666J	L C6566 1A PJ	No data
dentification numbers:			
CAS Registry	53-70-3 (b)	206-44-0	86-73-7 (b)
NIOSH RTECS	HN 2625000 (e)	LL4025000	LL5670000
EPA Hazardous Waste	U063	U120	No data
OHM/TADS	No data	8200136	No data
DOT/UN/NA/IMCO shipping	No data	No data	No data
HSDB	5097	5486	2165
NCI	No data	No data	No data
STCC	No data	No data	No data

	Dibenz(a,h)anthracene	Fluoranthene	Fluorene
olecular weight	278.35 (h)	202.26	166.2 (f)
olor	Colorless (f) Plates (recrystallized from acetone) leaflets (recrystallized from acetic acid) (b)	Colored needles; pale yellow needles or plates from alcohol	White when recrystallized from ethanol (f)
ysical state	Solid (plates or leaflets) (b)	Solid (needles or plates)	Solid (leaflets or flakes; crystalline plates) (f)
lting point	262°C (h)	111°C	116-117°C (f)
oiling point	269-270°C	375°C	295°C (f)
ensity	1.282	1.252 at 0°C/4°C	1.203 at 0°C/4°C
dor	No data	No data	No data
dor threshold:			
Water	No data	No data	No data
Air	No data	No data	No data
olubility:			
Water	0.5 µg/L (f)	In sea water at 22°C	Almost insoluble in water (1.68-1.98 mg/L) (f)
Organic solvents	Slightly soluble in ethyl alcohol; soluble in acetone, acetic acid, benzene, toluene and xylene (b)	Alcohol, ether, benzene, acetic acid	Acetic acid, acetone, benzene, carbon disulphide, carbo tetrachloride, diethyl e ethanol, pyrimidine, sol io toluene (f)
Partition coefficients	K_{ow} 6.9 x10^6; K_{oc} = 3.3x10^6 (c)	log K_{ow} 4.90; K_{oc} = 3.8x10^4 K_{ow} = 7.9x10^4; K_{oc} = 3.8x10^4 (c)	K_{ow} = 1.5x10^4; K_{oc} = 7.3x10^3 (
Vapor pressure:	1x10^{-10} mmHg at 20°C (c)	0.01 mmHg (20°C) 5.0x10^{-6} torr (25°C) (c)	10 mm at 146°C (f) 7.1x10^{-4} torr (c)
Henry's law constant	7.3x10^{-8} (c)	6.5x10^{-6} (c)	6.4x10^{-5} (c)
Autoignition temperature	No data	No data	No data
Flashpoint	No data	No data	No data
Flammability limits	No data	No data	No data
Conversion factors	No data	No data	No data

	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene
ynonyms	1P; ortho-phenylenepyrene; 1,10-(ortho-phenylene)pyrene; 1,10-(1,2-phenylene)pyrene; 2,3-ortho-phenylene pyrene (b) Indenopyrene	Phenanthrene; Phenantrin (b)	Benzo(def)phenanthrene; β-pyrene (1
:ade names	No data	No data	No data
Chemical formula	$C_{22}H_{12}$ (b)	$C_{14}H_{10}$ (b)	$C_{16}H_{10}$ (b)
hemical structure			
awesser	No data	No data	No data
ientification numbers:			
CAS Registry	193-39-5 (b)	85-01-8 (b)	129-00-00 (b)
NIOSH RTECS	NK 9300000	SF7: :000	No data
EPA Hazardous Waste	U137	No data	No data
OHM/TADS	No data	8200140	No data
DOT/UN/NA/IMCO shipping	No data	No data	No data
HSDB	5101	2166	4023
NCI	No data	No data	No data
STCC	No data	No data	No data

S = Chemical Abstracts Services; NIOSH = National Institute for Occupational Safety and Health; RTECS = Registry of Toxic Effects of Chemical bstances; EPA = Environmental Protection Agency; OHM/TADS = Oil and Hazardous Materials/Technical Assistance Data System; DOT/UN/NA/IMCO = epartment of Transportation/United Nations/North America/International Maritime Dangerous Gooda Code; HSDB = Hazardous Substance Data Bank; NCI = tional Cancer Institute; and STCC = Standard Transport Commodity Code.

) All information obtained from HSDB 1988 except where noted.
) IARC 1983
) Callahan et al. 1979
) Eller 1984
) Sax and Lewis 1989
) Weast et al. 1988

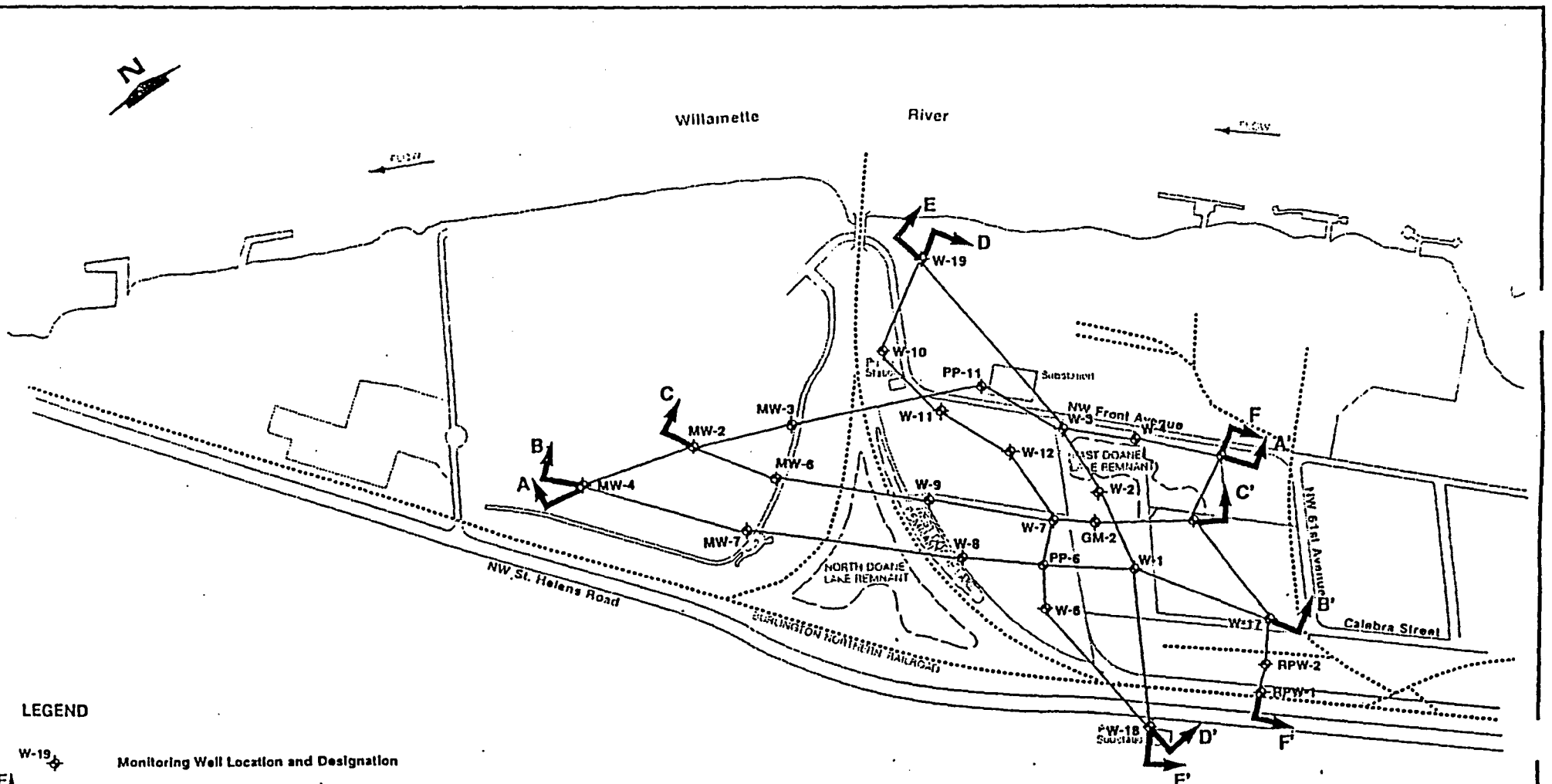
	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene
Molecular weight	276.3 (f)	178.2 (f)	202.3 (f)
Color	Yellow plates or needles showing a greenish-yellow fluorescence (f)	Monoclinic plates (recrystallized from ethanol) colorless, shining crystals; leaflets (f)	Pale yellow plates (recrystallized from toluene) monoclinic prismatic tablets (t) a slight blue fluorescens (r crystallized from ethanol (r sublimation) (f)
Physical state	Solid (plates or needles) (f)		Colorless solid
Melting point	163.6°C (f)	100°C (f)	156°C 153-155°C 156°C (k)
Boiling point	530°C	340°C (f)	393°C (b) 404°C (k)
Density	No data	0.900 at 4°C	1.271 at 23°C Boiling point 393°C
Odor	No data	Faint aromatic odor	No data
Odor threshold:			
Water	No data	No data	No data
Air	No data	No data	No data
Solubility:			
Water	Insoluble in water (f)	Virtually insoluble in water (1-1.6 mg/L) (f)	Virtually insolbule in water (129-165 µg/L) (f)
Organic solvents	Soluble in organic solvents (f)	Soluble glacial acetic acid; 1 g dissolves in the following volumes: 2 ml benzene, 1 ml carbon disulphide, 2.4 ml carbon tetrachloride, 3.3 ml anhydrous diethyl ether, 60 ml cold ethanol, 25 ml absolute ethanl, 10 ml boiling 95% ethanol, and 2.4 ml toluene (f)	Soluble in benzene, carbon sulphide, diethyl ether, ethanol, petroleum ether toluene, race tone (f) Alcohol
Partition coefficients	log K_{ow} 6.584 K_{ow} =3.2x10^{6}; K_{oc} = 1.6x10^{6} (c)	4.57 K_{ow} = 2.8x10^{4}; K_{oc} = 1.4 x10^{4} (c)	Octanol/water: log K_{ow} = 4 K_{ow} = 8.0x10^{4}; K_{oc} = 3.8x10 (c
Vapor pressure:	~10^{-10} torr (20°C) (c)	9.6x10^{-4} torr (25°C) (c)	2.5x10^{-6} torr at 25°C (c)
Henry's law constant	6.95x10^{-8} (c)	2.26x10^{-4} (c)	5.1x10^{-6} (c)
Autoignition temperature	No data	No data	No data
Flashpoint	No data	171°C	No data
Flammability limits	No data	No data	No data
Conversion factors	No data.	No data	No data

(a) All information obtained from HSDB 1988 except where noted.
(b) Weast et al. 1988
(c) Mabey et al. 1982
(d) EPA 1987a
(e) ITII 1982
(f) IARC 1983
(g) Sax and Lewis 1989
(h) Eller 1984
(i) Weast 1987
(j) Aldrich 1986
(k) Windholz 1983
(l) Verschueren 1983

