FINAL
FOCUSED
REMEDIAL INVESTIGATION
WORK PLAN

Wacker Siltronic Corporation Property
7200 NW Front Avenue
Portland, Oregon

June 1, 2001

Prepared for:

NW Natural
Portland, Oregon

Prepared by:

Hahn and Associates, Inc.
Portland, Oregon

HAI Project No. 5237

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June 1, 2001

1. INTRODUCTION

NW Natural has retained Hahn and Associates, Inc. (HAI) to complete Remedial Investigation (RI) activities at the Wacker Siltronic Corporation (Wacker) property, 7200 NW Front Avenue, Portland, Oregon (Figures 1 and 2). RI activities at the Wacker property are to be completed as per an Order (DEQ No. ECVC-NWR-00-27) issued jointly to both NW Natural and to Wacker by the Oregon Department of Environmental Quality (DEQ), dated October 4, 2000. The sole stated purpose of the order is to provide for the completion of RI activities sufficient in scope to "determine the nature and extent of releases of hazardous substances to Willamette River sediments from certain property in Multnomah County, and to develop and implement source control measures, if necessary."

This RI Work Plan provides the rationale and approach for meeting the purpose of the Order by performing a focused RI at the Wacker site. The Work Plan presents a conceptual model for the hydrogeology and the nature of contamination at the Wacker site as it may pertain to potential sediment impacts, and provides details with regard to the completion of the RI.

2. BACKGROUND

The Wacker site is located within a 6-mile stretch of the Lower Willamette River in which the U.S. Environmental Protection Agency (EPA) conducted a sediment study in September and October 1997. This area, referred to as the Portland Harbor, is between the upstream ends of Sauvie Island (River Mile (RM) 3.5) and Swan Island (RM 9.5).

Results of the 1997 EPA sediment investigation, as conducted by the EPA's contractor, Roy F. Weston, Inc., are documented within a May 1998 report entitled *Portland Harbor Sediment Investigation Report, Multnomah County, Oregon* (Weston, 1998). As provided within the Weston report, the overall sediment investigation involved the collection of 150 shallow (upper 6 to 17 centimeters (cm)) and 37 deep (55 to 139 cm) near-shore sediment samples throughout the Portland Harbor, of which 7 samples (6 shallow, 1 deep) were collected adjacent to the Wacker site, while 5 samples (all shallow) were collected adjacent to the NW Natural – Gasco facility, located immediately northwest and downstream of the Wacker site. Sediment sampling locations are depicted on Figures 2 and 3.

All Portland Harbor sediment samples were analyzed for total metals, semi-volatile organic compounds (SVOCs) including PAHs, total organic carbon (TOC), and sediment grain size. Additionally, selected Portland Harbor samples, including 4 samples collected adjacent to Wacker property, were analyzed for polychlorinated biphenyls (PCBs), titanium, and organotins (TBTs), while 5 Wacker-area samples were analyzed for pesticides, and 1 was analyzed for chlorinated herbicides.

Based, in part, on analytical results provided within the Weston report, which showed areas of elevated chemical concentrations within the study area, on December 1, 2000 the EPA placed the Portland Harbor on the federal National Priority List (NPL); also known as Superfund.

As detailed within a DEQ *Strategy Recommendation* document for the Wacker Site dated October 8, 1999 (DEQ, 1999), the DEQ evaluated the 1998 Weston Report to ascertain possible sources for those areas of elevated chemical concentrations identified within the Harbor that were not otherwise being actively addressed in DEQ's Cleanup Programs. As part of this review, the DEQ flagged areas within the Portland Harbor based on the following three criteria:

- Areas having the highest detected concentration of a given contaminant;
- Areas with contaminant concentrations in the upper five percent of a given contaminant's detected concentrations throughout the Harbor; and
- Areas having contaminant concentrations above an apparent "baseline range" most commonly detected throughout the harbor area.

According to the DEQ Strategy Recommendation document, the contaminant "baseline range" was developed by examining the geometric distribution of concentrations for each contaminant detected. Any sediment concentrations that appeared to depart significantly from the ranges most commonly detected were suspected of lying near a potential contaminant source.

The DEQ data evaluation described above was strictly based on frequency or magnitude of chemical detection, and did not involve a hazard evaluation or an assessment of risk. Results of the DEQ evaluation indicated the presence of elevated chemical concentrations within sediments adjacent to the Wacker property with concentrations ranging from 1.2 times (inorganics) to 100 times (PAHs) the apparent Portland Harbor baseline maximum concentrations (Table 1). Accordingly, the DEQ reached the conclusion that past and/or present operations conducted at the Wacker property may have led to the observed exceedances of the apparent harbor baseline sediment concentrations, and that a remedial investigation should be conducted to evaluate the nature and extent of potential ongoing releases from the Wacker property to the Willamette River sediments.

With regard to the adjacent downstream NW Natural – Gasco facility, as summarized on Table 1, slight exceedances of the apparent harbor baseline maximum for several inorganic compounds were identified, none by more than 1.5-times while PAHs were identified at concentrations greater than 200 times the apparent Portland Harbor baseline concentration. NW Natural is currently nearing completion of RI activities associated with the Gasco property, a process that has been undertaken as per an agreement (DEQ No. ECVC-WMCVC-NWR-94-13) under the DEQ's Voluntary Cleanup Program.

3. SITE LOCATION AND DESCRIPTION

Wacker Siltronic operates a silicon wafer fabricating facility on an 85 acre site along the western bank of the Willamette River in a section of northwest Portland zoned by the city as "Heavy Industrial".

The property, situated immediately northwest of the Burlington Northern / Santa Fe (BNSF) railroad bridge, is generally rectangular in shape. Property boundaries include the Willamette River to the northeast; BNSF railroad berms to the southwest and southeast; and a property line shared with NW Natural and Koppers Industries, Inc. (KII) to the northwest (i.e., the former Gasco-facility property). US Highway 30 (NW St. Helens Road), a former rock quarry, and the Tualatin Mountains lie beyond the BNSF right-of-way to the southwest. Beyond the southeastern BNSF right-of-way lie the Rhone-Poulenc, ESCO Corp., Gould / NL Industries, and Elf Atochem North America properties, all of which are undergoing environmental investigation and/or cleanup.

Presently, the Wacker site is approximately 50% to 60% developed with two silicon wafer fabrication plants (Fab 1 and Fab 2) and associated wastewater treatment plants and structures, as well as a Portland General Electric (PGE) substation, an administration building, and parking facilities (Figure 2). A majority of the development activities completed to date have occurred within the northeastern and northwestern portions of the property, extending along nearly the full length of the shared property line with NW Natural. Much of the southern portion of the site is currently undeveloped. Access to the site is limited due to the site's proximity to the river and the railroad grades that border the site on two sides. The active portions of the facility are fenced, and the area is patrolled by private security personnel.

Additional site features include a narrow greenway that has been created along the full riverfront portion of the property, as well as an approximate 100-foot wide City of Portland utility easement that divides the property from the northwest to the southeast (Figure 2). Underground utilities that exist within the City of Portland easement include oil, gasoline, natural gas, water, and sewer pipelines, as well as electric and telephone cables.

4. SITE USE AND DEVELOPMENT HISTORY

This section provides a summary description of historical property ownership and site development activities that are of pertinence to the present-day Wacker property.

4.1 Property Ownership

As provided within a March 7, 1985 report prepared for the Portland Development Commission (PDC) entitled *Site History, Wacker Siltronic Corp., Portland, Oregon 1850-1984* (PDC, 1985), in the mid to late 1800s the land between the St. Johns and Burlington Northern railroad bridge (includes the current Wacker, NW Natural, and U.S. Government Moorings properties) was owned by Milton Doane and William Baker, with ownership having been established through Donation Land Claims. As of 1906, title records indicate the property to be owned by the Spokane, Portland, and Seattle Railroad, which apparently received the property as part of a large land grant (PDC, 1985). Portland Gas & Coke (PG&C) purchased the Wacker property from the railroad in 1939, and in 1962 sold it to Victor Rosenfeld and H.A. Anderson, who in turn conveyed an interest in the property to Gilbert Schnitzer in 1964. The PDC purchased the property from Rosenfeld and Anderson in 1978 as part of an Urban Renewal project, and during the same year subsequently sold the property to Wacker, who has owned and utilized the property since that time.

4.2 Site Use and Development

4.2.1 Pre-Development Conditions

According to the Site History report (PDC, 1985), with the exception of the adjacent railroad construction, the Wacker site remained primarily undisturbed prior to 1900. The southwest portion of the pre-developed property contained part of a small, shallow lake (reportedly less than 5 feet deep) known as Doane Lake, which was bisected by the present Burlington Northern railroad bridge at the time of it's construction in 1906 (see Figure 1 and the 1936 aerial photo, Appendix A). The remainder of the property consisted primarily of low lying wooded wetlands, prone to seasonal flooding. The PDC report indicates that a small creek traversed the property, with it's source being the Tualatin Mountains immediately across NW St. Helens Road in what is now Forest Park. As depicted in aerial photographs of the site taken in 1936 and 1940 (Appendix A), it appears that Doane Lake was an additional headwater for this creek.

With additional regard to the above-identified creek, it is noted that a 1906 elevation survey map (pre-development) of the adjacent PG&C property to the northwest of the present-day Wacker site, depicts a small northwest-southeast trending creek situated approximately midway between the Tualatin Mountains and the Willamette River and extending onto the

Wacker site. Although the map does not extend it's coverage to the present day Wacker property, it would seem likely that this creek would be a drainage associated with the former Doane Lake located at the southwest corner of the Wacker property. As evidenced by 1936 and 1940 aerial photographs (Appendix A), with the development and partial filling of the PG&C property (circa 1913), this creek was ultimately diverted to the northeast, with discharge into the Willamette River near the present day NW Natural / Wacker property line (Figure 4).

4.2.2 Western Transportation Operations

The earliest known use of the present day Wacker property was in the mid 1930s by Western Transportation, which had a river dock with two piers, five buildings, and two above-ground fuel storage tanks located in the southeastern portion of the site (Figure 4). Western Transportation used the facility for refueling tugs and to tie log rafts and barges (PDC, 1985). Historical aerial photographs indicate the dock and piers were removed prior to 1960, while the buildings were removed some time between 1967 and 1973 (Appendix A).

During the same timeframe as the Western Transportation operations (i.e., mid 1930s), the Shell Oil Company operated a petroleum transfer facility near the northern corner of the Wacker property, consisting of a river dock, one building, and one above-ground storage tank (Figure 4). This facility was located on the riverfront just north of the property line, and was accessed by a road that paralleled, and was approximately 50 feet northwest of, the present day Wacker / NW Natural property line. From it's dock, the Shell operation loaded onto barges and shipped a by-product derived from the PG&C oil gasification facility (described below). Based on review of historical aerial photographs, the storage tank located at the Shell facility was removed some time between 1936 and 1940, while a portion of the Shell dock, as well as the building foundation, remain identifiable on the NW Natural property to the present time.

4.2.3 Pacific Gas & Coke Operations

As described both within the 1985 PDC Site History report, as well as within a June 1987 Camp Dresser & McKee, Inc. (CDM) document entitled *North Doane Lake Site Characterization Work Plan*, (CDM,1987), in 1913, PG&C constructed an oil gasification plant, known as the Gasco facility, on property immediately northwest of the present day Wacker property. The plant produced town gas and pressed lampblack briquettes which were sold in the area as fuel. In 1923, the gasification process was modified to optimize aromatic generation and light oil recovery for use as motor fuel. Tar recovery and refining were incorporated into the process in 1925 to provide tar for use as a road binder. During the 1930s, the plant expanded, and in 1941 a coking plant began production of electrode grade coke and high BTU gas.

The following, summarized from the 1987 CDM document cited above, indicates that the Gasco facility used the "Pacific Coast Oil Gas Process" throughout the plant's life. This process involved thermal cracking of oil at near atmospheric pressure in a cylindrical

shell containing heated refractory checkerbrick. In this process, heavy oils were introduced to the gassifier vessel after pre-heating the checkerbrick to 2,000°F. These oils were then thermally cracked as they moved downward through the gassifier. During the life of the Gasco plant, it is reported that approximately 70,000,000 barrels (2,940,000,000 gallons) of petroleum feedstock (8.4 degree API (specific gravity of 1.011) oil) were processed. This process generated the following products and by-products for each 10 gallons of 8.4 degree API oil used:

- 1,000 cubic feet oil gas
- 28.3 pounds of lampblack
- 0.38 gallons of tar
- 0.46 gallons of light oil

In 1941 a coke oven was installed at the plant to generate electrode grade coke and high oil 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:

- 540 cubic feet of oil gas
- 19.5 pounds coke
- 3.6 gallons tar
- 0.66 gallons light oil
- 0.06 gallons creosote oil

In addition to the preceding by-products, spent oxide (also called purifier box wastes) was generated from the use of iron oxide (iron-impregnated wood chips) as solid reactants for the removal of sulfur from the oil gas. Spent oxide is primarily a blend of iron sulfides, sulfur, iron oxides and wood substrate, however spent oxide material may also contain hydrocarbons that passed through the upstream gas processing equipment, as well as cyanides that would be removed from the gas along with the sulfur. Cyanide gas, however, was significant only within coal gas, with cyanide reaction only found in significant quantities at former coal carbonization sites (Hayes, 1996), and not at former oil gasification sites such as Gasco. In addition to the preceding, spent oxide wastes have been found to contain varying amounts arsenic, chromium, copper, lead, nickel, and zinc (Fischer, 1999).

Due to the large scale of operations at the Gasco site, economic recovery of many of the by-products typically wasted at other plants of this type was conducted, thereby reducing the quantities of waste from this site. According to information provided within the 1987 CDM document, gasification by-products were refined to produce the following products at the Gasco site:

- soft pitch
- specification tars and tar distillates
- specification creosote
- hard pitch
- crude naphthalene
- crude benzene

- motor fuel
- toluene
- xylene
- solvent naphtha

Once natural gas became available in the 1950s, much of the plant was shut down, with the last full year of plant operation occurring in 1955 (CDM, 1987). With the arrival of natural gas, PG&C changed it's name to the Northwest Natural Gas Company, and more recently to NW Natural. The Northwest Natural Gas Company constructed a liquefied natural gas (LNG) plant at the site in the late 1960's, at which time most of the old gasification plant was demolished and associated underground utilities were removed.

Prior to PG&C plant expansion activities that were brought on-line in 1941, waste bi-products from the oil gasification process that did not have a market (wastewater with petroleum emulsions, tars, and spent oxide) were discharged to low lying areas of the site (CDM, 1987). Historical aerial photographs indicate lampblack placement and likely effluent discharge to a low area on the Gasco property south of the southernmost fuel storage tank area, which in turn discharged directly to the Willamette River (see 1936 and 1940 aerial photographs, Appendix A). RI activities completed at the Gasco facility have confirmed this occurrence, with the identification of bulk tars extending across the shoreline in this area (HAI, 1998).

Waste management practices associated with the former Gasco facility are of relevance to the adjacent Wacker property since plant expansions in the 1930s and 1940s involved the construction and use of effluent settling ponds on the southeastern portion of the Gasco property. As depicted on Figure 4, and as shown in aerial photographs taken between 1952 and 1961 (Appendix A), portions of these two effluent ponds appear to have partially extended onto the northern portion of the present-day Wacker property. These settling ponds received effluent from tar boxes and lampblack dryers (tar and oil-water emulsions), and were meant to reduce the discharge of wastes to the river. Overfill or scour from these effluent ponds, if any, would have likely migrated to low areas immediately surrounding the effluent ponds. The primary low areas adjacent to the effluent ponds were to the north, located at the north-central portion of the PG&C property, and to the south, within an approximate 400-foot wide strip of property located on the northwestern portion of the present day Wacker property.

With the construction of the above-described effluent ponds, it appears that the creek which formerly traversed the area, discharging near the present-day NW Natural / Wacker property line, was channelized and re-diverted further south, immediately adjacent to the ponded lowlands on the Wacker property. An aerial photograph taken in 1952 (Appendix A) clearly depicts the location of effluent ponds, the adjacent lowland, as well as the re-diverted creek. These features have been depicted on Figure 4.

Finally, historical aerial photographs from the 1950s and 1960s also indicate the storage or filling of the northwestern corner of the present day Wacker property with a dark-colored material (see 1952 through 1961 aerial photos, Appendix A).

Based on the preceding, the portion of the Wacker property with the greatest potential to have received impacts resulting from waste management practices associated with the former Gasco-facility appears to be limited to the lowland area along the northwestern end of the property. With regard to the effluent ponds, aerial photographs indicate that the two smaller effluent ponds extending onto the Wacker property were eliminated in the late 1960s, with another, much larger effluent pond (30,000 cubic yards), located on the present day NW Natural property, subsequently filled in the 1970s. It has been speculated (PDC, 1985) that demolition debris, as well as consolidated soils from the tar pond close-outs, may have been spread onto the former lowland portion of the present-day Wacker property, and perhaps incorporated into fill placed elsewhere on the site.

4.2.4 Filling and Site Development Activities

As provided within a Bridgewater Group report entitled *Supplement to DEQ's Strategy Recommendation for the Wacker Siltronic Facility* (Bridgewater Group, 2000), filling activities associated with the Wacker property were initiated in May 1966 and were completed by December 1975. The property owners (Rosenfeld and Anderson) had an agreement with the Spokane, Portland, and Seattle Railroad to fill the property to a minimum elevation of thirty feet by the end of 1973, and to construct industrial buildings on the property by the end of 1978 (PDC, 1985).

Approximately 1,500,000 cubic yards of imported material were placed on the property as part of filling activities (Bridgewater Group, 2000). The fill consisted of rock from a quarry located across Highway 30 immediately west of the site, as well as more than 700,000 cubic yards of material dredged from the river (from an unspecified location) by the Port of Portland (PDC, 1985). By 1967, as part of filling and site development activities, the channelized creek that formerly ran across the northwestern portion of the property had again been re-channelized to route water through a ditch and culverts around the southern edge of the Wacker property, where it currently discharges to the Willamette River at an off-site location near the location of the Railroad bridge. A 1978 aerial photograph (Appendix A) provides a view of the Wacker site subsequent to filling and prior to building construction.

Construction of Wacker's new plant began immediately after the property was purchased in 1978. Construction was completed by the end of 1979, and plant operations began in March 1980. A 1980 aerial photograph is provided in Appendix A that depicts the initial Wacker facility layout.

5. POTENTIAL CONTAMINANT SOURCES

The *Strategy Recommendation* report prepared by Mr. Eric Blischke of the DEQ in October 1999 (DEQ, 1999), and the follow-up *Supplement to DEQ's Strategy Recommendation* report (Bridgewater Group, 2000), contain detailed summaries of identified site contamination, as well as a description of all known chemical releases reported to have occurred at the Wacker site. Based in large part on the preceding summaries, a description of potential ongoing contaminant sources at the Wacker property, including a description of one-time spills or releases known to have occurred at the Wacker site, are provided below.

5.1 Former PG&C Gasco Facility

As detailed above, historical aerial photographs indicate that historical operations associated with oil gasification processes at the former Gasco site have potentially resulted in manufactured gas plant- -related contamination at the Wacker site, with the area of primary interest being the approximate 400 foot-wide strip of former low-lying property located immediately south of the present day NW Natural / Wacker property boundary (see Figure 4 and the 1952 aerial photo, Appendix A). This low area may have received discharges and overflow from adjacent effluent ponds, with potential subsequent discharge to the Willamette River via a rerouted creek that entered the Willamette River opposite a berm at the southern end of the lowland area (see Figures 4 and 1952 through 1964 aerial photos, Appendix A). As described above in Section 4.2.3, it has been speculated (PDC, 1985) that this low area may have received discharge or placement of oil-water emulsifications, tar, lampblack, spent oxide, as well as building debris. Finally, based on observations made during various geotechnical and environmental investigations completed at the Wacker site (described herein in Section 6.0), it appears possible that PG&C-related wastes may have been a component of fill placed at other portions of the Wacker property after it had been sold by the Northwest Natural Gas Company.

5.2 Former Western Transportation Terminal

Western Transportation, which operated a fueling dock at the southeast corner of the Wacker Facility had two large above ground fuel tanks. The occurrence or manner of leaks, spills or waste disposal activities associated with the former Western Transportation facility are unknown; however, according to DEQ (1999), an EPA analysis of a 1970 air photo concluded that soils in this area were stained. The 1970 aerial photograph (Appendix A) indicates the possible areas of discolored soils (partially obscured by shadows) to be limited to the immediate vicinity of the Western Transportation structures (Figure 4). No follow-up investigation activities at this portion of the site are known to have been completed.

5.3 Olympic Pipeline

Olympic Pipeline utilizes two product lines within a utility corridor that traverses the central portion of the Wacker property (Figures 2 and 6). Of these two pipelines, one is used to transport diesel and kerosene, while the other is used to transport gasoline. In February 1979, Wacker discovered the presence of petroleum while excavating the foundation for a clarifier in the Fab 1 wastewater treatment plant area. An initial sample of impacted soil from the excavation was found to contain hydrocarbons that matched a sample of diesel fuel obtained from one of the pipelines, although a second sample apparently did not match the Olympic Pipeline product (DEQ, 1999).

Olympic Pipeline subsequently exposed their pipelines. Holes in the pipeline were found and floating oil product being identified within the utility corridor to the northwest and southeast of the clarifier excavation. Olympic pipeline replaced the leaking section of pipe, removed floating product from the excavation, and removed residual oil stained soils in the bottom of the clarifier excavation (Bridgewater Group, 2000). The approximate location of the Olympic Pipeline release is depicted on Figure 4.

5.4 Wacker Operations-Related Chemical Releases

Over the past twenty years, a number of incidents involving the release of hazardous substances to the environment have occurred at the Wacker facility, as described below in chronological order.

5.4.1 1980 Chromium Release

On December 16, 1980, chromic acid was found within the Wacker wastewater treatment plant concentrated acid system. An estimated 5.5 pounds of chromium was captured and taken to the Arlington hazardous waste landfill for disposal. Although no chromic acid was reportedly released to soil underlying the wastewater treatment plant, an estimated 1.3 pounds of chromium was discharged to the Willamette River through the combined effluent outfall near the northern corner of the property (Figure 6). According to Bridgewater Group (2000), Wacker conducts permitted discharges of chromium to the Willamette River of up to 11 pounds per year.

5.4.2 1981 Chromic and Nitric Acid Leak

Approximately 6,000 gallons of acid etch solution and rinse water were spilled at the Materials Characterization Production Area (Fab 1 Building) at the Wacker site in 1981, with some of the spilled material being collected within a sump, while the remainder was reportedly collected within the overfilled above-ground storage tank's secondary containment. No release to underlying soil or surface water was documented as a result of this spill (Bridgewater Group, 2000). The approximate location of this release is depicted on Figure 4.

5.4.3 1984 Trichloroethylene Spills

According to Bridgewater Group (2000), spills at the Wacker facility's trichloroethene (TCE) stripper unit (immediately west of the Fab 1 Building) occurred on December 3, 1984 (0.33 gallons) and again on December 31, 1984 (11.6 gallons). As a result of these spills, Wacker removed 128 cubic yards of soils, with the removed soils transported to a hazardous waste landfill in Arlington, Oregon. Confirmation soil samples indicated the presence of less than 1 ppm TCE remaining in the soil. No groundwater sampling was conducted. Wacker reportedly received a letter of "No Further Action" regarding the TCE spill from the DEQ in 1985. Wacker ceased the use of TCE at the facility in 1988 (Bridgewater Group, 2000). The approximate location of the TCE spills / area of soil removal are depicted on Figure 4.

5.4.4 1987 Organic Wastewater Overflow

Approximately 2,000 gallons of weak detergents and surfactants from the organic wastewater system overflowed onto a gravel yard and roadway on the Wacker property in June 1987. The overflow entered a stormwater catch basin, with subsequent discharge to the Willamette River from the combined effluent/outfall located near the northern corner of the property. Soil sampling in the spill area did not identify the presence of contaminants, and no cleanup was necessary.

5.4.5 1988 Pentachlorophenol Detection in Wastewater

On January 11, 1988, pentachlorophenol (PCP) was identified within one of Wacker's wastewater effluent samples at a concentration of 0.2 ppm. Follow-up sampling conducted on January 27, 1988 indicated the presence of PCP in a combined effluent sample at a concentration of 0.004 ppm. Further follow-up testing of the combined effluent in February, March, and April 1988, did not identify the presence of PCP at concentrations greater than the analytical detection limit of 0.005 ppm (Bridgewater Group, 2000). The source for the PCP identified within the wastewater effluent was not ascertained.