NWT 003434

ATTACHMENT 16

FENCE DIAGRAMS AND LITHOLOGICAL MAPS



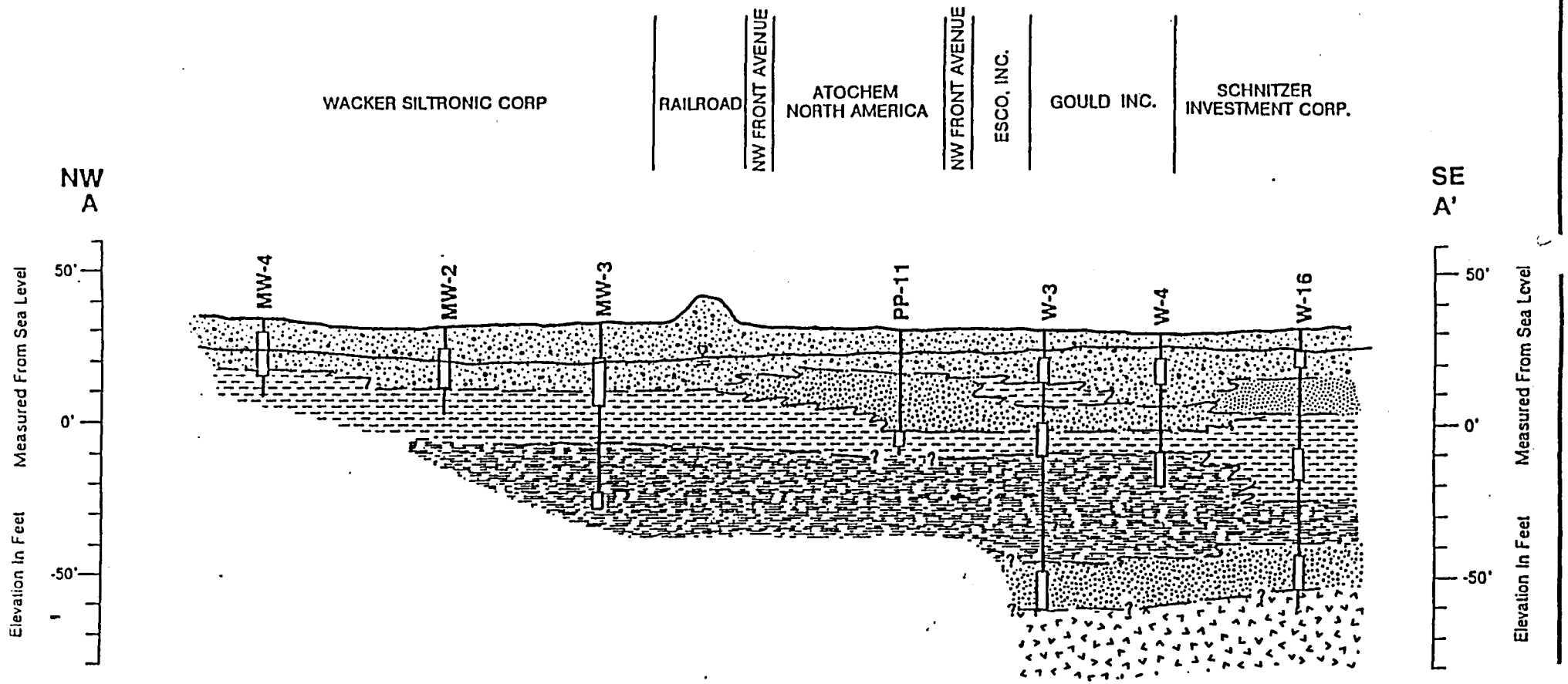
GERAGHTY & MILLER, INC.

CROSS-SECTION TRANSECT MAP

Doane Lake Area
Portland, Oregon

FIGURE 3-1

NWT 003436



LEGEND

- Fill
- Sand
- Silty Sand
- Silt
- Clayey Silt
- Troutdale Formation
- Basalt
- Water Level July 1990

Vertical Scale: 1" = 50'
Horizontal Scale: 1" = 500'

GERAGHTY & MILLER, INC.
Environmental Services

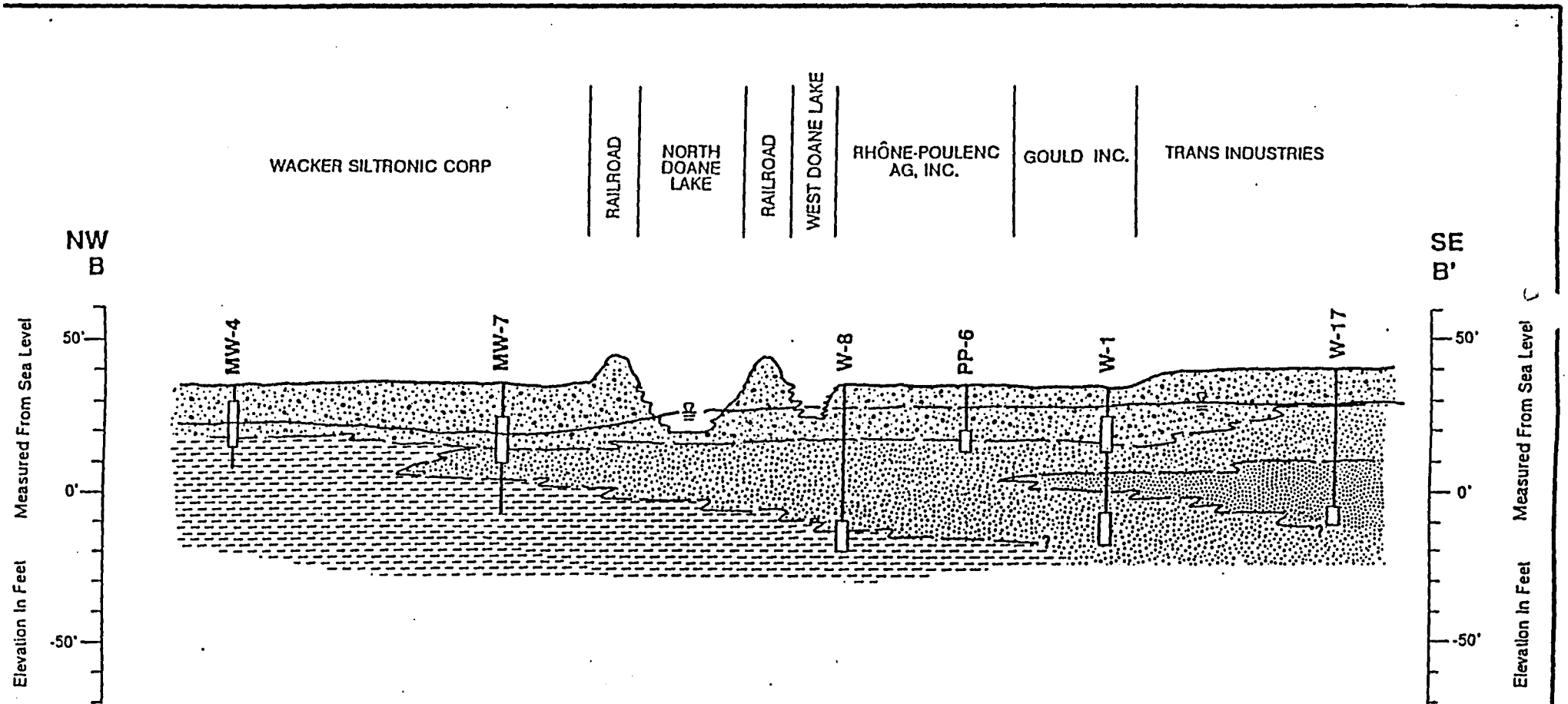
STRATIGRAPHIC CROSS SECTION A-A'

Doane Lake Area
Portland, Oregon

DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA103.01

FIGURE 3-2

NWT 003437



LEGEND

- Fill
- Sand
- Silty Sand
- Clayey Silt
- Troutdale Formation
- Basalt
- Water Level July 1990

Vertical Scale: 1" = 50'
Horizontal Scale: 1" = 500'

GERAGHTY & MILLER, INC.
Environmental Services

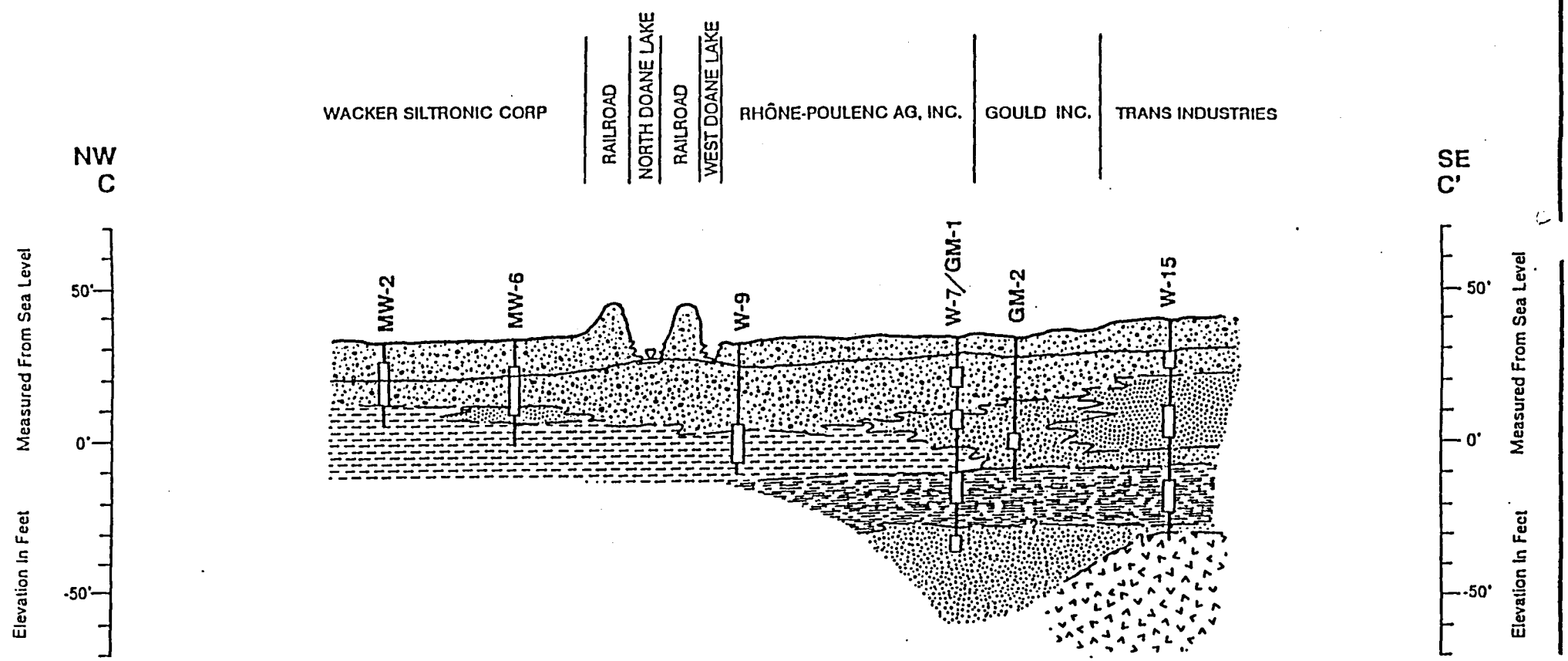
STRATIGRAPHIC CROSS SECTION B-B'

Doane Lake Area
Portland, Oregon

FIGURE 3-3

DRAWN SAC | COMPLETED BY AAR | DATE FEB. 1991 | PROJECT NUMBER W[redacted]01

NWT 003438



LEGEND

- Fill
- Sand
- Silty Sand
- Silt
- Clayey Silt
- Troutdale Formation
- Basalt
- Water Level July 1990

Vertical Scale: 1" = 50'
Horizontal Scale: 1" = 500'

GERAGHTY & MILLER, INC.
Environmental Services

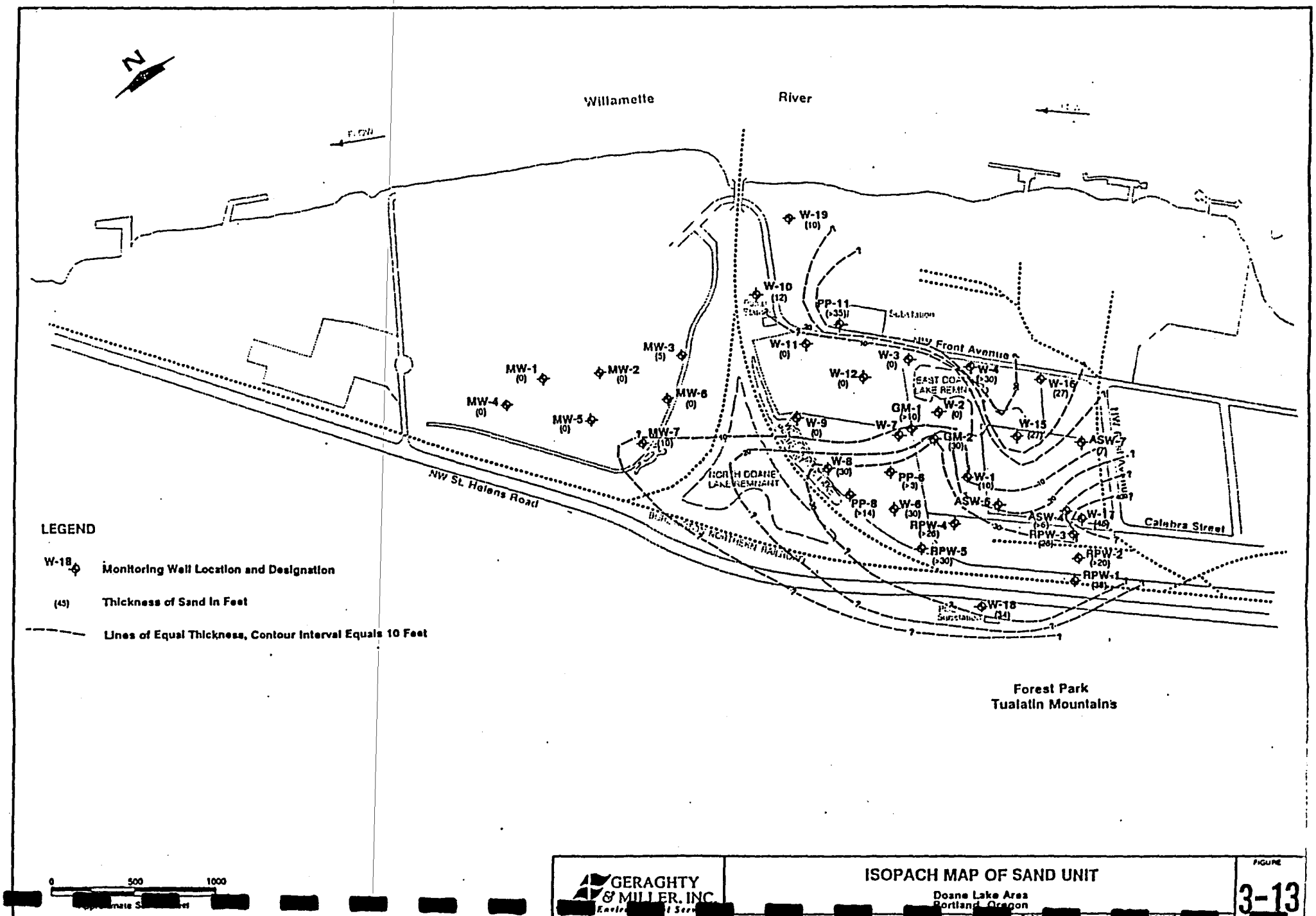
STRATIGRAPHIC CROSS SECTION C-C'

Doane Lake Area
Portland, Oregon.