5.4.6 1991 Weak Acid Storage Tank Leak

Approximately 4,000 gallons of weak acid (spent, deionized rinsewater) was released to the ground at the wastewater treatment plant area on September 11, 1991. Wacker blocked all storm drains in order to contain the spilled material, after which approximately 1,000 gallons of the acid were recovered. DEQ concluded that the release was not a hazardous waste, did not exceed a reportable quantity, that no NPDES effluent limits were exceeded, and that further investigation would not be necessary (Bridgewater Group, 2000).

5.4.7 1997 Caustic Rinse Water Release

On April 28, 1997, caustic rinsewater from an ion-exchange regeneration unit, containing an estimated 50 pounds of caustic (pH reportedly ranging from 7.4 to 11.3), was accidentally sprayed onto bare ground west of the Fab 1 building (Figure 4). The spilled caustic solution was neutralized, then recovered with a vacuum truck. Soil samples collected from the spill area indicated the presence of soils with a pH of up to 11.6, greater than the control sample pH of 7.6. Based on these results, the upper 6-inches of soil were scraped off. Resampling indicated remaining soils to have a pH similar to the control sample (Bridgewater Group, 2000).

6. SUMMARY OF PREVIOUS INVESTIGATIONS

A summary of available investigatory activities, pertinent to the Wacker site, that have been completed to date, are provided below.

6.1 Fab 1 Building Area

In August, 1977, three geotechnical test borings were installed by CH2M Hill on the Wacker parcel in the area of the current Fab 1 Process Building (Figure 3). Each boring log had multiple references to black sand and/or bitumen, possible references to lampblack, or other hydrocarbon-related materials. Additionally, a follow-up geotechnical boring installed by CH2M Hill in the Fab 1 Process Building area in 1998 (B1-B) indicated the presence of oil extending through apparent fill to a depth of approximately 50 to 55 feet below ground surface (bgs) (Figure 4). Boring B1-B was extended to the top of bedrock (basalt), which was encountered at a depth of approximately 215 feet bgs. Relevant boring logs from the Fab 1 Process Building area are provided within Appendix B.

6.2 Undeveloped, Western Property Area

CH2M Hill conducted a soil investigation at the western portion of the Wacker facility in April 1985. This investigation included the installation of seven soil borings in the vicinity of a proposed polysilicon plant in the southwestern portion of the Wacker property. Borings were installed to depths ranging from 31.5 to 41.5 feet and were originally completed as monitoring wells MW-1 through MW-7. At this time, in order to avoid possible future name confusion between wells at Wacker and wells at the adjacent Gasco site, existing wells located on the Wacker property have been re-designated with the prefix "WS". For example, the well formerly identified as "MW-1" now carries the identification "WS-1". Well locations are depicted on Figure 4.

Soil descriptions from 4 of the 7 well borings (WS-1, -2, -5, and -7) indicated the presence of oily product within surficial fill. Soil samples were collected from these borings and analyzed for oil and grease, phenols, VOCs, PAHs, as well as pesticides, herbicides and metals according to the extraction procedure - toxicity (EP-Tox) methodology.

Analysis of the soil samples detected the presence of VOCs, phenols (including pentachlorophenol), and 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 300 to 3,400 ppm. Soil data are summarized in Table 2.

Groundwater samples collected from the monitoring wells WS-1 through WS-7 in July and August 1985 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. Groundwater data are presented in Table 3.

The identified 2,4-D, an agricultural herbicide, in soil at the Wacker property, as well as within sediments adjacent to the Wacker facility, has been attributed to Rhone-Poulenc Ag. Co. (DEQ, 1999), located upstream of the site, and therefore has not been identified as a contaminant of interest for RI activities to be conducted by NW Natural at the Wacker site (Section 7.4.2).

In 1990, Geraghty and Miller, Inc. conducted a *Hydrogeological Investigation of the Doane Lake Area* in northwest Portland (Geraghty & Miller, 1990). 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 assess the impact that groundwater quality in the Doane Lake area could have on potential Gould site remedies.

As part of the Geraghty & Miller investigation, two monitoring wells on the Wacker property were sampled. These included the existing WS-7, installed by CH2M Hill in 1985, and a newly installed intermediate depth monitoring well (WS-3I), installed at the WS-3 well cluster. WS-3I is screened from 55 to 60 feet while WS-3 is screened from 12 to 27 feet. No BTEX compounds, and only low levels of phenol (0.003 ppm) and PAHs (0.215 ppm total PAHs) were detected in groundwater samples collected from well WS-3I, screened below the surficial fill, within the alluvial unit. Boring logs and well construction details for wells WS-1 through WS-7 are provided within Appendix C.

6.3 Fab 2 Building / Olympic Pipeline Area

In June 1990, elevated levels of VOCs and PAHs were identified within soil samples collected from two geotechnical borings that were placed in the footprint of the then proposed Fab 2 manufacturing plant. Total PAH concentrations detected in the two samples were 10,000 ppm and 6,100 ppm respectively (DEQ, 1999). As a result, Wacker retained CH2M Hill to conduct an assessment of the nearby utility corridor that contains the aforementioned Olympic Pipeline, among other lines. Assessment activities involved the

installation of approximately 25 well points and 3 soil gas sampling points placed on a grid pattern using approximate 75-foot centers. The study area, located in the vicinity of the 1979 Olympic Pipeline release, occupied approximately 250 feet on either side of the utility corridor, and extended along approximately 600 feet of the corridor. Groundwater samples were collected just below the water table at a depth of approximately 25 feet. All samples were field analyzed for BTEX and total petroleum hydrocarbons (TPH). Figure 4 depicts the approximate location of these investigatory activities.

The results of the investigation indicated elevated levels of BTEX and TPH in groundwater. Benzene concentrations ranged from non-detect to 23.3 ppm, while TPH concentrations ranged from 0.012 to 89.1 ppm. The highest concentrations of TPH and benzene were detected at a point west of, and immediately adjacent to, the pipeline utility corridor. The location of maximum BTEX concentrations were found to coincide with the area surrounding three adjacent borings where a "black viscous substance" (i.e., likely tar), was identified within the fill. Analytical results from groundwater samples indicated decreasing BTEX concentrations to the northwest and southeast along the utility corridor, with the long axis of the apparent contaminant plume extending northeast away from the corridor and towards the river. The benzene results, as well as CH2M Hill's interpretation of plume morphology, are provided within Figure 7.

CH2M Hill concluded that the source of the petroleum contamination could not be conclusively identified, but that it appeared to be gasoline-related. Based on the preceding, Olympic Pipeline subsequently uncovered the pipelines within the area of concern. No holes or leaks from the pipeline were apparent and pressure testing of the lines was inconclusive. Upon further pressure testing, one of the lines was ruptured. In March 1991 Olympic Pipeline capped both of the old lines in-place and connected approximately 2000 feet of new pipeline in March, 1991.

As part of subsequent construction activities associated with the Fab 2 foundation (occurring in 1995), approximately 5,500 tons of petroleum-contaminated soil were excavated and thermally treated with a mobile soil remediation unit. Soils were treated under a solid waste letter of authorization issued by DEQ on April 17, 1995. Treated soils were disposed of at the St. Johns Landfill in Portland, Oregon.

6.4 Willamette River Sediments

As stated in Section 2.0 above, the EPA conducted a sediment investigation within the Portland Harbor in 1997. The sediment investigation included the collection of 150 samples, of which 7 samples were collected adjacent to the Wacker property. A summary of constituents identified within sediments adjacent to the Wacker facility that were reported to exceed overall Portland Harbor baseline values, is provided as Table 1.

On July 29, 2000, an oil sheen was created on the Willamette River at a location immediately adjacent to the Wacker site as silt was being dredged as part of bank repair work being conducted by Wacker. According to the laboratory that analyzed samples of the dredged silt, fuel fingerprinting indicated the petroleum hydrocarbon patterns to be

consistent with coal tar or creosote (Bridgewater Group, 2000). Investigatory activities associated with the dredging incident were not conducted. In total, approximately 115 tons of sediments were disposed as petroleum-contaminated waste (Bridgewater Group, 2000). The location of the dredging-induced sheen, located in the vicinity of the former channelized creek discharge, is depicted on Figure 4.

6.5 NW Natural – Former PG&C Gasco Facility

Since 1994, a remedial investigation has been underway at the former PG&C Gasco-facility, the property adjacent to, and northwest of, Wacker. Overall RI results indicate that the primary contaminants of interest at the Gasco site are PAH and aromatic hydrocarbon (BTEX) compounds, with contaminant concentrations and distribution correlating with the distribution of residual tar and oil at the site. Other contaminants of interest at the Gasco site, primarily associated with the presence of spent oxide materials, include cyanide as well as the metals arsenic, chromium, copper, lead, nickel, and zinc. Of the preceding contaminants potentially associated with spent oxide materials, only chromium and zinc have been identified through upland ecological and human health risk screening (Anchor, 2001) as Constituents of Potential Concern (COPCs). Phenolic compounds, which are part of the acids from coal tars, have not been found in significant concentrations in soil or groundwater at the Gasco site. The preceding correlates with findings that the presence of phenols within gas plant wastes is largely limited to coal carbonization sites (Hayes, 1996), unlike the former PG&C Gasco operation, which utilized an oil gasification process.

With the exception of the southeastern portion of the Gasco site, where the former effluent ponds were located, it has been demonstrated that manufactured gas-plant contamination is primarily restricted to soils and groundwater within the surficial fill. Impact to the underlying native alluvial sands, including limited migration of dense non-aqueous phase liquid (DNAPL), has been found to be primarily limited to the southeastern portion of the Gasco site, beneath, and down-gradient of the former effluent ponds, as well as in the vicinity of the former low area / former drainage to the south of the southern tank farm (well clusters MW-3 through MW-5, Figure 2).

A soil boring (B-33) installed through the former effluent pond near the Wacker/Gasco property line detected tar contamination into the alluvial sands to a depth of 67 feet bgs, while groundwater collected from a monitoring well (MW-5) installed along the Willamette River adjacent to the Gasco/Wacker property line at a depth of 100 feet bgs has been found to contain up to 11.4 ppm benzene and 7.4 ppm naphthalene. Groundwater samples collected from the same location, but at a depth of 175 feet bgs, consistently indicate no contamination. Based on boring B1-B, installed nearby on the adjacent Wacker property, the depth to bedrock is estimated to be approximately 205 feet bgs at the MW-5 well location. The consistent lack of detected chemicals within the alluvial sand unit immediately above the bedrock surface indicates that site-related impacts to the bedrock aquifer are not reasonably likely.

Pertinent soil borings and monitoring well construction logs for the NW Natural - Gasco site are included within Appendix D.

6.6 Rhone-Poulenc Doane Lake Facility

Rhone-Poulenc is located south of the Wacker property, immediately south of the BNSF railroad right-of-way. The plant was known as Chipman Chemical / Rhodia Agricultural Division until 1978, at which time it became Rhone-Poulenc. The plant began operations in 1956 as a liquid formulation plant for 2,4-D and other herbicides / pesticides. Prior to the 1960's, effluent from the Chipman Chemical plant was pumped to Doane Lake. Due to concerns with regard to the migration of contaminants onto the Wacker property from the adjacent Rhone-Poulenc site, URS Greiner Woodward Clyde (URS) has completed RI activities pertaining to the Rhone-Poulenc site on the southern portion of the Wacker property as well as within the BNSF railroad right-of-way between the two properties in 1999 and 2000. Based on the DEQ Environmental Cleanup Site Information (ECSI) database, contaminants associated with the Rhone-Poulenc site include: 2,4-D; 2,4,5-T, dioxins and furans, isomers of dichlorobenzene, phenolic compounds, cresols, trichloroethene (TCE), aromatic hydrocarbons, including benzene, toluene, ethylbenzene, and xylene (BTEX), lead, and arsenic.

The URS RI activities on or in the vicinity of the Wacker site included the installation of 4 cone penetrometer (CPT) borings to provide an indication of subsurface soil types, 4 push probe borings for direct soil sampling, and 8 groundwater monitoring wells, with wells having been completed within the surficial fill unit (RP-1-31, RP-3-26 (abandoned), RP-3-30R, and RP-6-31), the alluvial unit (RP-1-51, RP-3-63 (abandoned), RP-3-52R, W-3-81, and RP-6-87), and the bedrock unit (RP-1-65). Pertinent boring and well locations related to the Rhone Poulenc RI activities are depicted on Figures 2 and 4.

Results of the Rhone-Poulenc RI activities indicate that soils beneath the southern portion of the Wacker site typically consist of likely fill (sandy silt, gravel, and silt) to depths of approximately 25 to 30 feet bgs, underlain by alluvial silts, clays and sand down to the bedrock surface. The bedrock surface was encountered at depths ranging from 50 to 60 feet bgs near the southwestern and southeastern corners of the site, with a trough between these two locations where the bedrock surface was found to dip to a depth of approximately 115 feet bgs near the location of WS-3. As further discussed in Section 7.2 below, the alluvial unit across the southern portion of the Wacker site has been found to be composed of much more fine grained material than that identified to the north on the northern portion of the Wacker site and the adjacent NW Natural property.