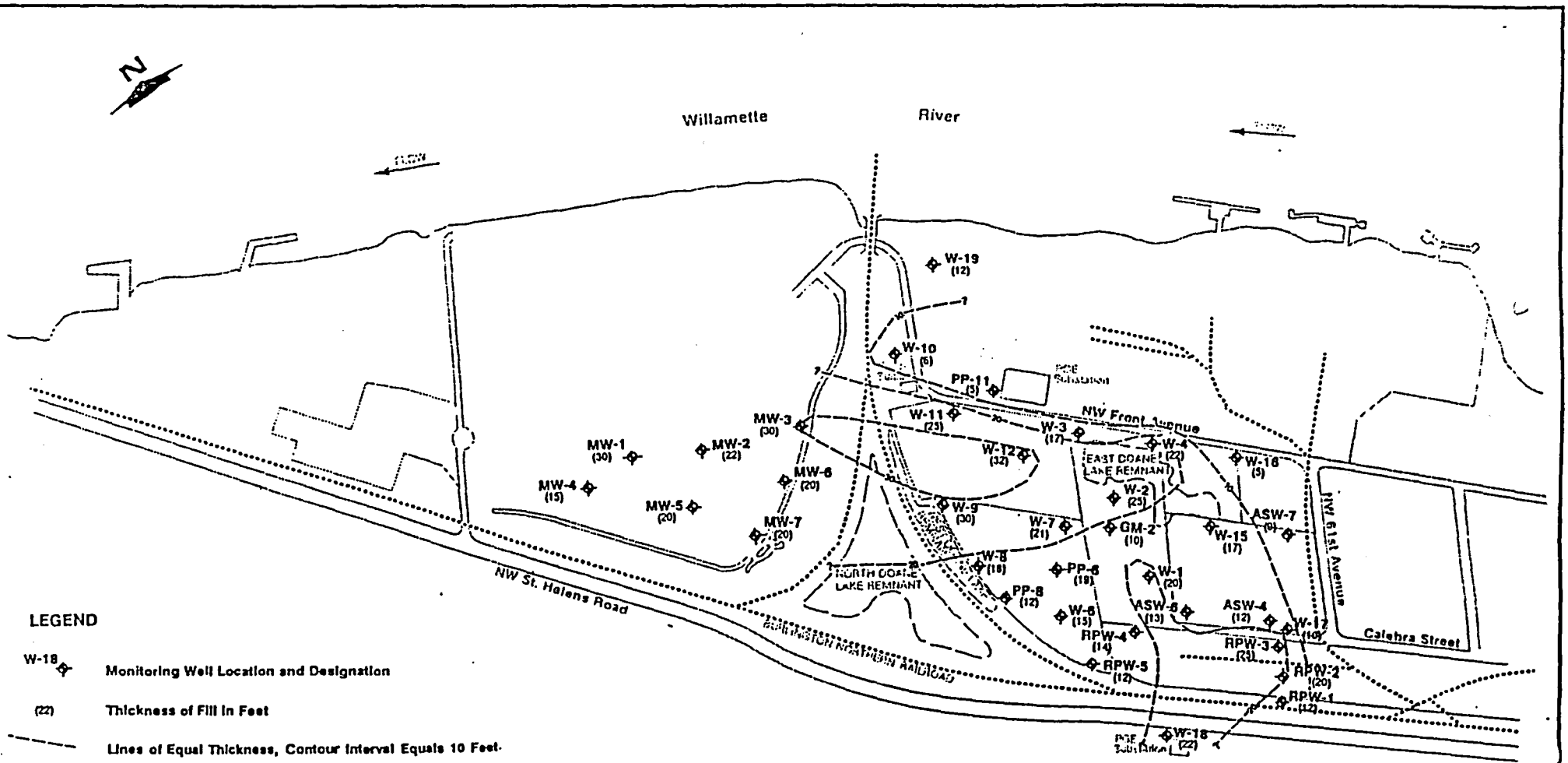
FIGURE 3-4

DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA103.01

NWT 003439


N
Willamette River
W-19 (10)
W-10 (12)
PP-11 (>35)
W-11 (0)
W-12 (0)
W-3 (0)
W-4 (>30)
W-16 (27)
W-2 (0)
GM-1 (>10)
W-15 (27)
GM-2 (30)
ASW-7 (7)
W-9 (0)
W-7
W-8 (30)
PP-6 (>3)
W-1 (10)
PP-8 (>14)
W-6 (30)
ASW-5
ASW-4 (>6)
W-17 (45)
RPW-4 (>26)
RPW-3 (26)
RPW-5 (>30)
RPW-2 (>20)
RPW-1 (38)
W-18 (14)
MW-1 (0)
MW-2 (0)
MW-3 (5)
MW-4 (0)
MW-5 (0)
MW-6 (0)
MW-7 (10)
NW Front Avenue
NW St. Helens Road
Calabra Street
Forest Park
Tualatin Mountains
LEGEND
W-18 Monitoring Well Location and Designation
(45) Thickness of Sand in Feet
Lines of Equal Thickness, Contour Interval Equals 10 Feet
0
500
1000
GERAGHTY & MILLER, INC.
ISOPACH MAP OF SAND UNIT
Doane Lake Area
Portland, Oregon
FIGURE
3-13

NWT 003440



LEGEND

W-18 — Monitoring Well Location and Designation

(22) — Thickness of Fill in Feet

Lines of Equal Thickness, Contour Interval Equals 10 Feet.