Of the 12 push probe and monitoring well borings installed by URS within and near the southern portion of the Wacker property, oil or tar product was identified only in borings installed at the RP-3 location. Based on boring log for these locations, the product had a creosote-like odor and was restricted to a depth of approximately 20 feet bgs at the base of the surficial fill unit above a clay zone.

Laboratory validated groundwater quality data from the monitoring wells installed by Rhone-Poulenc were not available within the DEQ files at the time of this writing.

Pertinent CPT, push probe, and monitoring well logs, associated with the Rhone-Poulenc RI, as well as a cross-section depicting the lithology encountered along the southern property line of Wacker, all prepared by URS, are included within Appendix E.

An HAI-prepared hydrogeologic cross-section parallel to the river, prepared using environmental and geotechnical boring logs available for the NW Natural, Wacker, and BNS&F (Rhone-Poulenc investigation) properties, is included as Figure 5.

7. PRELIMINARY CONCEPTUAL SITE MODEL

A preliminary conceptual site model is presented herein based on the history of the Wacker property as well as investigations performed to date at, and in the vicinity of, the site. Phase I of the RI has been designed based on this preliminary conceptual model. The information gathered during the Phase I investigation will subsequently be utilized to modify or reconstruct the conceptual model, if necessary.

7.1 Land Use

The site consists of 85 acres of uplands located along the southern bank of the Willamette River. The property is zoned "IH" - Heavy Industrial, and "IHi" – Heavy Industrial with an industrial river greenway overlay zone. The utility easement that occupies a vacated, never-constructed section of NW Front Avenue transects the western portion of the property, dividing the "IHi"-zoned property to the northeast, from the "IH" – zoned property to the southwest.

7.2 Local Geology

The geologic units of interest at the subject site can be subdivided as follows, from youngest to oldest:

- Surficial Fill Deposits
- Alluvial Deposits
  - Willamette River Deposits
  - Catastrophic Flood Deposits
- Columbia River Basalt Group

7.2.1 Columbia River Basalt Group

The oldest and lowermost geologic unit of interest at the site consists of the Columbia River Basalt Group. The Miocene-age Columbia River Basalt Group, composed of a series of individual lava flows, generally forms the base (bedrock) of the Portland Basin and outcrops immediately to the southwest of the Site in the Tualatin Mountains.

A significant amount of bedrock surface elevation data are available for the former Gasco site, immediately to the northwest of the Wacker property. These data indicate the basalt surface dips steeply to the northeast, with the top of the basalt occurring at a depth of approximately 36 feet bgs near the western corner of the Wacker site, to depths of 215 feet bgs near the northern corner of the Wacker site. Although, in general, the bedrock surface is anticipated to dip steeply from the Tualatin Hills towards the Willamette River, undulations in the surface are expected. Investigatory activities conducted by Geraghty & Miller (1991) near the southern corner of the Wacker property, as well as preliminary, unpublished results of investigatory activities completed by URS Greiner Woodward Clyde (URS) along the southeastern Wacker property boundary, indicate the presence of a trough in the bedrock surface, with the bedrock surface occurring at a depth of 115 feet bgs near the location of well WS-3 and rising towards the east corner of the Wacker site adjacent to the Willamette River, where bedrock was encountered at a depth of 63 feet bgs.

7.2.2 Alluvial Deposits

Overlying the eroded basalt surface at the site are Quaternary-Age alluvial deposits, composed of unconsolidated sands and silts, that range in thickness from approximately 30 feet near St. Helens Road and the southeastern portion of the site (above the bedrock mound), to an estimated thickness of approximately 160 to 180 feet adjacent to the Willamette River near the northern corner of the Wacker site. These 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 site model groups the two units together and refers to them as undifferentiated Alluvial Deposits. The uppermost unit of the undifferentiated Alluvial Deposits in the vicinity of the site has been identified as a clayey silt by Camp Dresser (1987), while Geraghty & Miller (1991) identified both silt and clay facies associated with the upper zone of the Alluvial Deposits.

HAI (1998) encountered a laterally extensive silt unit, with typically little to no clay content, at the upper portion of the Alluvial Deposits during investigatory activities completed at the Gasco site. This silt unit was found to exhibit coloration ranging from olive gray to green, with some areas of orangish-brown mottling. Small sand lenses and rootlet zones are present within portions of the silt unit. Fine to medium-grained sands, silty sands, and relatively thin interbedded silts were encountered below the silt unit at intermediate depths within the Alluvial Deposits. Boring logs for wells WS-1 through WS-7, installed by CH2M Hill (1985) at the western portion of the Wacker site (Appendix C), all

encountered the top of this silt unit at depths ranging from 20 to 35 feet bgs. With regard to thickness, Geraghty & Miller (1991) reports that within the Doane Lake area, the silt unit has been found to be the thickest beneath the Esco and Wacker properties. As encountered in wells and borings recently installed by URS on the southeastern portion of the Wacker property, the silt unit was found to have a thickness of greater than 35 feet. Similar thicknesses have been identified to the northwest of Wacker, near the central portion of the Gasco site.

Boring logs for wells and borings installed at the southern and southeastern portions of the Wacker site indicate the presence of much finer-grained alluvial material than have been identified at the northern portions of the property, with silts and occasional sand zones extending all the way to the bedrock surface.

The existence of a northwest-southeast trending depression in the top of the silt unit is apparent across the central portion of the Gasco site. The depression appears to be oriented roughly parallel to the location of a former creek bed, and is thought to be a former drainage feature associated with Doane Lake. Assuming that the observed depression does correlate with the historic creek bed, then it would be expected that this depression in the surface of the silt extends across the western portion of the Wacker property, to the vicinity of the former Doane Lake remnant.

7.2.3 Surficial Fill Deposits

As described in Section 4.2 herein, approximately 1,500,000 cubic yards of imported material were placed on the property as part of filling activities (Bridgewater Group, 2000). The fill consisted of rock from the quarry located across Highway 30 immediately west of the site, as well as more than 700,000 cubic yards of material dredged from an unknown portion of the Willamette river by the Port of Portland (PDC, 1985). Aerial photographs suggest that the western corner of the Wacker property was filled with spent oxide, lampblack, and possibly tar residue derived from the Gasco operations. Surficial fill thicknesses ranging from 10 to 30 feet across the Wacker site are likely. Based on a review of available boring logs for the Wacker site (Appendices B and C), it appears that much of the fill consists of poorly graded sands and silty sands. In addition, references to bitumen and tar, potential byproducts from the oil gasification process, have been identified within the surficial fill unit at portions of the site.

7.3 Local Hydrogeology

Groundwater is deemed likely to occur in three principal hydrologic zones at the site including the unconfined Surficial Fill water-bearing zone (WBZ), the semi-confined Alluvial WBZ, and the confined bedrock aquifers in the Columbia River Basalts. Based on available boring log data from the Wacker, Gasco, and adjacent properties to the south, it is anticipated that a laterally extensive low permeability silt unit separates the Surficial Fill WBZ from the Alluvial WBZ across a majority of the site. The hydraulic conductivity of the silt unit at the Wacker site, as determined from slug testing at well MW-3I, was

calculated as 3.22×10^{-5} cm/sec, indicating that the silt unit is not highly conductive (Geraghty & Miller, 1991).

With respect to the overall regional groundwater flow regime in the vicinity of the Wacker site, it is anticipated that the Tualatin Mountains form a regional groundwater recharge area to the southwest of the site, while the Willamette River likely forms a regional groundwater discharge boundary to the northeast, acting as a hydraulic barrier to groundwater flow to the opposite side of the river.

In the southern portion of the site, groundwater has been encountered in the Surficial Fill WBZ at depths of 14 to 25 feet bgs. In the area of the site's monitoring well network, groundwater flow within the surficial fill WBZ appears to generally be to the southeast towards North Doane Lake. However, since the site's monitoring well network covers only a portion of the site, site-wide data regarding overall groundwater flow is not available. Local topography, in addition to extensive groundwater flow data available to the northwest and southeast of the Wacker site, suggest that the overall site groundwater flow direction within both the Surficial Fill WBZ and the Alluvial WBZ, should generally be to the northeast, toward the Willamette River. Specifically, as contoured by URS for the northern portion of the adjacent Rhone-Poulenc site (March 2000 groundwater elevation data), groundwater flow direction for the surficial fill and alluvial water-bearing zones is interpreted to be predominantly to the north-northeast, towards the Willamette River. A similar interpretation exists with regard to groundwater flow direction immediately north of the Wacker site, beneath the NW Natural property.

Select contoured groundwater elevation maps for the Wacker property, as well as for the adjacent Rhone-Poulenc and NW Natural properties, are included within Appendix F.

7.4 Contaminant Source, Transport, and Fate

7.4.1 Potential Contaminant Sources

The primary potential sources of sediment-related contamination at the Wacker property, as described in Section 5, are as follows:

- Oil gasification waste placement within former PG&C effluent settling ponds;
- Oil gasification waste placement within the filled northern lowland area, or mixed with fill elsewhere on the site;
- Potential direct discharge to Willamette River sediments of PG&C oil gasification wastes via overflow, flood scour, and clean-out of effluent settling ponds;
- Undocumented spills and waste management practices associated with the Former Western Transportation fuel terminal;

- Olympic Pipeline-related releases;
- Releases and Spills associated with Wacker Operations;

7.4.2 Contaminants of Interest

Contaminants of Interest (COIs) have been identified, with few exceptions, as those constituents identified within the *Strategy Recommendation* Report (DEQ, 1999) as being present within sediments adjacent to the Wacker site at concentrations considered to exceed the Portland Harbor baseline maximum values. Exceptions include the addition of the aromatic hydrocarbons (BTEX) and total cyanide to the COI list, all of which have previously been identified in site groundwater, but have not been analyzed in sediments. Additionally, although remaining impacts have not been documented, TCE is included as a COI because of the two TCE spills that occurred in the Fab 1 Building area at the site in 1984.

Conversely, herbicides, pesticides, and phthalates, identified within the DEQ *Strategy Recommendation* document as being present within adjacent sediments at concentrations exceeding the Portland Harbor Baseline, are not considered to be COIs for the purpose of this RI. Rationale for the elimination of these constituents as COIs pertaining to Wacker operations has previously been documented within the *Supplement to DEQ's Strategy Recommendation* (Bridgewater Group, 2000), and is therefore not repeated herein. Furthermore, herbicides, pesticides, and phthalates have not been identified as contaminants of interest related to historic PG&C operations, and as such do not appear attributable to potential PG&C manufactured gas plant-related contaminant sources.

Ecological risk evaluation studies completed to date with regard to sediments at the NW Natural site indicate that metals concentrations, only slightly greater than the Harbor Baseline Maximum as reported by DEQ, do not appear to pose unacceptable risks. However, due to the presence of several acid spills at the Wacker facility, and the potential for resulting acid-induced mobilization of naturally-occurring metals from soils, those metals identified by the DEQ as being present in sediments at concentrations slightly above the harbor baseline maximum concentrations, have been identified as COIs for the purpose of this RI. Furthermore, antimony and chromium, metals used in Wacker's fabrication process, as well as arsenic, copper, lead, and nickel, metals sometimes associated with spent oxide materials, have been included as COIs to be evaluated as part of the RI.

Based on the preceding, COIs for the Wacker RI have been identified as follows:

- Polynuclear aromatic hydrocarbons (PAHs);
- Semi volatile organic compounds (SVOCs), including carbazole, dibenzofuran, 2-methylnaphthalene, and phenols
- Volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, xylenes (BTEX) and trichloroethene (TCE);
- Total cyanide;
- Metals (antimony, arsenic, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, titanium, vanadium, and zinc)

Based on the expected nature of the potential contamination present at the Wacker property, the presented COI list will be adequate for the identification and evaluation of contaminant migration pathways into the Willamette River.

7.4.3 Transport and Fate

Because primary contaminant type (petroleum-related); mode of placement (release to the ground, incorporation within fill); and the hydrogeological framework (sand fill overlying an alluvial silt layer, below which are alluvial sands and silts) are similar at both the Wacker and Gasco facilities, contaminant transport and fate processes are also expected to be similar. Accordingly, it is possible to design the Wacker RI to target specific zones within the subsurface that have been demonstrated to be zones for primary contaminant transport at the Gasco facility.