0 500 1000

Approximate Scale in Feet

GERAGHTY & MILLER, INC. Environmental Services

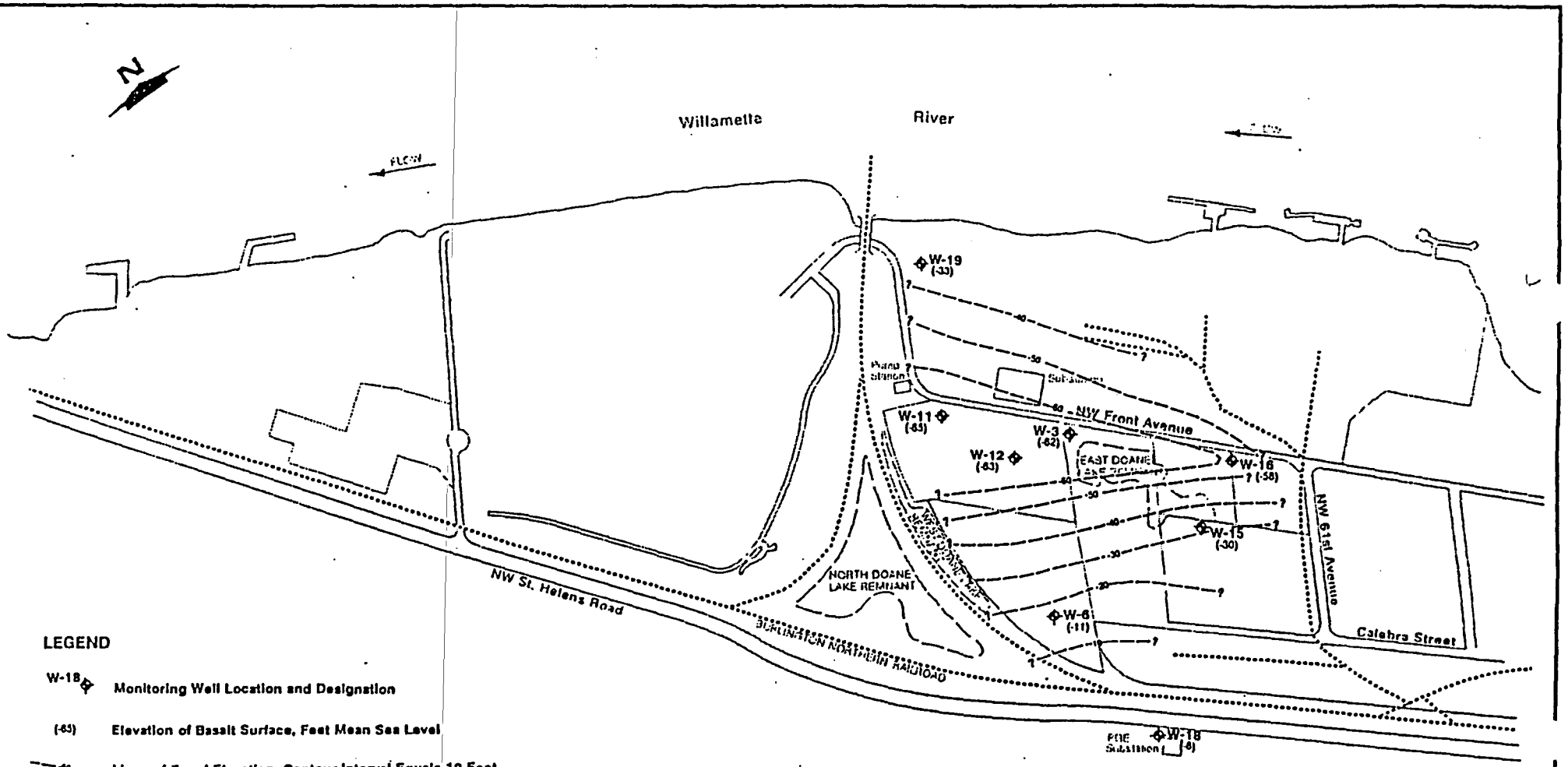
ISOPACH MAP OF FILL

Doane Lake Area
Portland, Oregon

DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA103.01

FIGURE 3-11

NWT 003441

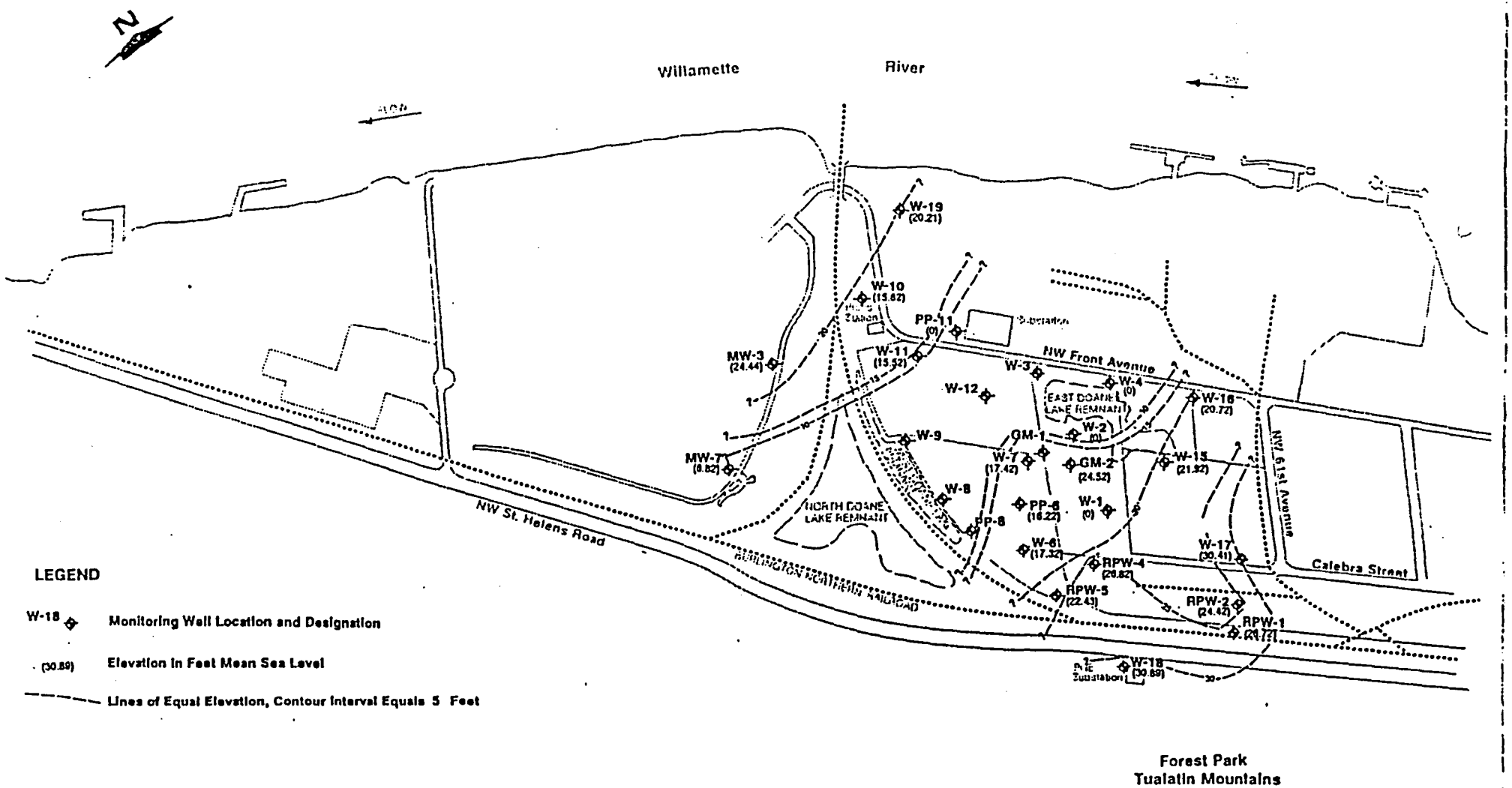


GERAGHTY & MILLER, INC.

BASALT SURFACE CONTOUR MAP

Doane Lake Area

FIGURE 3-17



GERAGHTY & MILLER, INC.
Environmental Services

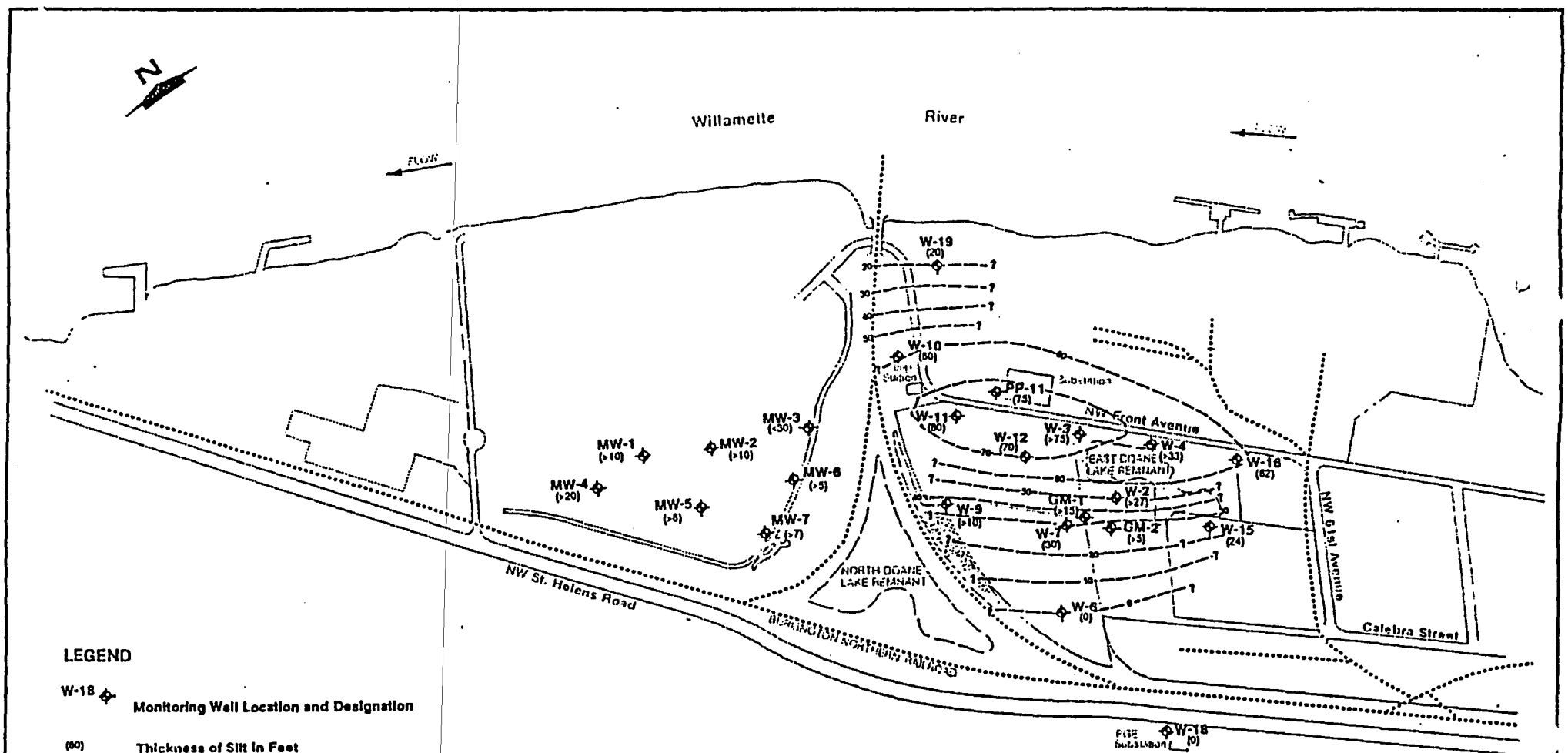
ELEVATION OF TOP OF SAND UNIT

Doane Lake Area
Portland, Oregon

DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA10301

FIGURE 3-14

NWT 003443



LEGEND

W-18 — Monitoring Well Location and Designation

(80) — Thickness of Silt in Feet

— Lines of Equal Thickness, Contour Interval Equals 10 Feet

0 500 1000

Approximate Scale in Feet

GERAGHTY & MILLER, INC.

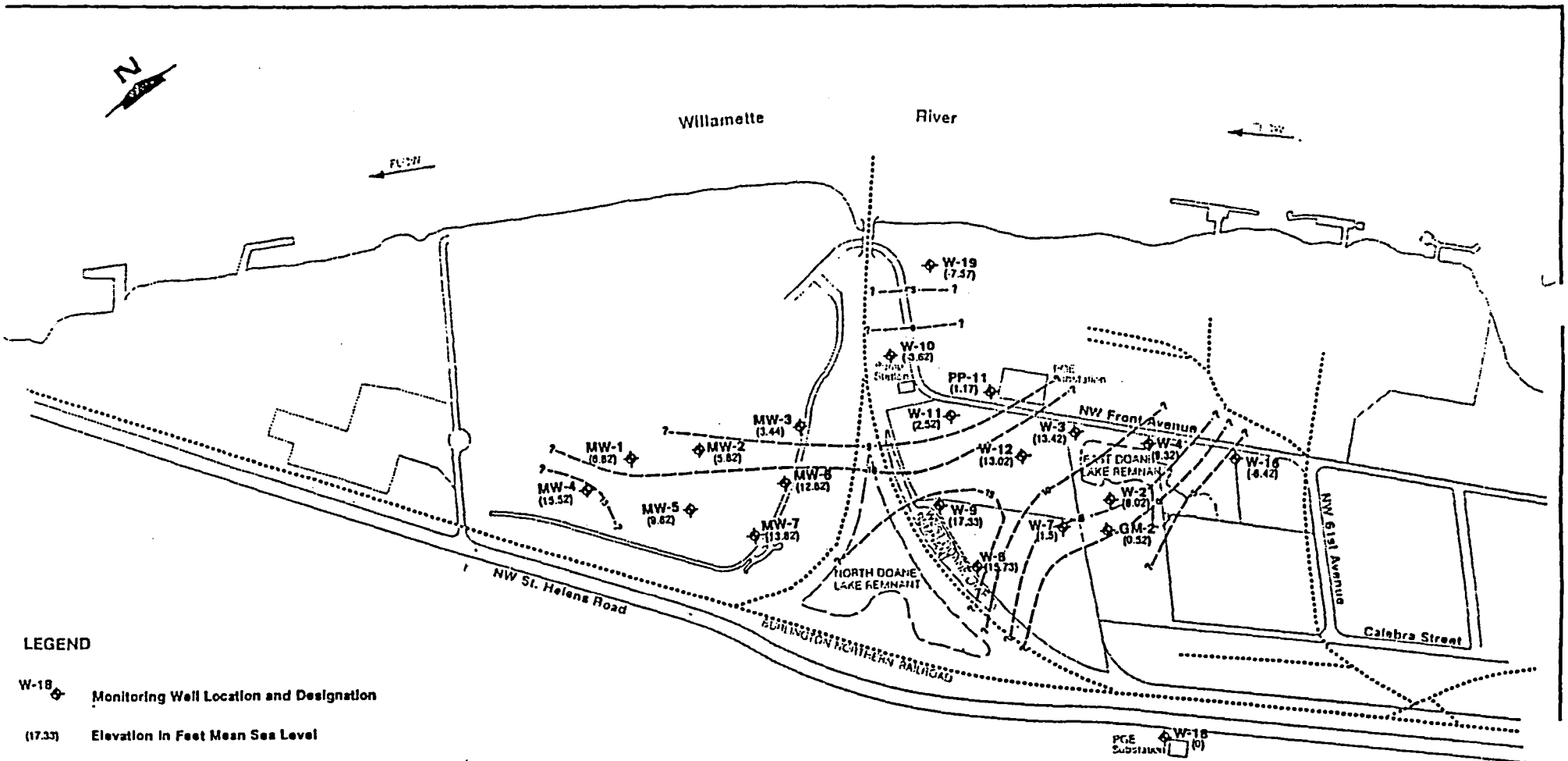
ISOPACH MAP OF SILT UNIT

Doane Lake Area
Portland, Oregon

DRAWN BY | COMPILED BY | DATE | PROJECT WA1037.01

FIGURE 3-15

NWT 003444



LEGEND

W-18 ◇ Monitoring Well Location and Designation

(17.33) Elevation in Feet Mean Sea Level

——— Lines of Equal Elevation, Contour Interval Equals 5 Feet

Forest Park
Tualatin Mountains

0 500 1000
Approximate Scale in Feet

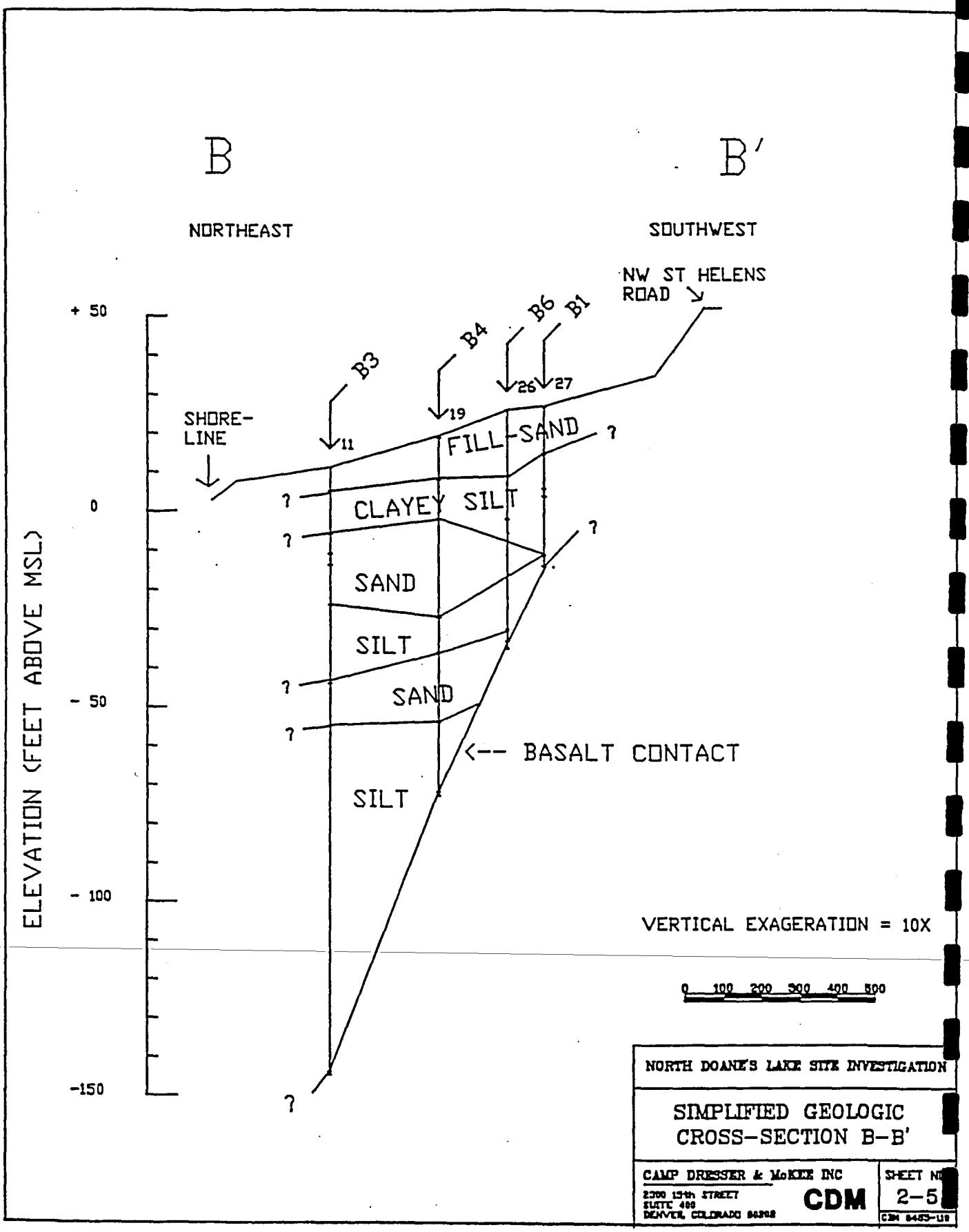
GERAGHTY & MILLER, INC.
Environmental Services

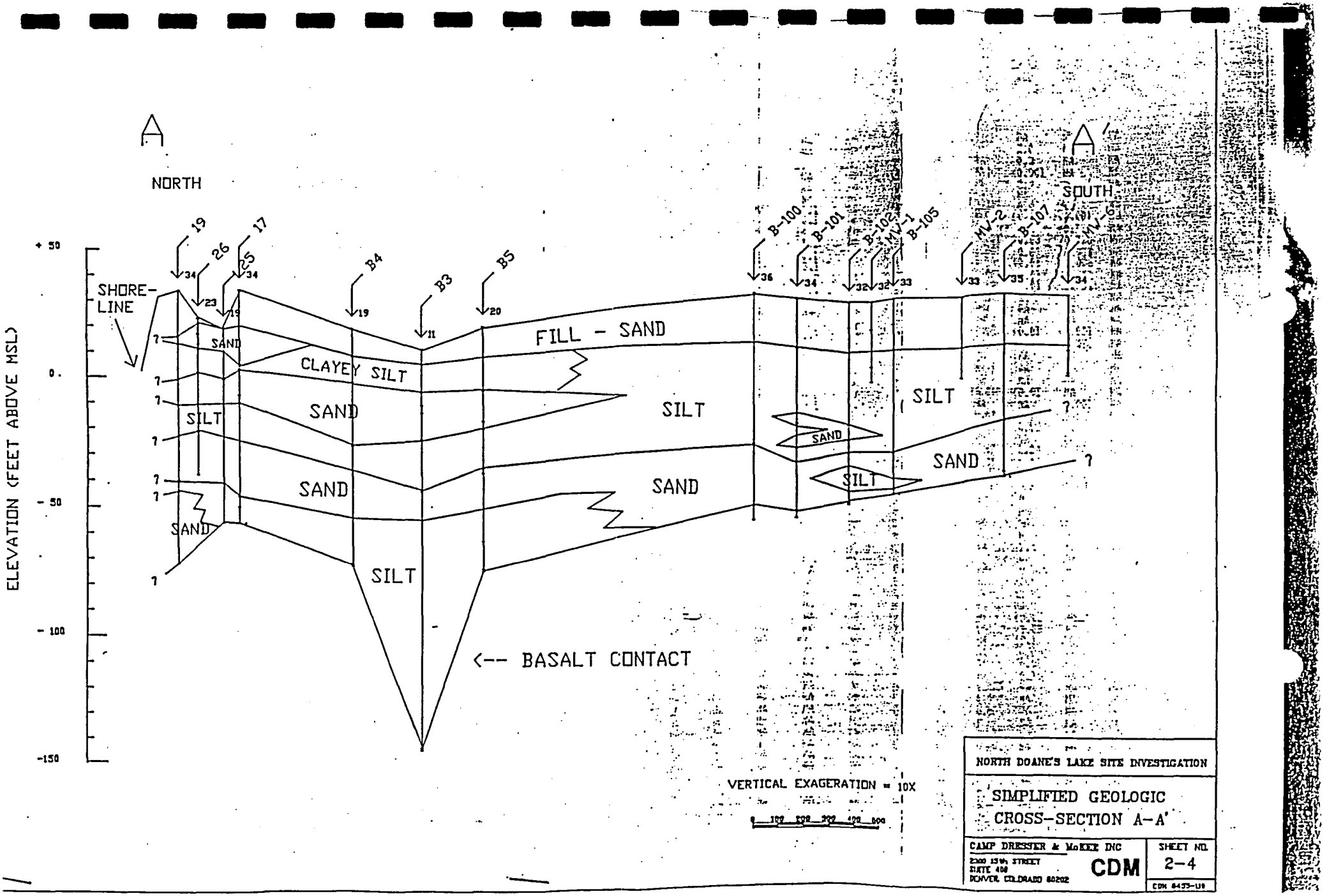
ELEVATION OF TOP OF SILT UNIT
Doane Lake Area
Portland, Oregon

DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA103.01

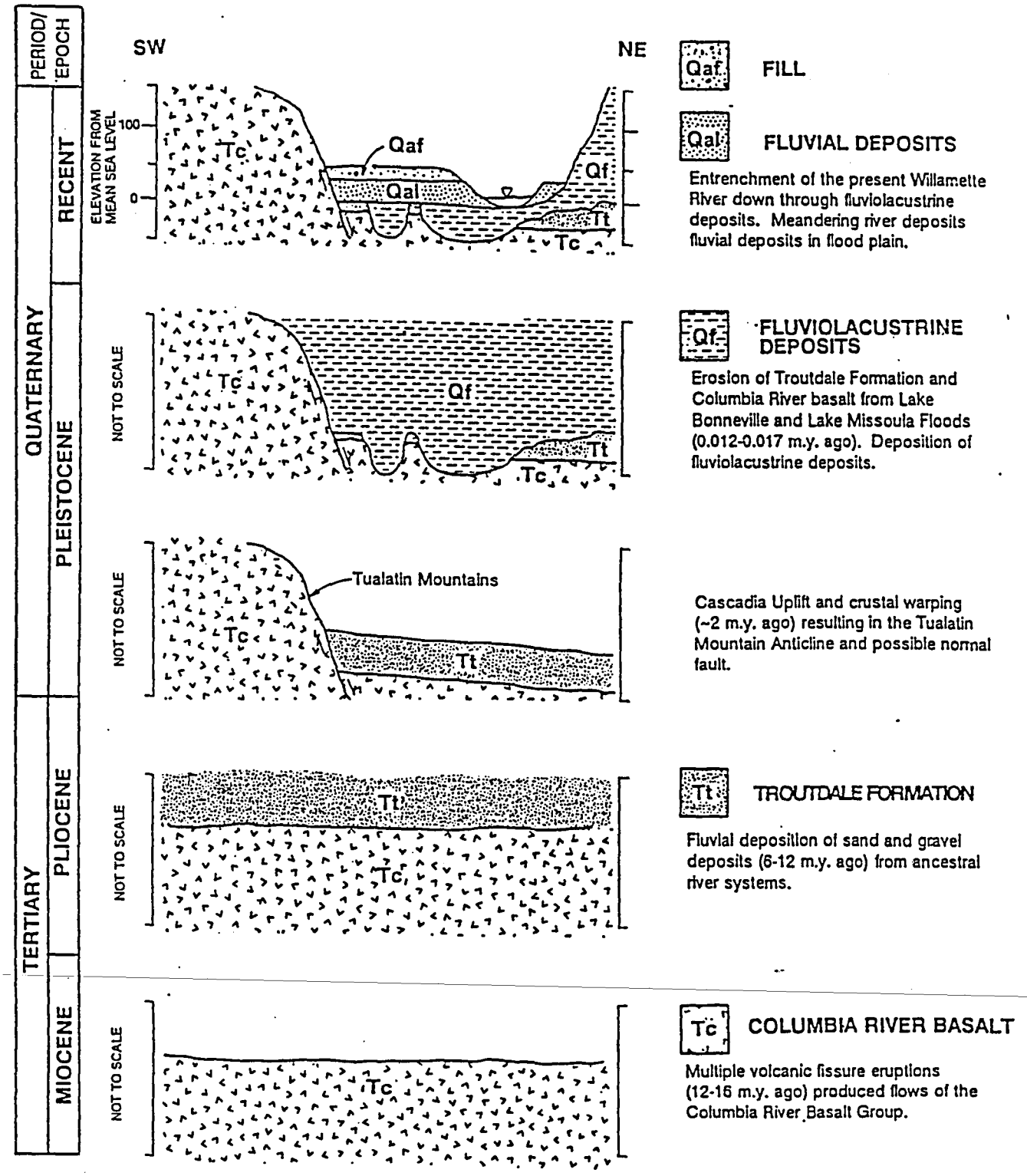
FIGURE 3-16

NWT 003445


B
B'
NORTHEAST
SOUTHWEST
NW ST HELENS ROAD
B3
B4
B6
B1
11
19
26
27
SHORE-LINE
FILL-SAND
CLAYEY SILT
SAND
SILT
SAND
SILT
<-- BASALT CONTACT
?
+ 50
0
- 50
- 100
-150
ELEVATION (FEET ABOVE MSL)
VERTICAL EXAGERATION = 10X
0 100 200 300 400 500
NORTH DOANE'S LAKE SITE INVESTIGATION
SIMPLIFIED GEOLOGIC CROSS-SECTION B-B'
CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 400
DENVER, COLORADO 80202
CDM
SHEET NO
2-5


A
NORTH
A'
SOUTH
ELEVATION (FEET ABOVE MSL)
+ 50
0
- 50
- 100
-150
SHORE-
LINE
19
26
17
25
B4
B3
B5
B-100
B-101
B-102
MW-1
B-105
MW-2
B-107
MW-6
34
23
19
34
19
11
20
36
34
32
32
33
33
35
34
FILL - SAND
CLAYEY SILT
SAND
SILT
SAND
SILT
SAND
SILT
SAND
SILT
SAND
SILT
SAND
?
<-- BASALT CONTACT
VERTICAL EXAGERATION = 10X
NORTH DOANE'S LAKE SITE INVESTIGATION
SIMPLIFIED GEOLOGIC
CROSS-SECTION A-A'
CAMP DRESSER & McKEE INC
2300 15th STREET
SUITE 450
DENVER COLORADO 80202
CDM
SHEET NO.
2-4

NWT 003447



Horizontal Scale: No Scale

GERAGHTY & MILLER, INC.
Environmental Services

GENERALIZED GEOLOGIC HISTORY

Doane Lake Area
Portland, Oregon

FIGURE 3-16

DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA08301

APPENDIX C

Northwest Natural Gas Company Office Correspondence
Dated December 8, 1994

NWT 003449

NORTHWEST NATURAL GAS COMPANY
OFFICE CORRESPONDENCE

Date: December 8, 1994

To: Memo to Gasco File

From: S.K. Hart

Subject: **City of Portland - Water Policy - Water Sources**

Re: Telephone Conversation with Jeff Golden, Assistant to Commissioner Mike Lindberg, concerning the city of Portland plans for future water supply sources

I asked Mr. Golden what the city of Portland is planning for future water supplies.