7.4.3.1 Groundwater Pathway

Based on RI results at Gasco, it is known that the most significant contaminant migration at the site occurs within the Alluvial Sand WBZ. Specifically, based on one-time depth-discrete sampling and on-going monitoring conducted down-gradient of primary source areas at Gasco, it is known that the majority of contamination is present within the Surficial Fill WBZ, although the primary zone of contaminant migration towards the Willamette River is below the silt unit within the upper portion of the Alluvial Sand WBZ (approximately 60 feet bgs), extending vertically to depths ranging from 65 feet bgs (MW-4) to approximately 100 feet bgs (MW-5) down-gradient of the most massive area of former waste placement (i.e., former effluent ponds). Based on the understanding of contaminant migration at the Gasco site, dissolved phase contamination from any of the identified potential contaminant sources on the Wacker property, or from contaminated fill in general, would be expected to be limited to the surficial fill and/or present within the

upper 40 to 75 feet of the Alluvial WBZ. It is noted that the lower Alluvial Sand WBZ across the Gasco site has consistently indicated the absence of chemical impacts.

With regard to non-aqueous phase product (NAPL), based on the history of former PG&C waste management practices, as well as a review of historical aerial photographs (Section 4.2.3), it is possible that tar wastes may have been historically placed within the northern lowland portion of the Wacker site, with possible periodic discharge into the river via scouring or overflow into the adjacent channelized creek. Additionally, as previously indicated, it has been speculated (PDC, 1985) that demolition debris, as well as consolidated soils from the tar pond close-outs, may have been incorporated into fill placed elsewhere on the Wacker site. As observed at the Gasco site, the historic placement of these materials directly adjacent to, and within, the river, adds some complexity with regard to the differentiation of historic placement versus potential ongoing contaminant releases to Willamette River sediments. However, if NAPL is identified at the shoreline, sediment and porewater-related investigatory could be developed for the Wacker site, if deemed necessary to adequately evaluate the nature and magnitude of ongoing releases.

In addition to the preceding, the possibility exists for preferential migration of dissolved and/or NAPL contamination via buried utilities that cross the site and lead to the Willamette River. Figure 6 depicts the location of known subsurface utilities at the Wacker property. Of these utilities, five extend across the site and terminate at the embankment above the Willamette River. As depicted in Figure 6, utilities that intercept, or nearly intercept, the river embankment are as follows (from down-stream to up-stream):

- Combined effluent outfall (Fab 1 area stormwater and treated process effluent);
- Fab 2 area stormwater outfall;
- 16-inch diameter abandoned natural gas pipeline;
- Administration Building downspout outfall
- 96-inch diameter abandoned concrete masonry pipe (possible former City of Portland storm sewer).

As described in Section 9, these utilities will be investigated to the extent possible to determine whether any or all of them are acting as conduits for the preferential migration of contaminants to Willamette River sediments.

Finally, because localized groundwater flow in the surficial fill water-bearing zone at the southern portion of the site has been previously interpreted to be to the south, towards the off-site drainage ditch and a remnant of North Doane Lake, the RI will evaluate the potential for groundwater discharge to the off-site drainage ditch.

7.4.3.2 Surface Water Runoff Pathway

According to the National Flood Insurance Program, Flood Insurance Rate Map (FIRM), City of Portland, Oregon, Multnomah, Clackamas, and Washington Counties, Community Panel 410183 0015 C, Panel 15, dated October 19, 1982, the bulk of the Wacker property is situated within Flood Zone B, described as an area within the 500-year flood zone, or an area within the 100-year flood zone with average depths less than one foot, or with a drainage area less than one square mile, or areas protected by levees from the 100-year flood.

Flooding of the Willamette River during February 1996 resulted in limited bank erosion and damage, with no flood waters encroaching upon the portion of the site above the top of the shoreline embankment. As described by Bridgewater Group (2000), during the Summer of 1998, Wacker implemented a river bank stabilization project that included the placement of 5,415 cubic yards of Class 500 rock rip rap above ordinary high water (OHW) and 2,300 cubic yards of Class 1000 rock rip rap below OHW along the full length of the property's shoreline. This river bank stabilization project was designed to alleviate issues with regard to potential future riverbank erosion.

A map depicting pre-fill site topography (circa 1975), the level of a 100-year flood event, as well as the limit of the February 1996 flood event, is provided as Figure 8. It is noted that a map depicting current site topography was not available at the time of work plan preparation. As such, further attempts to locate a map depicting site topography will be made as part of the Phase I RI. If a current site topographical map cannot be located, and if results of Phase I RI activities indicate that such topographical information is necessary to achieve project objectives, then a plan for completion of a site-wide topographic survey will be developed and included within plans for Phase II RI activities.

As previously documented by Bridgewater Group (2000), with one exception, site stormwater runoff across the entire property is collected within catch basins and is subsequently conveyed to the Willamette River via three on-site outfalls identified above (combined effluent outfall; Fab 2 area outfall; and Administration Building downspout outfall). The exception involves stormwater runoff from the Administration Building parking lot, which is piped approximately 100 feet off-site to the southeast, where it discharges to the 84-inch diameter City of Portland storm sewer, which in turn discharges to the Willamette River immediately upstream of the Wacker property at a location adjacent to the BNSF railroad bridge (City of Portland Stormwater Outfall No. 22c). The only other potential current surface water runoff pathway to the Willamette River would involve localized overland sheet flow of surface water with incidental erosion of the embankment into the Willamette River. However, based on the nature of the embankment (a heavily rip-rapped slope with established grass above), significant sheet flow or erosion from the embankment into the Willamette River is not deemed likely.

Historically (i.e., pre-1967), a small creek traversed the property, with it's source being the Tualatin Mountains immediately across NW St. Helens Road in what is now Forest Park, as well as the former North Doane Lake remnant located on the southern corner of the Wacker property. Until the on-set of site development activities associated with the former PG&C in 1913, this creek likely paralleled the river, flowing north-northwest across the

present-day Wacker and Gasco sites. As depicted in aerial photographs of the site taken in 1936 and 1940 (Appendix A), with the development and partial filling of the PG&C property (circa 1913), this creek was diverted to the northeast, with discharge into the Willamette River near the present day NW Natural / Wacker property line. In 1941, with further development of the PG&C property (i.e., effluent pond construction), the creek was once again diverted, this time to a location approximately 400 feet southeast of the present day Wacker / NW Natural property boundary, a route that passed beneath the current location of the Fab 1 and the Central Facilities buildings at Wacker (Figure 4). In 1967, during the filling and development of the Wacker property, the creek was rerouted along the railroad right-of-way on the southwestern edge of the property, which in turn discharges through the aforementioned City of Portland Outfall located upstream of Wacker adjacent to the BNSF railroad bridge. No stormwater runoff from the site, other than that which is piped from the Administration Building parking lot as described above, enters the re-routed creek / ditch or the City of Portland storm sewer (Bridgewater Group, 2000).

8. SOURCE CONTROL EVALUATION PLAN

Subsequent to the completion of Phase I RI activities, a technical memorandum on source control measures will be prepared that presents and evaluates all data relevant to the characterization of confirmed contaminant migration pathways from the Wacker property to Willamette River sediments. The source control evaluation will cover both potential surface water and groundwater migration to the Willamette River, as well as the potential for risks to human health and the environment as a result of potential groundwater or surface water releases. Complete risk evaluations will be conducted as part of the Portland Harbor in-water RI/FS. As such, exposure pathway and receptor identification will occur during the problem formulation process.

The potential for human health and/or ecological risks will be determined using screening level risk values (e.g., ERLs, ERMs, and RBCs). Specific risk-based screening criteria to be used for the source control evaluation will be based in large part upon those screening criteria yet to be deemed appropriate for use as part of overall Portland Harbor risk evaluations. Due to the uncertainty regarding the timing of the establishment of appropriate screening criteria for the Portland Harbor, it is proposed that a review of available screening criteria be conducted at the time data are received. Once these data are available, a proposal will be provided to the ODEQ describing the screening criteria intended for use as part of the overall source control evaluation.

The specific objectives of the Source Control Evaluation are as follows:

- Determine potential contaminant migration pathways from the Wacker property to the Willamette River sediments.
- Characterize identified migration pathways from the Wacker property to Willamette River sediments.

- Estimate potential magnitude of chemical migration via these pathways, if any, from the Wacker property to Willamette River sediments.

- Based on the potential for human health and ecological risks, evaluate the need for source control measures to prevent the ongoing migration of chemicals, if any, from the Wacker site to Willamette River sediments.

- If source control is deemed necessary, identify and evaluate alternatives for source control measures.

Using a similar approach as with the NW Natural "Gasco" site, several procedures will be used to meet the above objectives for the source control evaluation. These include reviewing chemical concentrations in surface water discharging from the site; reviewing groundwater chemical concentrations for monitoring wells installed adjacent to the shoreline; modeling chemical concentrations at the sediment water interface resulting from potential contaminated groundwater releases to the River; and possibly collecting pore water and sediment samples from the Willamette River to confirm modeled chemical concentrations.

Initially, the source control evaluation will consist of reviewing the groundwater chemical concentrations for the monitoring wells proposed for the Willamette River shoreline, as well as for surface water discharging from the site. These concentrations will be compared to DEQ's Ambient Water Quality Criteria to determine the occurrence and magnitude of potential aquatic life impairment. Comparing the groundwater chemical concentrations, without dilution, to the water quality criteria will provide an absolute worst case estimate of potential adverse effects resulting from groundwater discharge to the River.

Assuming that at least some chemicals are detected in the monitoring wells at concentrations above the DEQ water quality criteria, a series of groundwater transport (fate and degradation) models will be conducted to better predict actual chemical concentrations at the sediment water interface in the Willamette River. As with the Gasco project, two transport models are proposed: the Boudreau and the Reible model.

The Boudreau model assesses the long-term advection, diffusion, and biodegradation of contaminants through the soil and sediment. Bernard Boudreau has written several numerical models to evaluate contaminant transport in both the dissolved and sorbed (mixing of sediments) phases. These models are written in FORTRAN and use a variable coefficient ordinary differential equation solver that is part of the ODEPACK algorithms. The list of potentially relevant transport and attenuation processes that control chemical transport to the sediment surface generally includes the following:

- Contaminant dissolution
- Groundwater transport
- Hydrodynamic dispersion
- Chemical adsorption
- Organic biodegradation

For this analysis of potential sources to the sediments, all of the above listed mechanisms have been included in the model. Other potentially significant processes such as tidal-induced dispersion and chemical precipitation, which require considerably more data and sophisticated modeling techniques, have not been included in the screening-level model.

The Reible model was developed and used by the Corps and EPA to assess flux from contaminated sediments, including sediment pore water quality assessments. The Reible model examines the long-term transport of chemicals due to groundwater advection and diffusion processes, using a modeling approach different in structure from the Boudreau model. Using the site-specific parameters for groundwater flow, contaminated groundwater in the Reible model is allowed to flow through the soil matrix and into the sediment layer, allowing for advection, diffusion, dispersion, and retardation in the sediments. Once steady state is reached, the resulting pore water concentration at the sediment water interface (0 - 1 cm) is estimated based on a flux balance. This model is conservative since it does not allow for biodegradation of the contaminants. The Reible model also does not address tidal-induced dispersion and chemical precipitation reactions.

Following completion of the groundwater transport modeling effort, pore water and sediment samples may be collected in the field to validate the model results. If such sampling is deemed appropriate, then a supplemental work plan will be provided that will describe proposed sampling procedures.

The necessary data for completing the initial steps of the source control evaluation is limited to groundwater chemical concentrations for monitoring wells located along the shoreline of the Willamette River. Physical properties such as soil porosity and biodegradation rates will be either collected during well installation, estimated based on the data collected at the Gasco facility, or obtained from the literature.

9. RI SITE CHARACTERIZATION PLAN

9.1 RI Objectives and Approach

The objectives of the proposed RI activities at the Wacker site are as follows:

1) To identify, characterize, and estimate the magnitude of any ongoing unpermitted discharges from the Wacker site to the Willamette River sediments.

2) To obtain sufficient information to allow for an evaluation of the need to implement source control measures at the site necessary to prevent the ongoing discharge of unacceptable levels of contaminants, if any, to Willamette River sediments.

3) To characterize sources of identified ongoing unacceptable impact to Willamette River sediments for the purpose of evaluating, developing, and implementing source control measures sufficient in scope to provide for the mitigation of the identified unacceptable impact.

The Remedial Investigation will likely be performed in two phases. The Phase I investigation will gather the basic information necessary to adequately address the first objective identified above, while a second phase of investigatory activities may be necessary to more fully evaluate the need for, or options associated with, the second and third objectives (source control).

The following subsections describe the various activities to be performed at the Wacker site as part of Phase I RI activities.

9.2 Groundwater Pathway Investigation

The groundwater pathway investigation will include the collection of depth discrete soil and groundwater samples at down-gradient portions of the site, near the groundwater / surface water interface with the Willamette River. These investigatory activities will include an evaluation of soil and groundwater quality across the entire riverfront portion of the Wacker property, with additional emphasis on those areas known to be either down-gradient of a potential contaminant source, and/or within a zone of potential preferential migration (i.e., filled creek channel, utility corridor backfill). Investigation activities will include: 1) detailed screening of the soil column at each boring location for the presence of contamination, with an emphasis on NAPL or residual product identification; 2) collection and analysis of soil samples from zones of likely impact; 3) collection and analysis of depth discrete groundwater samples from zones of likely impact; and 4) seasonal groundwater monitoring and flow direction determinations. Additionally, in order to ascertain the potential occurrence of contaminant migration in groundwater from the site to the adjacent off-site drainage ditch near the southern and western property boundaries, a survey of the elevation of the base of this drainage ditch will be conducted. If it is subsequently determined, through review of groundwater and ditch elevation data, that the potential for groundwater discharge to the ditch exists, then options regarding a sampling scheme of sufficient scope to allow determination of site-related impacts to the Willamette River via the ditch, if any, will be developed and provided under separate cover.

A description of planned investigatory activities is provided below, while detailed sampling procedures are provided within the Sampling and Analysis Plan (SAP), included within Appendix G.

9.2.1 Geophysical Survey

A geophysical survey (electromagnetic and ground penetrating radar (GPR) will be conducted along the riverfront at the locations of the former creek channels and the utility corridors such that the nature and spatial position of these features can be ascertained to assist in boring location.

9.2.2 Push Probe Investigation

As depicted on Figure 9, it is proposed that 10 push probe borings (P-1 through P-10) be installed with a lateral spacing of between 150 and 350 feet along the Wacker shoreline. It is proposed that each of the boring locations be utilized for collection of depth-discrete groundwater samples. As depicted on Figure 9, groundwater samples will be collected along virtually the entire Wacker / Willamette River shoreline, with emphasis on portions of the site down-gradient of the former effluent ponds / filled lowland area (P-1 through P-4), and the former Western Transportation fueling facilities (P-7 and P-8). Furthermore, push probe boring locations P-1 through P-5 will also provide coverage down-gradient from historical Wacker operational-related spills (i.e., TCE and various acid spills), all of which occurred either in the vicinity of the Fab 1 Building or the wastewater treatment plant area.

With regard to an evaluation of zones of potential preferential contaminant migration between the upland portion of the site and the Willamette River, push probe borings P-1 and P-3 will be placed at each of the two locations of the historical on-site channelized creek, while P-1 will simultaneously provide for an evaluation of subsurface conditions adjacent to the utility corridor associated with the combined sewer effluent pipe (Figure 9). Other zones of potential preferential contaminant migration between the upland portion of the site and the Willamette River that will be evaluated include the Fab 1 storm sewer utility corridor (P-6), the abandoned natural gas utility corridor (P-8), the abandoned concrete masonry pipe corridor (P-9), and the Administration Building downspout storm water drain line (P-10). At all locations where a utility corridor is being evaluated as a potential zone of preferential contaminant migration to the river (P-1, P-6, P-8, P-9, and P-10), an attempt will be made to collect samples of shallow/perched groundwater within the zone of backfill, with the depth and location of the backfill to be estimated via the geophysical survey (Section 9.2.1).

No groundwater collection activities (beneath the zone of potential utility backfill) have been proposed for borings installed at the extreme northern and eastern corners of the property (P-1 and P-9), nor adjacent to the Administration Building downspout stormwater drain line (P-10), where proposed borings P-7 and P-8 as well as existing wells located immediately beyond these property lines (MW-5 to the northwest, and RP-01 to the southeast), provide adequate groundwater quality coverage.

In summary, the proposed density of push probe borings will provide a continuity of soil and groundwater quality data across the shoreline, including locations down-gradient of key suspected contaminant source areas and within zones of potential preferential contaminant migration. This continuity of soil and groundwater quality data will assist in the identification of the lateral and vertical subsurface distribution of contaminants across the shoreline (visual and chemical).

With regard to the proposed push probe boring locations (with the exception of P-10), it is anticipated that multiple borings will be installed at each specified location, with the first boring used to collect soil samples as well as detailed hydrogeological and contamination profile information (based on field screening and visual observation), while the second boring will be used to collect depth-discrete groundwater samples. In this regard, continuous soil cores will be collected at all push probe borings (except P-10) to a minimum depth of 64 feet bgs, allowing for a detailed description and screening of soils across the water table, through the Surficial Fill WBZ, and into the Alluvial Sand WBZ. Sampling activities will be extended to greater depths at locations where field screening would indicate contamination extends through the targeted completion depth. To evaluate deeper flow paths, four of the preceding push probe borings (P-2, P-3, P-5, and P-8) will be further advanced to a depth of 100 feet bgs, with soil samples to be collected approximately every 10 feet below the continuously-cored portion of the borehole. Because potential deep migration pathways in the vicinity of the current Administration Building / Former Western Transportation Facility will be evaluated via push probes P-7 and P-8, push probe boring P-10 is proposed solely for installation across the zone of backfill surrounding the Administration Building downspout stormwater effluent line such that impacts, if any, associated with this line may be evaluated.

At all locations where deep groundwater sampling is proposed (P-2 through P-8), depth discrete groundwater samples will be collected at key depth horizons, to be selected based on the soil profile observed at each location (Table 5). Based on the existing Site Conceptual Model, key depth intervals to sample at all locations include Surficial Fill WBZ (at the water table, estimated depth of 20 to 24 feet bgs), as well as the upper portion of the Alluvial Sand WBZ (approximately 50 to 65 feet bgs). Additionally, to characterize deeper flow zones across the riverfront, 4 probes (P-2, P-3, P-5, and P-8) will be advanced to a depth of approximately 100 feet bgs for the collection of groundwater samples within the intermediate to deep portion of the Alluvial WBZ. Finally, if encountered, shallow (potentially perched) groundwater samples will be collected at those push probe locations that are installed at the location of identified subsurface utility lines that extend to the river (i.e., borings P-1, P-6, P-8, P-9, and P-10). It is anticipated that any such sampling would likely occur at depths of less than 12 feet bgs.
It is noted that should free product be encountered within the surficial fill unit at any push probe location, it may not be possible to extend these borings to the full proposed depth due to potential cross-contamination issues. In such an occurrence, alternatives such as using a temporary outer-casing (including the protectiveness provided by a hollow-stem auger), will be evaluated relative to the actual site conditions encountered.

Groundwater samples collected during the above investigatory activities will be analyzed for PAHs, VOCs, total cyanide, dissolved metals, and cyanide, COIs that have been found to be good indicators of the presence and magnitude of impacts that may be associated with the suspected sources. Magnesium, barium, and chloride, although not COI's, will also be included in the groundwater analyses in order provide potential "tracers" that could be useful with regard to the source control modeling described in Section 8.0. Additionally, a minimum of one soil sample per boring (selected by field screening from unsaturated zone soils) will be analyzed for all inorganic COIs, as well as for a hydrocarbon identification (HCID) test. The HCID test will indicate whether petroleum or other organic-related impacts are present. If such impacts are identified, then these impacts will be quantified and representative samples will be further analyzed for VOC and SVOC content. Additional samples may be selected for more focused analyses if necessary for defining vertical contaminant extent or evaluating multiple zones of impact. Further, total organic carbon (TOC) will be analyzed in select soil samples in order to assist in determination of site-specific attenuation factors. A summary of the groundwater and soil sampling plans are provided in Tables 4 and 5, respectively. Sampling procedures are included within the site-specific Sampling and Analysis Plan (Appendix G).

In an effort to determine impacts that may be attributable to anthropogenic sources, concentrations of metals within soil samples will be compared to background concentrations derived by the Washington State Department of Ecology (WDOE, 1984) for soils within Clark County, Washington. For the same reasons, concentrations of metals and cyanide within groundwater will be compared to area specific background concentrations, as provided by non-impacted wells at the Wacker and the adjacent Gasco sites. Specifically, it is proposed that wells MW-2-61 (Alluvial) and MW-9-29 (Surficial Fill) from the Gasco site, and wells RP-3-63 (Alluvial) and W-3-81 (Alluvial) from the Wacker site, be used to provide representative background metals concentrations for groundwater.

9.2.3 Monitoring Well Installation

Subsequent to the completion of the push probe investigatory activities described in Section 9.2.1, a specific proposal for monitoring well installation will be prepared and submitted to the DEQ. Specific monitoring well locations and depths will be such that the contaminant plume, and/or NAPLs, if any, will be monitored within the anticipated zone of greatest flux into the river. Additional wells will be clustered at each location, as necessary, to provided vertical plume definition.

Although the number and location of necessary monitoring wells will not be known until completion of push probe sampling activities, a preliminary monitoring plan includes the installation of 5 new well clusters at the Wacker site (WS-8 through WS-12). Of these wells, it is anticipated that 4 clusters will be installed along the riverfront, while 1 cluster will be installed at the central portion of the site (Figure 9). The primary purpose of the cluster installed at the central portion of the site would be to supplement existing coverage

with regard to groundwater elevation and flow direction, necessary for an evaluation of potential contaminant flux into the river.

Currently, it is anticipated that each of the five anticipated well clusters will consist of two wells, one screened within the Surficial Fill WBZ, and the second screened within the upper Alluvial Sand WBZ. This conceptual well installation plan will be modified, as necessary to meet the RI objectives, based on actual site conditions encountered during the push probe investigatory activities.

Groundwater samples collected from each of the monitoring wells will initially be analyzed for the full suite of COIs, as well as other parameters (i.e., cations and anions) that may be deemed helpful with regard to evaluating groundwater flux to the river.

9.2.4 Location and Elevation Survey / Off-Site Ditch Evaluation

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.

Further, the location and elevation of the off-site drainage ditch present along the railroad right-of-way to the west and south of the site will be surveyed. Surface elevation measurements of the base of the ditch will be made along the length of the ditch adjacent to the Wacker property at approximate 500 foot intervals. At the time of the survey, the banks of the ditch will be visually inspected for the presence of groundwater seeps. Locations of seeps, if any, will be included within the survey.

9.2.5 Groundwater Monitoring

Monitoring of static water levels in the monitoring wells will be performed on a quarterly basis to gather information on seasonal fluctuations of the water table and hydraulic gradients. River stage data will also be collected at the same time to determine hydraulic continuity with the Willamette River. Water levels at the Wacker site will be collected synchronously with water level collection activities at the adjacent NW Natural site, as well as within Rhone-Poulenc wells RP-01, RP-03, and RP-06 (assuming access is provided to the Rhone-Poulenc wells), such that overall groundwater flow direction across the site can best be determined. Further, water levels within the Willamette River, as well as within select monitoring wells on the Wacker property, will undergo continuous monitoring for a period of at least 48 hours in order to evaluate tidal influences on the hydrogeologic system at Wacker. A specific proposal for this short term continuous monitoring event will be included as part of the groundwater monitoring plan, described below.

In addition, quarterly monitoring of water quality parameters will be performed at all newly installed monitoring wells over the course of one year to establish if there are any seasonal fluctuations or long-term trends of the contaminant concentrations in the groundwater. These monitoring activities will be coordinated, as possible, with sampling activities conducted at the adjacent NW Natural site. A specific groundwater monitoring plan, including a description of planned short-term continuous water level monitoring, will be included with the specific proposal for monitoring well installation, to be submitted to the DEQ upon the completion of groundwater quality screening portion of the investigation.

9.2.6 Aquifer Tests

Aquifer slug tests will be performed on select (two to four) existing and/or newly installed monitoring wells at the site to gather data on aquifer characteristics, including hydraulic conductivity and transmissivity. These testing activities will be confirmational in nature and will provide basic aquifer characteristic data that can be compared to literature values (based on soil type) as well as to data obtained from aquifer testing activities previously completed at near-by properties. 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.

Specifically, rising-head slug tests will be performed in a representative selection of monitoring wells (based on varying lithology and spatial location) 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), solution method to calculate preliminary estimates of transmissivity.