Mr. Golden stated that the city is in phase two of their studies. Phase one listed potential water supply sources. Phase two has limited their preferred options to:

- Third Bull Run Reservoir
- River Water
- Aquifer Storage and Recovery

New groundwater wells are not being considered.

S.K. Hart

SKH8636/sxj

APPENDIX D
Example Boring Log and Monitoring Well Log

NWT 003451

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**		
PROJECT:	HAI LOGGER:	DRILL START	DRILL FINISH
	SAMPLING METHOD:		
	DRILLING METHOD:	Time:	Time:
	EQUIPMENT TYPE		
	DRILLER:	Date:	Date:
PROJECT #:	DRILLING CONTRACTOR:		

ABANDONMENT DETAILS	SAMPLE NUMBER	TIME	HEADSPACE (ppm)	LAB RESULTS TPH (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	BORING DIAMETER: CASING DIAMETER: SURFACE ELEVATION: TOP OF CASING ELEVATION: SOIL DESCRIPTION
							1			
							2			
							3			
							4			
							5			
							6			
							7			
							8			
							9			
							10			
							11			
							12			
							13			
							14			
							15			
							16			
							17			
							18			
							19			
							20			

NWT 003452

HAHN & ASSOCIATES, INC 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**		
PROJECT:	HAI LOGGER:	DRILL START	DRILL FINISH
	SAMPLING METHOD:		
	DRILLING METHOD:	Time:	Time:
	EQUIPMENT TYPE		
	DRILLER:	Date:	Date:
PROJECT #:	DRILLING CONTRACTOR:		

ABANDONMENT DETAILS	SAMPLE NUMBER	TIME	HEADSPACE (ppm)	LAB RESULTS TPH (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	BORING DIAMETER: CASING DIAMETER: SURFACE ELEVATION: TOP OF CASING ELEVATION: SOIL DESCRIPTION
							21			
							22			
							23			
							24			
							25			
							26			
							27			
							28			
							29			
							30			
							31			
							32			
							33			
							34			
							35			
							36			
							37			
							38			
							39			
							40			

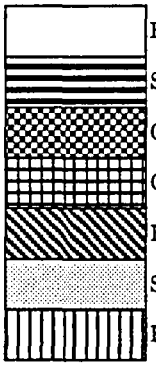
NWT 003453

KEY TO BORING LOGS

Soil classification in this report is based upon visual and manual field observations which include moisture, consistency, plasticity and grading estimates and should not be construed to imply field or laboratory testing unless presented herein. Soils are classified in accordance with the Unified Soil Classification System. Stratigraphic boundaries are approximate representations only. No warranty is provided as to the continuity of soil strata between borings.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)					
MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COURSE GRAINED SOILS More Than Half is Larger Than #200 Sieve	GRAVELS More Than Half the Course Fraction is Larger Than No. 4 Sieve Size	Clean Gravels With Little or No Fines	GW		Well Graded Gravels, Gravel-Sand Mixtures
			GP		Poorly Graded Gravels, Gravel-Sand Mixtures
		Gravels With Over 12% Fines	GM		Silty Gravels, Poorly Graded Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Poorly Graded Gravel-Sand-Clay Mixtures
	SANDS More Than Half the Course Fraction is Smaller Than No. 4 Sieve Size	Clean Sands With Little or No Fines	SW		Well Graded Sands, Gravelly Sands
			SP		Poorly Graded Sands, Gravelly Sands
		Sands With Over 12% Fines	SM		Silty Sands, Poorly Graded Sand-Silt Mixtures
			SC		Clayey Sands, Poorly Graded Sand-Clay Mixtures
FINE GRAINED SOILS More Than Half is Smaller Than #200 Sieve	SILTS AND CLAYS Liquid Limit Less Than 50%		ML		Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands, or Clayey Silts with Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL		Organic Clays and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit Greater Than 50%		MH		Inorganic Silts, Micaceous or Diatomacious Fine Sandy or Silty Soils, Elastic Silts
			CH		Inorganic Clays of High Plasticity, Fat Clays
			OH		Organic Clays of Medium to High Plasticity, Organic Silts
HIGHLY ORGANIC SOILS			Pt		Peat and Other Highly Organic Soils

LEGEND FOR BORING LOGS



- Blank Casing
- Slotted Screen
- Cement Grout
- Concrete
- Bentonite
- Sand Pack
- Fill Material

ABBREVIATIONS

NA	Not Applicable
ND	Not Detected Above Detection Limit
NS	Not Sampled
PCBs	Polychlorinated Biphenyls
ppm	Parts Per Million
SPT	Standard Penetration Test
▽	Measured Static Water Level in Well
▼	Estimated Water Level During Drilling

Updated: 1/15/95
File: Boring Log Key

HAHN AND ASSOCIATES, INC.
Project #2708

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** MW - 1 **OWRD# 70144**			
PROJECT:	HAI LOGGER:	Roger Brown	DRILL START	DRILL FINISH
	SAMPLING METHOD:	3-inch OD Split Spoon		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	Time:	Time:
	EQUIPMENT TYPE	Mobile Model B-59	555	918
	DRILLER:	Bob Roberts	Date:	Date:
PROJECT:	DRILLING CONTRACTOR:	Geo-Tech Explorations	3-Aug-94	3-Aug-94

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	1256.8 Feet MSL
TOP OF CASING ELEVATION:	1259.41 Feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	Lab Results PCBs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Steel Monument							-3			
							-2			
							-1			Ground surface
Concrete	M1-01	610	6.1	0.17	37	100			SP	Dry paint residue and container debris at surface. 3-inches of loose sand fill below paint.
					50/6"	70	1			
	M1-02	616	6.9	3.8	32	80				
					50/6"	0	2			
Bentonite	M1-03	624	10.1	ND	50/2"	100				Silty Sandy GRAVEL with Clay - reddish-brown, dry, very dense, well graded, non-cemented, rounded pebbles and cobbles, matrix is stiff and slightly plastic.
							3			
	NS	630	-	-	30	0				
					50/2"	0	4		GM	No recovery, rock in sampler.
	M1-04	635	-	0.056	50/5"	50				
							5			
					21	100				Silty Sandy GRAVEL with Clay - as above, brown, moist
	M1-05	645	12.8	0.069	40	100	6			
					31	0				
							7			
										Silty Sandy GRAVEL with Clay - as above.
	M1-06	700	-	ND	50/6"	50	8			
							9	8/9/94		
							10			
	M1-07	710	18	ND	18	100			GM	Silty Sandy GRAVEL - as above, wet, matrix is loose and non-plastic
					50/6"	50	11			
							12			
	NS	720	-	-	50/2"	0	13			No recovery
							14	8/3/94		
							15			

2-inch ID Blank PVC Casing

2-inch ID 0.010-inch PVC Slotted Screen

Colorado 20-40 Sand Pack

NWT 003455

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**MONITORING WELL NUMBER** **MW - 1** **OWRD# 70144**			
PROJECT:	HAI LOGGER:	Roger Brown	DRILL START	DRILL FINISH
	SAMPLING METHOD:	3-inch OD Split Spoon		
	DRILLING METHOD:	6 1/4-inch ID Hollow Stem Auger	Time:	Time:
	EQUIPMENT TYPE	Mobile Model B-59	555	918
	DRILLER:	Bob Roberts	Date:	Date:
PROJECT:	DRILLING CONTRACTOR:	Geo-Tech Explorations	3-Aug-94	3-Aug-94

BORING DIAMETER:	10-inch
CASING DIAMETER:	2-inch ID
SURFACE ELEVATION:	1256.8 Feet MSL
TOP OF CASING ELEVATION:	1259.41 Feet MSL

WELL CONSTRUCTION DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	Lab Results PCBs (ppm)	SPT (blows/0.5 feet)	RECOVERY (%)	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
10-Slot Screen / Colorado 20-40 Sand Pack	M1-08	730	10	ND	50/2"	75	16		GM	Silty Sandy GRAVEL - as above
							17			
	M1-09	740	24	ND	20	100	18			
					50/5"	50	19			
Cap							20			Silty Sandy GRAVEL - as above
	M1-10	748	18.9	ND	50/6'	100	21			
							22			
							23			
							24			
							25			Boring terminated at 20.0 feet bgs Sampled to 20.5 feet Monitoring Well installed to 20.0 feet bgs
							26			Materials: 15 feet 2-inch diameter, 0.010-inch PVC slotted screen 10 feet 2-inch diameter PVC blank casing 10 50# bags 20/40 sand 2 50# bags bentonite chips 1 end cap 1 locking cap above-grade steel monument 3 guard posts
							27			
							28			
							29			Well depth is 22.4 feet below top of casing
							30			
							31			
							32			
							33			* Sample Prefix Number is 2626-940803-
							34			
							35			

NWT 003456

APPENDIX E

Example Chain-of-Custody Form

HAHN AND ASSOCIATES, INC.

Environmental Management

434 NW Sixth Avenue, Suite 203 • Portland OR 97209

(503) 796-0717 • Fax (503) 227-2209

Laboratory National Environmental Testing, Inc.

17400 SW U. Boones Ferry Rd., Portland OR

Lab Project No.

CHAIN OF CUSTODY

Chain of Custody No. 2708-001

Project Manager: Roger Brown
Project No.: 2708
Project Name: NWNG Gasco Site
Collected by:

Liquid with Sediment Sample

Test Filtrate ____ Test Sediment ____ Test Both ____

Multi-Phase Sample

Test One (which) ____ Test Separately ____ Shake ____

Samples Received at 4C (Y or N):
Appropriate Containers Used (Y or N):
Provide Verbal Results (Y or N): No
Provide Preliminary Fax Results: Yes

Comments

NOTE:

Sample Number Prefix: 2708-950322-

Lab ID	Sample #	Date	Time	Sample Description	Matrix: Soil	Matrix: Water	Matrix: Other	Number of Containers	TPH (ODEQ TPH-HCID)	TPH (Quantify as necessary)	PAHs - (EPA 8270 SIM)	BTEX (EPA 8020)	Phenols, Cresols (EPA 8270)	Total Lead (EPA 6010)	TCLP Lead (EPA 1311, 6010)	Cyanide (EPA 9010)		RUSH	Remarks

Relinquished by	Company	Date	Time	Received by	Company
Relinquished by	Company	Date	Time	Received by	Company

NWT 003458

HAHN AND ASSOCIATES INC.

CUSTODY SEAL

Date/Time

Sample Number

Signature

Location

(5/93)

APPENDIX F

Example Project Field Notes Form

NWT 003460

HAHN AND ASSOCIATES, INC.
PROJECT FIELD NOTES

Date : _____
Project: _____
Project Manager: _____

WORK FORCE	EQUIPMENT	SITE
HAI	Rental/Vendor	Conditions
Subcontractor	Rental/Vendor	Temperature
Subcontractor		

HAI EQUIPMENT

Air Pump (Sensidyne)	Gas Meter (GasTech)	Measuring Wheel	Pump, Peristaltic	Water Level Meter
Bailer (SS or Teflon)	Hand Auger	OVA (MicroTip/PID)	Pump, Submersible	Zone Sampler
Cond/pH/Temp Meter	Interface Probe	Power Tool	Purge Pump	
Data Logger (Hermit)	Magnetometer	Pressure Transducer	Wtr Filtration Unit	

HAI SUPPLIES

Bailer (disposable)	Drum Liners	Profile Shipping Kit	Sorbent Boom	
Bentonite (bags)	Gloves, disposable (pr.)	Resp. Cartridges (pr.)	Sorbent Pads	
Booties (pr.)	Gloves, Edmont (pr.)	Sample Tubes	Stakes	
Chlor D Tect Kit	Gloves, Solvex (pr.)	Sensidyne Tubes	Tyvek, coated	
Concrete (bags)	Labels	Siphon Pump	Tyvek, uncoated	
Distilled Water (gal)	Locks	Sorbent (bags)	Water Filters	

ACTIVITIES

Leave Office:	Arrive Site:	Leave Site:	Arrive Office:	
Respirator Use/ Hours:___ Minutes:___		Odometer Out:	Odometer In:	Total Mileage:

Time	Task Description

(3/94)

Signed _____

HAHN AND ASSOCIATES, INC.
PROJECT FIELD NOTES

Page ___ of ___
Date : _____
Project: _____
Project Manager: _____

CONTINUATION SHEET

Time	Task Description

(5/92)

Signed _____

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

NW-S-6

May 17, 1988

REPLY TO ATTN OF: HW-113

Suzanne M. Burtt
Koppers Company, Inc.
Legal Services
436 Seventh Avenue
Pittsburgh, Pennsylvania 15219

Re: Freedom of Information Act (FOIA) Request Number 10-RIN-370-88

Dear Ms. Burtt:

This letter is in response to your April 27, 1988, request. Enclosed are copies of all supporting documentation used by the U. S. Environmental Protection Agency's (EPA) contractor, Ecology and Environment, Inc. (E&E), to compile the Preliminary Assessment of Koppers Northwest Terminal site in Portland, Oregon.