A limited duration aquifer pumping test may be proposed at a later date, should such a test be deemed appropriate based on a review of modeling results in conjunction with model sensitivity to input aquifer characteristic parameters such as hydraulic conductivity or transmissivity.

9.3 Surface Pathway Investigation

In order to effectively evaluate the potential for ongoing contaminant migration from the Wacker site to the Willamette River via the surface pathway, the following investigatory activities will be completed:

- Collection and analysis of surface soil samples at the top of the river embankment;
- Collection and analysis of sediment samples from select storm water catch basins at locations where the potential to have received discharges of hazardous substances may exist;
- Collection and analysis of a soil sample from beneath the Fab 2 area stormwater outfall.
- Collection and analysis of effluent samples from site outfalls.

9.3.1 Surface Soil Sampling

To evaluate the potential for contaminant migration into sediments adjacent to the Wacker site via overland flow and erosion, soil samples will be collected at locations along the top of the river embankment where such processes appear most likely to occur. Based on a February 6, 2001 riverbank inspection conducted by HAI, it was found that the embankment is heavily reinforced along the entire shoreline with rip-rap and that the top of the embankment is covered with firmly established grass. As such, no areas of localized preferential surface water run-off / erosion into the river were identified along the Wacker riverfront. Based on the proceeding, surface soil samples will be collected at default locations correlating with every other push probe boring installed along the shoreline (i.e., borings P-1, P-3, P-5, P-7, and P-9).

Surface soil samples will be analyzed for nonvolatile COIs. A summary of the soil sampling plan is provided in Table 4. For comparison purposes, identified concentrations of metals within surface soils will be compared to background concentrations derived by the WDOE (1984) for soils within Clark County, Washington. Sampling procedures are included within the site-specific Sampling and Analysis Plan (Appendix G).

9.3.2 Stormwater Catch Basin Sampling

To evaluate potential impacts attributable to stormwater-related discharges, sediment samples from select on-site stormwater catch basins will be collected and analyzed. As depicted on Figure 9, four catch basins have been selected for sampling based on proximity of these basins to former spills and/or chemical storage areas. Specifically, of the catch basins selected for sampling, one is located in the vicinity of the facility wastewater treatment plant; two are located in facility process areas, including the area of the 1997 caustic solution spill and the 1984 TCE spill; and one is located adjacent to a bulk chemical storage area.

With regard to the catch basin sampling, assuming sediment is present, then samples will be collected by hand from the upper few inches of sediment within each selected basin. Sediment samples from all sampled basins will be composited into one sample by the laboratory and analyzed for the full suite of COIs. Compositing is warranted in this instance since all sediments from all basins, if scoured out, would be commingled prior to discharge to the river via the receiving stormwater outfall. It is noted that results of these catch basin sampling activities may provide an indication as to historical releases to the storm drain, as well as potential future releases to the river (should the sediment be scoured out), but will not necessarily be indicative of an ongoing source of contamination to the river. If analytical results of the composite sediment sample indicate the presence of particular constituents exceeding screening criteria, then the need for further catch basin sampling as an additional phase of investigation will be evaluated.

Catch basin sediments will be analyzed for the full suite of COIs. As summarized in the soil sampling plan provided in Table 4. For comparison purposes, identified concentrations of metals within surface soils will be compared to background concentrations derived by the WDOE (1984) for soils within Clark County, Washington. Sampling procedures are included within the site-specific Sampling and Analysis Plan (Appendix G).

9.3.3 Outfall Area Soil Sampling

To further evaluate potential historical and/or ongoing releases attributable to on-site stormwater catch basins, samples of soils located immediately below the existing on-site "Fab 2 Area" stormwater outfall, which discharges to the river embankment, will be collected. Sampling below the combined effluent/stormwater outfall has not been proposed since this outfall is located off-shore, beneath the surface of the Willamette River. Similarly, sampling associated with the Administration Building downspout stormwater outfall will not be possible as it appears that this outfall has been buried below the large diameter rip rap that has been emplaced along the embankment. Regardless, potential ongoing contaminant pathways attributable to these outfalls, if any, will be thoroughly evaluated via the proposed effluent and catch basin sampling activities (Sections 9.3.2 and

9.3.4), as well as via the proposed subsurface soil and groundwater sampling activities (Section 9.2.2).

The outfall soil sample will be analyzed for the full suite of COIs, as summarized in Table 4. For comparison purposes, identified concentrations of metals within surface soils will be compared to background concentrations derived by the WDOE (1984) for soils within Clark County, Washington. Sampling procedures are included within the site-specific Sampling and Analysis Plan (Appendix G).

9.3.4 Stormwater / Effluent Sampling

One-time grab samples of the discharge (wastewater treatment plant effluent and/or stormwater) from each of the accessible outfalls will be collected in order to provide data regarding current discharge conditions. Specifically, sampling of the combined process water/stormwater outfall will be sampled at an existing sampling station currently used by Wacker to satisfy NPDES permit monitoring requirements. Sampling of the Fab 2 area stormwater outfall will be conducted at the end of the discharge pipe immediately above the river embankment. Sampling of the Administration Building roof drain outfall will not be possible since this outfall is buried below the surface of the embankment. Stormwater / effluent samples will be collected during a storm event that is greater than 0.1-inches in magnitude, and that occurs at least 72 hours from the previous measurable (greater than 0.1-inches rainfall) storm event. An attempt will be made to collect the samples within the first hour of the storm event.

Stormwater /process water effluent discharges will be analyzed for the full suite of COIs. A summary of the water sampling plan is provided in Table 5. Sampling procedures are included within the site-specific Sampling and Analysis Plan (Appendix G).

9.4 Willamette River Bathymetric Survey

If significant dissolved and/or residual or free phase contamination (i.e., NAPL) is identified, then to assist in interpretation of soil and groundwater sampling results in relation to identified sediment impacts at the Wacker site, extension of the existing bathymetric survey for the Willamette River adjacent to the NW Natural Gasco facility will be conducted, past the Wacker facility and to the location of the Burlington Northern railroad bridge. Procedures for completing the bathymetric survey are provided within the Sampling and Analysis Plan (Appendix G).

10. PHASE II SITE INVESTIGATION

Data collected from the preceding tasks will be evaluated as described herein within Section 8.0 (Source Control Evaluation). Based on the findings of the source control evaluation, and as deemed necessary for the completion of source control evaluation activities at the adjacent Gasco facility, it is possible that Phase II RI activities may be necessary to allow a determination as to whether ongoing contaminant discharges from the uplands portion of the site may be resulting in unacceptable risks to human health or ecological receptors utilizing the Willamette River. The potential risks to these receptors and associated risk-based cleanup concentrations will be fully evaluated during the conduct of the Portland Harbor in-water RI/FS. A description of possible Phase II RI activities, including identification of the Phase I results that may lead to these additional activities, is provided below.

1) Conduct investigatory activities at portions of the site to characterize the source of identified contaminant discharges to Willamette River sediments. Source area investigatory activities would likely be deemed necessary under either of the following two scenarios:

    - The nature and extent of contamination identified in the vicinity of the surface water / groundwater interface does not fit the conceptual site model, and source area characterization is deemed necessary for ensuring that potential migration pathways to the river have been adequately characterized.

    - Results of the Source Control Evaluation indicate the presence of on-going contaminant discharges that may be adversely impacting sediments, and source area characterization is needed to adequately identify and evaluate control measure options.

2) Conduct investigatory activities within Willamette River sediments, as necessary, to allow one to distinguish between impacts that may be attributable to either historic placement / sedimentation or ongoing contaminant releases to the Willamette River sediments.

3) Fill other data gaps as may be identified during Phase I.

If deemed appropriate, a draft Phase II RI Work Plan will be provided to the DEQ within 60 days after a determination is made that Phase II characterization activities will be necessary.

11. PROJECT MANAGEMENT PLAN

The Project Management Plan (PMP) describes the roles of personnel involved in the Focused RI activities; reporting requirements; procedures for handling variations from the Work Plan; and a proposed schedule of submittals.

This PMP was developed in conjunction with, and is supplemented by other documents relating to the overall RI. These documents, all prepared according to DEQ guidelines, are as follows:

- RI Work Plan: A document that presents the scope of work for the focused RI activities.
- Sampling and Analysis Plan (SAP): A description of the procedures that will be used for the collection and analysis of soil and groundwater samples. It includes quality assurance/quality control (QA/QC) procedures for both field and laboratory. The SAP is intended to serve as a manual for field staff.
- Health and Safety Plan (HSP): A HSP presents a description of procedures to be used in the field to protect personnel from potential hazards that may exist during on-site activities.

11.1 Project Management and Organization

The following provides identification and a brief description of key personnel involved in the RI project. The DEQ will be notified should changes in key personnel occur during the life of the project.

Project Manager

The project manager's primary responsibilities will be to oversee and coordinate the activities of the technical consultant project manager and to serve as the point of contact with the DEQ and the technical consultant. The project manager is:

Mr. Bob Wyatt
NW Natural
220 NW Second Avenue
Portland, Oregon 97209
Phone: (503) 226-4211 ext. 5425
FAX: (503) 273-4814
Email: rjw@exchange.gasco.com

Technical Consultant Project Manager

The technical consultant project manager will have responsibility for overseeing the activities associated with the focused RI assessment. This person will be responsible for overall management of the project and coordination of the project team and will be the point of contact for all communications directed at the technical consultant. Additional responsibilities include: schedule control and adjustments; subcontractor procurement; cost control and reporting; identification of potential problems and the development of contingency plans to respond to the identified problems. The technical consultant project manager is:

Mr. Rob Ede, R.G.
Hahn and Associates, Inc.
434 NW 6th Avenue, Suite 203
Portland, Oregon 97209
Phone: (503) 796-0717
FAX: (503) 227-2209
Email: rede@hahnasoc.com

DEQ Project Manager

All reports, notices, and other communications required under or relating to the RI activities shall be directed to:

Mr. Eric Blischke
Oregon Department of Environmental Quality
Northwest Region
2020 SW Fourth Avenue, Suite 400
Portland, Oregon 97201
Phone: (503) 229-5648
FAX: (503) 229-6899
Email: blischke.eric@deq.state.or.us

Several activities will be completed by, or with the assistance of, others. Listed below are the activities that will be conducted by others (i.e., subcontracted), and the currently identified subcontractors.

Source Control Evaluation Services:

Mr. Steve Cappellino
Anchor Environmental, L.L.C.
1411 4th Avenue, Suite 1210
Seattle, Washington 98101
Phone: (206) 287-9130
FAX: (206) 287-9131
Email: scappellino@anchorenv.com

Laboratory Services:

Mr. Darwin Thomas
Environmental Services Laboratory, Inc.
17400 SW Upper Boones Ferry Road, Suite 270
Portland, Oregon 97224
Phone: (503) 670-8520
FAX: (503) 670-9243
Email: esl@eslportland.com

Mr. Howard Boorse
Columbia Analytical Services, Inc.
1317 South 13th Avenue
Kelso, Washington 98626
Phone: (800) 695-7222x07
FAX: (360) 636-1068
Email: hboorse@caslab.com

Drilling Services

Mr. Bill Klosterman
Geo-Tech Explorations, Inc.
19700 SW Teton
Tualatin, Oregon 97062
Phone: (503) 692-6400
FAX: (503) 692-4759
Email: bill@geotechinc.com

Upland Surveying Services

Mr. Eric Jones
Chase Jones & Associates, Inc.
1500 SW 12th Street
Portland, Oregon 97201
Phone: (503) 228-9844
FAX: (503) 239-5963

Mr. Bob Taylor
NW Natural
220 NW Second Avenue
Portland, Oregon 97209
Phone: (503) 226-4211 ext. 4347
FAX: (503) 273-4822

Willamette River Bathymetric Surveying Services

Mr. Robert Custer
INCA Engineers, Inc.
400 112th Avenue NE, Suite 400
Bellvue, Washington 98004
Phone: (425) 635-1000
FAX: (425) 635-1150
Email: Bcuster@incainc.com

Utility Locating Services

Mr. Carson Smith
Locates Down Under, Inc.
15725 SE Hanwood Lane
Milwaukie, Oregon 97267
Phone: (503) 654-2637
FAX: (503) 653-9529

Geophysical Services

Mr. Ralph Soule
GeoPotential, Inc.
437 NE Liberty Avenue
Gresham, Oregon 97030
Phone: (503) 665-7520
FAX: (503) 492-4404
Email: (b) (6) [redacted]

11.2 Reporting Requirements

Reporting requirements include monthly progress reports; a Monitoring Well Installation Proposal; Phase I Site Characterization Summary Report, and a Technical Memorandum on Source Control Measures. Additionally, if deemed necessary, then Phase II RI Work Plan and reporting will be conducted, as will a work plan providing proposed design of source control measures, if warranted. Once all necessary site characterization activities have been completed, a Remedial Investigation Report will be prepared.