The information requested in the second part of your request is being withheld. The document being withheld is a final report on a potentially responsible party search conducted in connection with the Gould Superfund site in 1986. This document is considered enforcement confidential and is exempt from mandatory disclosure under 5 U.S.C. Section 552(b)(7).

You may appeal this partial denial by submitting a written appeal to the Freedom of Information Officer (A-101), U. S. EPA, 401 M Street, S.W., Washington, D.C., 20460, within 30 days of receipt of this partial denial. Your appeal should refer to the RIN number listed above, the date of this determination, my name, title, and address.

The cost of providing this information is $44.85 (299 pages duplicated at 15¢ per page). You will notice that a few of the enclosed copies are not legible. That is the best copy that could be made from the file copies. You have not been charged for such copies. Your fee payment should be in the form of a check or money order payable to the U.S. Environmental Protection Agency (EPA) and should be sent to EPA, Region 10, P.O. Box 360903M, Pittsburgh, Pennsylvania 15251. This concludes the EPA Region 10 response to FOIA request number 10-RIN-370-88.

Sincerely,

for Robie G. Russell
Regional Administrator

Enclosures

April 15, 1975

Koppers Company, Inc.
7540 N. W. St. Helens Road
Portland, Oregon 97229

Attention: Mr. Paul Guth

Re: AQ - Koppers Company, Inc.
Multnomah County

Gentlemen:

Your application for an Air Contaminant Discharge Permit received on March 26, 1975, has been assigned application number 372 and has been accepted for filing by the Department on March 26, 1975. If the Department has not requested additional information within 15 days of the filing date, your application shall be considered complete for processing on April 10, 1975.

If final action to grant or deny you a permit has not been completed within 45 days of the date your application is considered complete for processing, you shall be deemed to have received a Temporary Air Contaminant Discharge Permit, such permit to expire when final action is taken to grant or deny you a permit. Such temporary or conditional permit does not authorize any construction, activity, operation or discharge which will violate any of the laws, rules or regulations of the State of Oregon or the Department of Environmental Quality.

NWT 003464

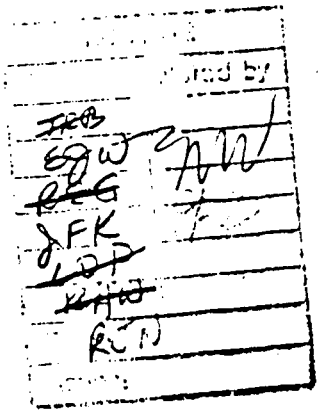
A Temporary Permit allows discharge of air contaminants from your petroleum batch distillation facility provided all processes discharging air contaminants and all air contaminant(s) collection and disposal facilities are operated and maintained at all times at maximum efficiency and in a manner which will minimize air contaminant discharge.

Sincerely,

KESSLER R. CANNON
Director

Robert E. Gilbert
Administrator
Portland Region

TRB/kz
cc Air Quality Division, DEQ



ROBERT W. STRAUB

February 5, 1975

Kessler R. Cannon

Koppers
Organic Materials Division
Koppers Company, Inc.
Pittsburgh, Pennsylvania 15219

Attention: Mr. Jon M. Anderson,
Coordinator, Environmental Control

Re: AQ - Koppers
Multnomah County

Gentlemen:

This is to confirm the meeting of January 29, 1975, at which Mr. Thomas Bispham and Mr. Larry Patterson of the Department of Environmental Quality and Mr. Jon Anderson, Mr. Robert Shannon and Mr. Paul Guth of Koppers discussed the Company's proposed program for the future operation of the Portland plant located at 7540 N. W. St. Helens Road.

Based upon the information submitted, it is the Department's understanding that Koppers would like to proceed on the following operation schedule:

1. On January 30, 1975, Koppers will complete the processing of 1,000 tons of coal tar - petroleum base pitch which was previously approved as an experimental run for customer evaluation. Five thousand tons of coal tar is available for future processing if the customer so requests after an evaluation period of February 1, 1975, to June 1, 1975.

2. During the period April 1, 1975, to June 1, 1975, Koppers desires to produce samples of straight petroleum base pitch for customer evaluation.

NWT 003466

3. June 1, 1975, to November 1, 1975, process 5,000 tons of coal tar - petroleum base pitch (if requested by the customer). Also run further petroleum base pitch tests.

4. November 1, 1975, obtain approval of capital expenditure to build new petroleum pitch facility.

5. December 1, 1975, to October 1, 1976, procure equipment (including odor control equipment), install and start-up new facility. Conduct further periodic tests.

According to the Koppers representatives, the length of this program is based upon the development of a market for the new petroleum base pitch.

Mr. Bispham's immediate response to the proposed program was that any future operation of this plant can only be initiated after receiving an Air Contaminant Discharge Permit, which incorporates a compliance program to control odor emission points.

Following the above cited meeting, the Department's staff reviewed the proposed program. Concern was expressed about the lengthy two year period requested to complete the odor control installation; particularly since this proposal is based upon economic factors. Extensions or compliance programs requested on the basis of economics, such as presented by Koppers, can only be treated as a variance, which is a function of the Environmental Quality Commission rather than the Department's staff. However, as discussed with Mr. Shannon in a subsequent telephone conversation, we believe a more reasonable approach and one which the Department's staff believes could be treated under the permit regulation and supported by the staff, is available. Basically, the Department would support a proposal which allowed for the submission of engineering for the odor control equipment at the earliest possible date in 1975, with installation based upon the vendors delivery time. This program would provide for interim controls on existing equipment, which will be used in conjunction with the new facility, and have the control equipment prepared for hook-up to the new processes upon their installation. This program could be handled at a staff level and incorporated into the compliance section of the required Air Contaminant Discharge Permit.

NWT 003467

In conclusion, we are enclosing the necessary Air Contaminant Discharge Permit application. With the submittal of the applications, we are requesting that you advise the Department whether the Company wishes to request a variance or incorporate a compliance schedule into the permit. We have enclosed a copy of the variance regulations should you wish to initiate this request with your application submittal. Should you desire to utilize the permit compliance procedure, we would be agreeable to reviewing a new proposal submitted with the application or meeting with you again to negotiate a new schedule.

If you have any questions or if we can be of any further assistance, please feel free to contact Mr. Thomas Bispham of this office at 238-8471.

Sincerely,

KESSLER R. CANNON
Director

Robert E. Gilbert
District Manager
Northwest Region

TRB/jms

Enclosures

cc: Air Quality Division - DEQ
Koppers
attn: Mr. Paul Gutz

NWT 003468

NORTHWEST TANK FARM

RAINWATER COLLECTION AND TREATMENT

JANUARY 23, 1975

RAINWATER COLLECTION AND TREATMENT PROCESS DESCRIPTION

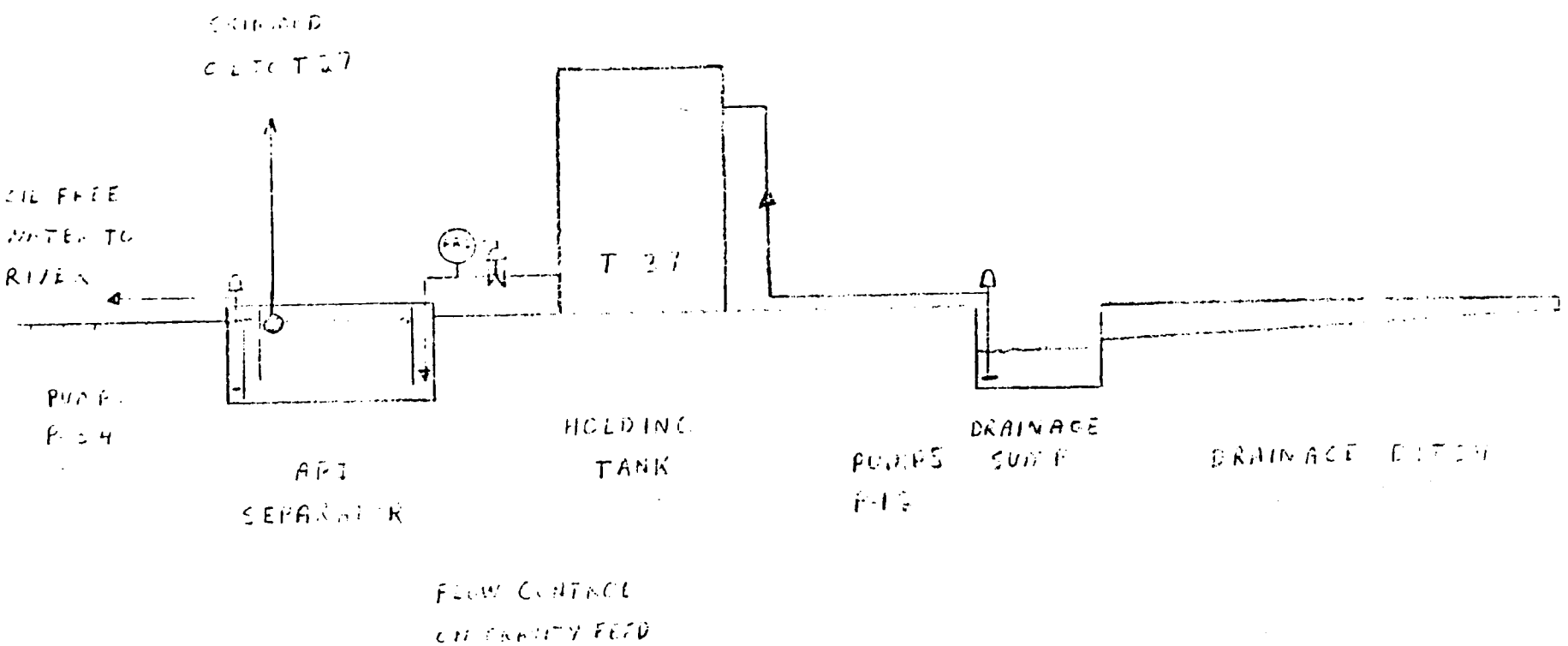
The tank farm will be paved to facilitate the collection and treatment of rainwater, and to prevent flooding by ground seepage when the water table rises.

The floor of the tank farm will slope from the center of the farm to a drainage ditch on each side. Rainwater will run off the floor of the tank farm, into the ditches, and then into a drainage sump.

Two float actuated, alternating sump pumps will transfer water from the drainage sump to the holding tank. In case the water level in the drainage sump triggers the high level alarm, both pumps would be activated.

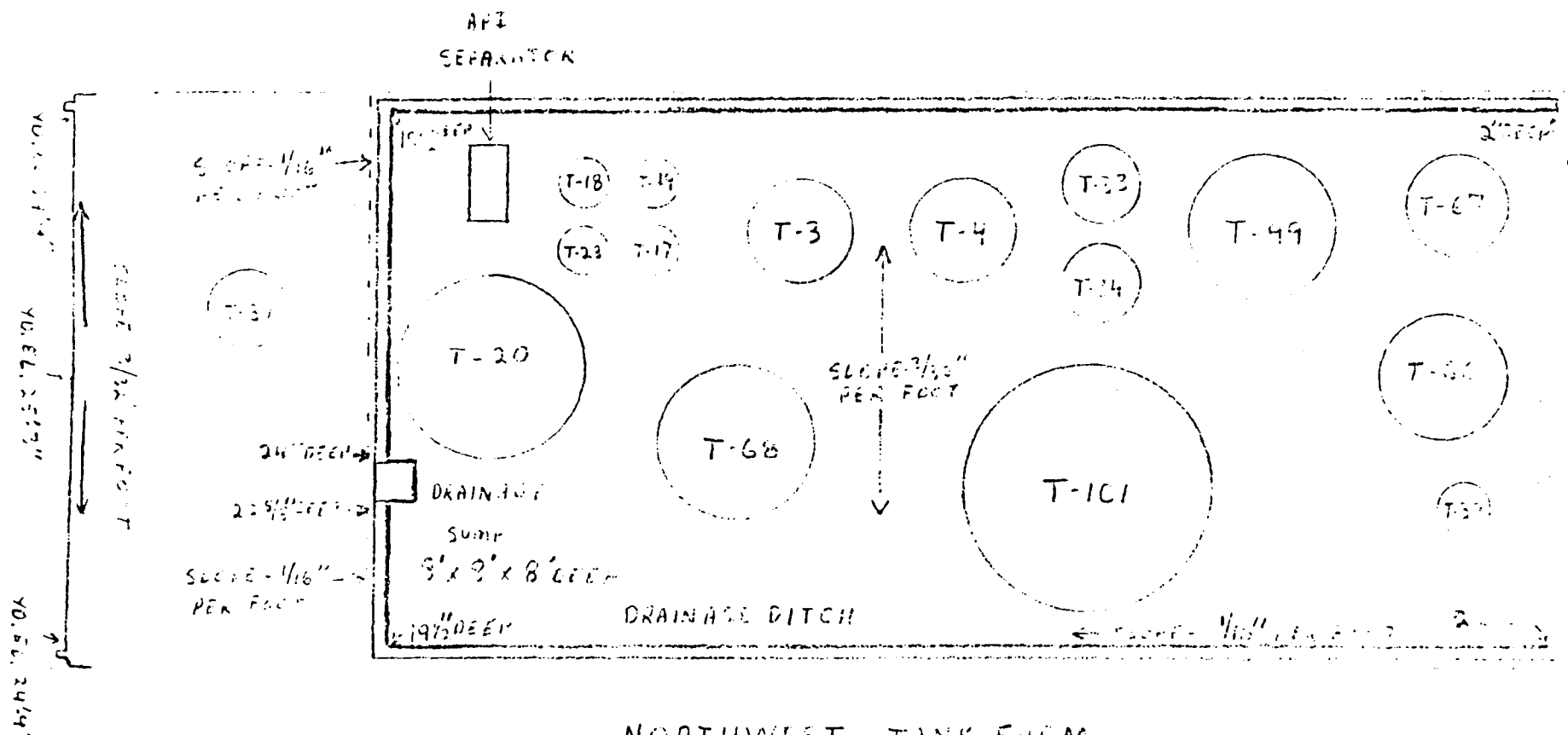
Water in the holding tank will drain into the API separator through a flow-recorder-controller. Any oil present will be skimmed off the surface of the separator and collected in tank T-23 for further processing. Clean water will be pumped out of the separator and into a storm water ditch leading to the river by two float activated, alternating sump pumps.

L. Bily
1-24-75



BY ..... DATE .....
CHKD. BY ..... DATE .....
SUBJECT .....
SHEET NO ..... OF .....
JOB NO. .....

NWT 003471



NORTHWEST TANK FARM
PAVING

BY ---- DATE ----
CHKD. BY ---- DATE ----
SUBJECT ----
SHEET NO ---- OF ----
JOB NO ----

NWT 003472

DEQ NORTHWEST REGION (Wed night (COMPLAINT FORM

SOURCE: DISTINCT sulfur or sulfide odor

COUNTY: _____ ADDRESS: ST Johns Bridge

(AIR QUALITY) WATER QUALITY SOLID WASTE SUBSURFACE SEWAGE NOISE

NATURE OF COMPLAINT: At 5:00 pm PJZ & I noted a strong sulfide oder on the ST. Johns Bridge

COMPLAINANT: TRB PHONE: _____

ADDRESS: _____

ACTION TAKEN: Called Koppers They were operating Wed PM

REFERRED TO: _____

INVESTIGATED BY: _____ DATE: 1-22-75

TAKEN BY: _____ DATE: _____

To	Noted by
[redacted]	
[redacted]	
[redacted]	
From:	
Action:	

December 21, 1974

Koppers Company, Inc.
Organic Materials Division
Pittsburg, Pennsylvania 15219

Attention: Mr. R. L. Shannon,
Engineering Department

Re: AQ - Koppers Company, Inc.
Multnomah County

Gentlemen:

This is to acknowledge receipt of your letter dated December 11, 1974, in which you requested permission to produce an experimental batch of electrode pitch at the Koppers plant located at 7540 N. W. St. Helens Road, Portland, Oregon.

Based upon the information submitted, it is our understanding that this experimental run will result in the production of 1,000 tons of electrode pitch which is a combination of both coal tar and petroleum residuals. The run is to take four to six weeks to complete.

In light of the fact that this is an experimental run and that any future operations will only be initiated after the Company receives the mandatory approval and permit from this Department, your request is granted subject to the following conditions:

1. Processing will be terminated upon completion of the 1,000 ton production run.

NWT 003474

2. Production will be terminated upon notification from the Department that emissions are resulting in public complaints or that during adverse meteorological conditions, the plant's emissions are contributing to a condition of air pollution.

3. In order to conduct an odor evaluation, Company management will permit plant access to Department personnel upon request.

If you have any questions or if we can be of any further assistance, please feel free to contact Mr. Thomas Bispham of this office at 238-8471.

Sincerely,

KESSLER R. CANNON
Director

Robert E. Gilbert
District Manager
Northwest Region

TRB/jms

cc: Air Quality Division - DEQ

NWT 003475

State of Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE MEMO

To: ~~REGilbert~~, RHWixom

Date: December 16, 1974

From: TRBispham

Subject: AQ - Koppers - Multnomah County

On December 11, 1974, Mr. Bob Shannon of Koppers Corporate offices called to report that the company had initiated an experimental run of material. Mr. Shannon expressed his regrets and apologies that the plant had not informed us of this run and he wanted to take any necessary action to correct this problem. He further explained that the run was one in which they would not be using the cake pans, but would be shipping out in a liquid form a petroleum base product which also included some of the off-spec coal tar materials. It is expected that this run of approximately 5,000 tons would take one month to six weeks. After that, future operation is indeterminant. Mr. Shannon wanted to know what action the company would have to take in order to complete this experimental run, or would they have to terminate the project. I advised him that we had not as yet received any complaints and that I believe we could accommodate allowing this experimental run, conditional on several factors. Specifically, an agreement to terminate the operation if adverse meteorological or malodors persist and that we be notified prior to any runs. Also, you would have to make this request in writing and adivse us of the materials processed, the length of the job and any future operations.

Mr. Shannon said he would immediately call the plant and advise them to extend full cooperation to our field staff, who will want to evaluate this processing.

It will be necessary for RHWixom and possibly another inspector to conduct a number of scentometer readings while this process is being conducted in order that we may set future permit limitations if it is the company's desire to process this material in the future.

DEQ-4

NWT 003476

Organic Materials Division, Kopp[redacted] Company, Inc.
Pittsburgh, Pa. 15219, Telephone [redacted]-391-3300

Air Mail
Return Receipt Requested

KOPPERS

December 11, 1974

Mr. Thomas R. Bispham
Assistant Portland District Manager
Department of Environmental Quality
1010 N.E. Couch Street
Portland, Oregon 97232

Dear Mr. Bispham:

This is to inform you that Koppers Company, Inc. wishes to resume operations temporarily at 7540 N.W. Street and St. Helens Road to produce an experimental batch of 1,000 tons of electrode pitch in existing equipment for a trial plant run at a customer's plant. The plant will need to run five days a week for four to six weeks to produce this material. It is a new product which is a combination of both coal and petroleum residuals. This will be sold in the liquid state and will not pass through the chilling pans. The electrode pitch will be produced into the existing elevated pitch cooler and loaded into trucks directly from the cooler. As you know there is a fume system on this tank. We do not anticipate any odor problem from the production of this material and invite your inspection during its production.

We have no production plans following the shipment of this material and most likely will cease operations while it is evaluated by the customer.

Very truly yours,

R. L. Shannon
Engineering Department

RLS:jfc

NWT 003477

DEQ NORTHWEST REGION ((COMPLAINT FORM

SOURCE: _____

COUNTY: _____ ADDRESS: _____

AIR QUALITY WATER QUALITY SOLID WASTE SUBSURFACE SEWAGE NOISE

NATURE OF COMPLAINT: smell of gas awful

COMPLAINANT: _____ PHONE: 286-3570

ADDRESS: _____

ACTION TAKEN: _____

REFERRED TO: _____

INVESTIGATED BY: _____ DATE: _____

TAKEN BY: _____ DATE: _____

State of Oregon

DEPARTMENT OF ENVIRONMENTAL QUALITY INTEROFFICE MEMO

To: File

Date December 20, 1974

From: TRBispham

Subject: AQ - Koppers, Inc. - Multnomah County

On December 19, 1974, at 6:50 p.m., TRBispham and REGilbert noted a very strong odor of H_2S while on the St. Johns Bridge. This is the same odor (only stronger) which has previously been determined to come from Koppers. We were downwind from the plant. Also, at approximately 8:30 p.m. on the same evening, the odors were again noted when passing the plant.

DEQ-16 SP*18645-340

NWT 003479

C[illegible]A-WILLAMETTE AIR POLLUTION A[illegible]ITY
1010 NE Couch Street, Portland, Oregon 97232
Telephone: 233-7176

FIELD OBSERVATION REPORT

Name of Facility Koppers

Address 7540 NW ST Helens Rd

Date [illegible]

[illegible]

By [illegible]

Date [illegible] 930 + 3PM

observed [illegible]

[illegible] OK

By [illegible]

Date 1/9/75 [illegible]

[illegible]

[illegible] OK

By [illegible]

Date 1/10/75

[illegible]

property line OK

By [illegible]

NWT 003480

COLUMBIA-WILLAMETTE AIR POLLUTION AUTHORITY
710 NE Couch Street, Portland, Oregon 97232
Telephone: 233-7176

FIELD OBSERVATION REPORT

Name of Facility [illegible]

Address [illegible]

Date [illegible]

[illegible]

By [illegible]

Date [illegible]

[illegible]

By [illegible]

Date [illegible]

[illegible]

By [illegible]

Date [illegible]

[illegible]

By [illegible]

C[illegible]MBIA-WILLAMETTE AIR POLLUTION [illegible]HORITY
1010 NE Couch Street, Portland, Oregon 97232
Telephone: 233-7176

FIELD OBSERVATION REPORT

Name of Facility Koppers

Address ST Helens Rd

Date 3/11/74

Boiler was smoking - Stoped in [illegible] under the assumption that they [illegible] smoke for [illegible] Explained that it was 3 minutes in one hour

By [illegible] Dixon

Date 12/18/74 3 PM

observed the odor along the N, S + W property lines OK 10 MIN

By RHW

Date 12-20-74 900 AM + 7 PM

observed the odor along the N S + W property lines 10 MIN OK

By [illegible]

Date 12-21-74 930

observed the odor along the N S + W property lines OK 10 MIN

By [illegible]

December 9, 1974

Koppers Company, Inc.
7540 N. W. St. Helens Road
Portland, Oregon 97229

Attention: Mr. Paul Guth,
Plant Superintendent

Re: AQ - Koppers Company, Inc.,
Multnomah County

Gentlemen:

This is to acknowledge your letter of October 30, 1974, in which you reported that plans for future production at the Portland plant have not developed.

At present, it is our understanding that Koppers is currently serving as a creosote distributing plant and no coal tar processing is being conducted. Under the present operation an Air Contaminant Discharge Permit is not required; however, we wish to reemphasize that any future operation entailing chemical processing will require a permit prior to start up.

If you have any questions or if we can be of any further assistance, please feel free to contact Mr. Tom Bispham of this office at 238-8471.

Sincerely,

KESSLER R. CANNON
Director

Robert E. Gilbert
District Manager
Northwest Region

TMB/kz

NWT 003483

Organic Materials Division, Koppers Company, Inc.
Pittsburgh, Pa. 15219, Telephone 4[illegible]91-3300

Certified Mail
Return Receipt Requested

KOPPERS

October 30, 1974

Mr. Thomas R. Bispham
Assistant Portland District Manager
Department of Environmental Quality
1010 N.E. Couch Street
Portland, Oregon 97232

Dear Sir:

On September 24, 1974, you visited the plant to review the status of our pending application for an air contaminant discharge permit. At that time, planned revisions in plant operation were brought to your attention.

Since the date of that meeting, these plans have not developed as quickly as anticipated. The plant has not resumed production, and it is unclear at this time when production will resume.

Prior to beginning any construction of new equipment or significant modification of existing equipment, permit applications will be filed with your office.

Very truly yours,

Paul W. Guth

Paul W. Guth
Plant Superintendent

NWT 003484