Report distribution will be as follows:

- NW Natural: 3 copies of all reports
- DEQ: Monthly progress reports: 2 copies
  All other reports: 4 copies; 3 bound and 1 unbound

11.2.1 Monthly Progress Reports

Monthly reports will be submitted to the DEQ by the 15th day of the month following the reporting period. The monthly reports will summarize activities performed, data results collected or received, any approved variations from the approved RI Work Plan, and problems encountered or resolved during the reporting period and activities planned for the upcoming two months.

11.2.2 Site Characterization Summary Report

The Site Characterization Summary Report will summarize and present preliminary results of the Site Characterization, and will be sufficient in breadth to allow a determination as to the need for the completion of Phase II Site Characterization activities. The Site Characterization Summary Report shall include the following:

- Introduction and Purpose
- Summary of Site Characterization Activities
- Summary of Investigative Results
- Summary of Data Gaps, if any
- Recommendations and Conclusions

11.2.3 Technical Memorandum on Source Control Measures

The Technical Memorandum on Source Control Measures will present all data relevant to the characterization of contaminant migration pathways from the Wacker and adjacent Gasco facility to the Willamette River. The Technical Memorandum will be based on the results of the Phase I Site Characterization Activities, and shall include the following:

- An identification of contaminant migration pathways to the Willamette River
- Characterization of contaminant migration pathways to the Willamette River
- An estimation of the magnitude of contaminant migration to the Willamette River via the various migration pathways
- Assuming no further site characterization activities are deemed necessary, then alternatives for source control measures to prevent unacceptable levels of contaminant migration to the Willamette River, will be presented and evaluated, as applicable.

11.2.4 Remedial Investigation Report

The RI Assessment Report will include the following:

- Executive Summary
- Introduction (purpose and report organization)
- Facility Background (including current and reasonably likely future land and water uses)
- Study Area Investigation (including figures and tables presenting investigative results)
- Summary and Conclusions (including conclusions regarding the likelihood of present source(s) and pathways for the release of hazardous substances to sediments adjacent to the site
- Appendices

11.2.5 Source Control Measures Design Plan

The Source Control Measures Design Plan will be prepared if it is determined through site characterization and source control evaluation activities that source control measures to address contaminant migration to the Willamette River are necessary.

11.3 Project Schedule

Assuming that Wacker will permit access to it's property, the Phase I RI site characterization field activities will be completed within 120 days after receiving work plan approval from the DEQ. The Phase I Site Characterization Summary Report and the Technical Memorandum on Source Control Measures will be completed within 90 days of the completion of Phase I RI site characterization field activities.

If appropriate, a draft Phase II RI Work Plan will be provided to the DEQ within 60 days after a determination is made that Phase II characterization activities will be necessary. Additionally, a Preliminary Design of Source Control Measures will be provided to the DEQ within 60 days after a determination is made that Source Control Measures are necessary.

A draft RI Report will be provided to the DEQ within 180 days of completion of all site characterization field activities.

The DEQ will be notified in writing of all subsequent modifications to the project schedule, should they occur. The notice shall include an explanation and justification of the changes.

The DEQ will be notified at least 5 working days in advance of the initiation of RI sampling activities.

12. SITE HEALTH AND SAFETY PLAN

A site-specific Site Health and Safety Plan has been 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 includes 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 is provided within Appendix H.

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GLOSSARY OF ABBREVIATIONS

bgs	below existing ground surface
BNSF	Burlington Northern / Santa Fe Railroads
BTEX	benzene, toluene, ethylbenzene, and xylenes
CDM	Camp Dresser & McKee, Inc.
cm	centimeter
COIs	contaminants of interest
COPCs	constituents of potential concern
DEQ	Oregon Department of Environmental Quality
DNAPL	dense non-aqueous phase liquids
EPA	U.S. Environmental Protection Agency
HAI	Hahn and Associates, Inc.
KII	Koppers Industries, Inc.
LNG	liquefied natural gas
NAPL	non-aqueous phase liquid
NPL	National Priority List
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PDC	Portland Development Commission
PG&C	Portland Gas & Coke
PGE	Portland General Electric
RI	Remedial Investigation
RM	river mile
SVOCs	semi volatile organic compounds
TBT	organotins
TOC	total organic carbon
TPH	total petroleum hydrocarbons
URS	URS Greiner Woodward Clyde, Inc.
VOCs	volatile organic constituents
Wacker	Wacker Siltronic Corporation
WBZ	water-bearing zone

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

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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.

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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

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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.

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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

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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.

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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

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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).

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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

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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

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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.

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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

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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.

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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

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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.

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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.

SCOEPA00003332

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

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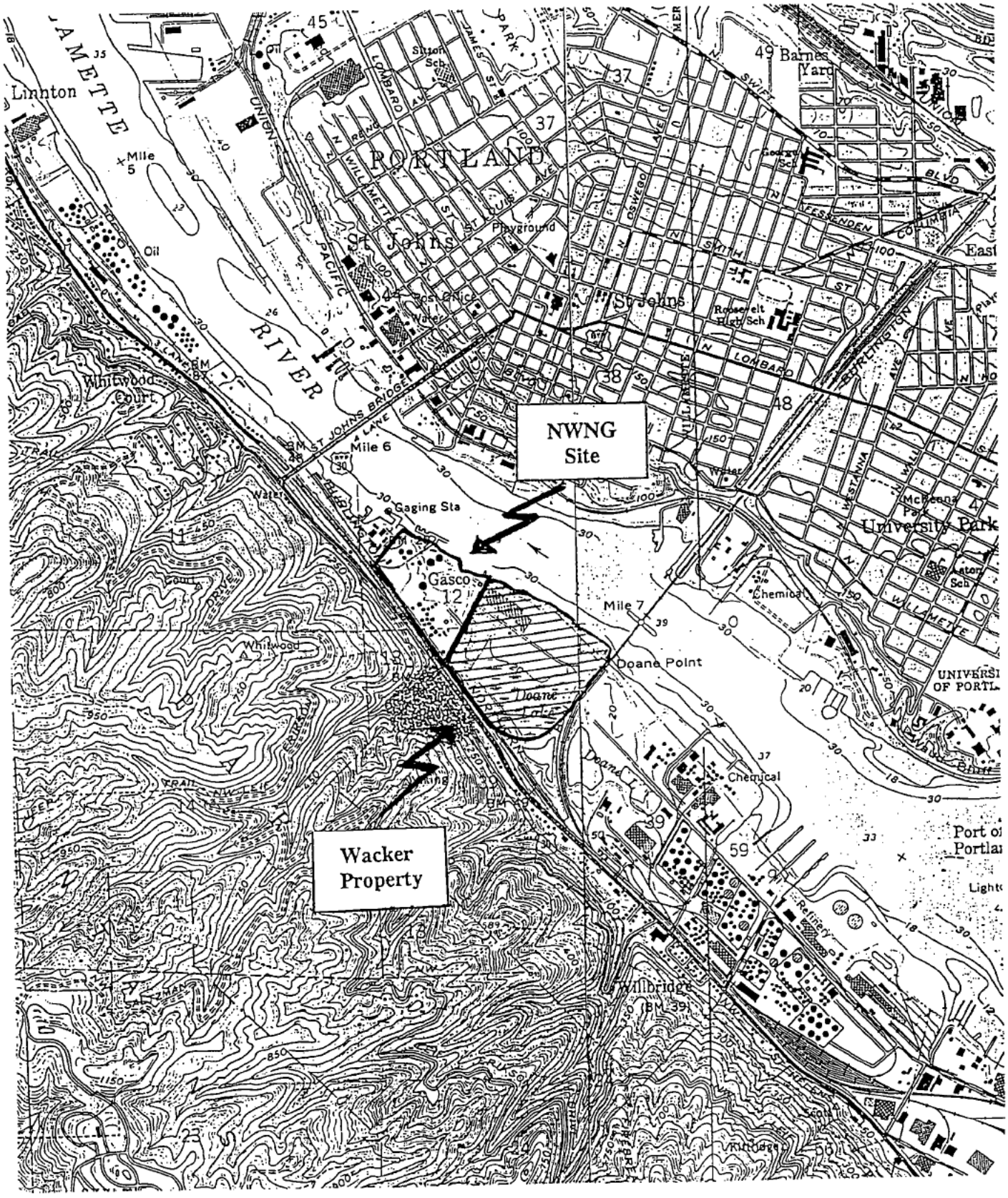
ATTACHMENT 2

SITE LOCATION MAP



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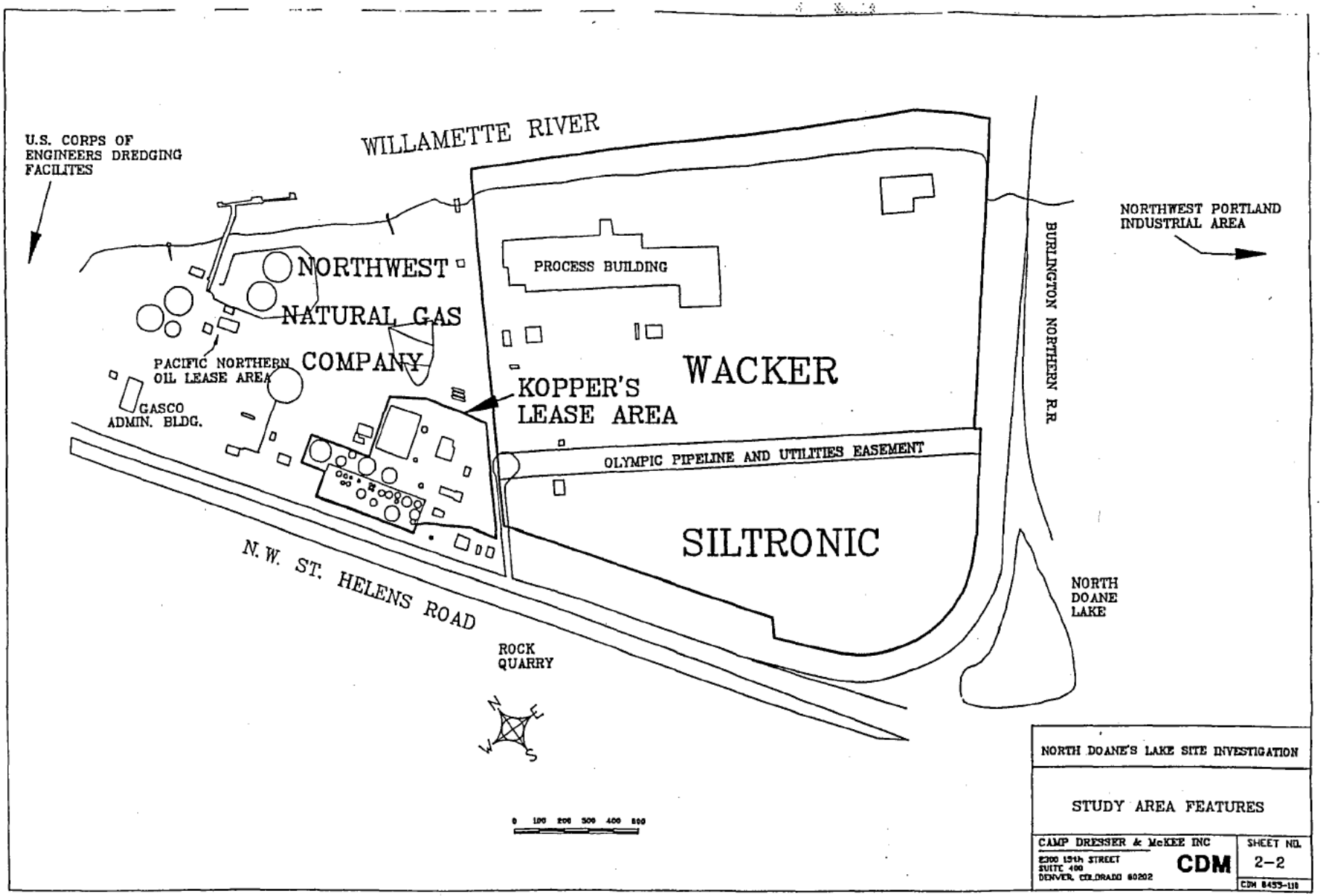
ATTACHMENT 3

SITE LAYOUT MAP



SCOEPA00003337

ATTACHMENT 4

GASCO PLANT LAYOUT MAP

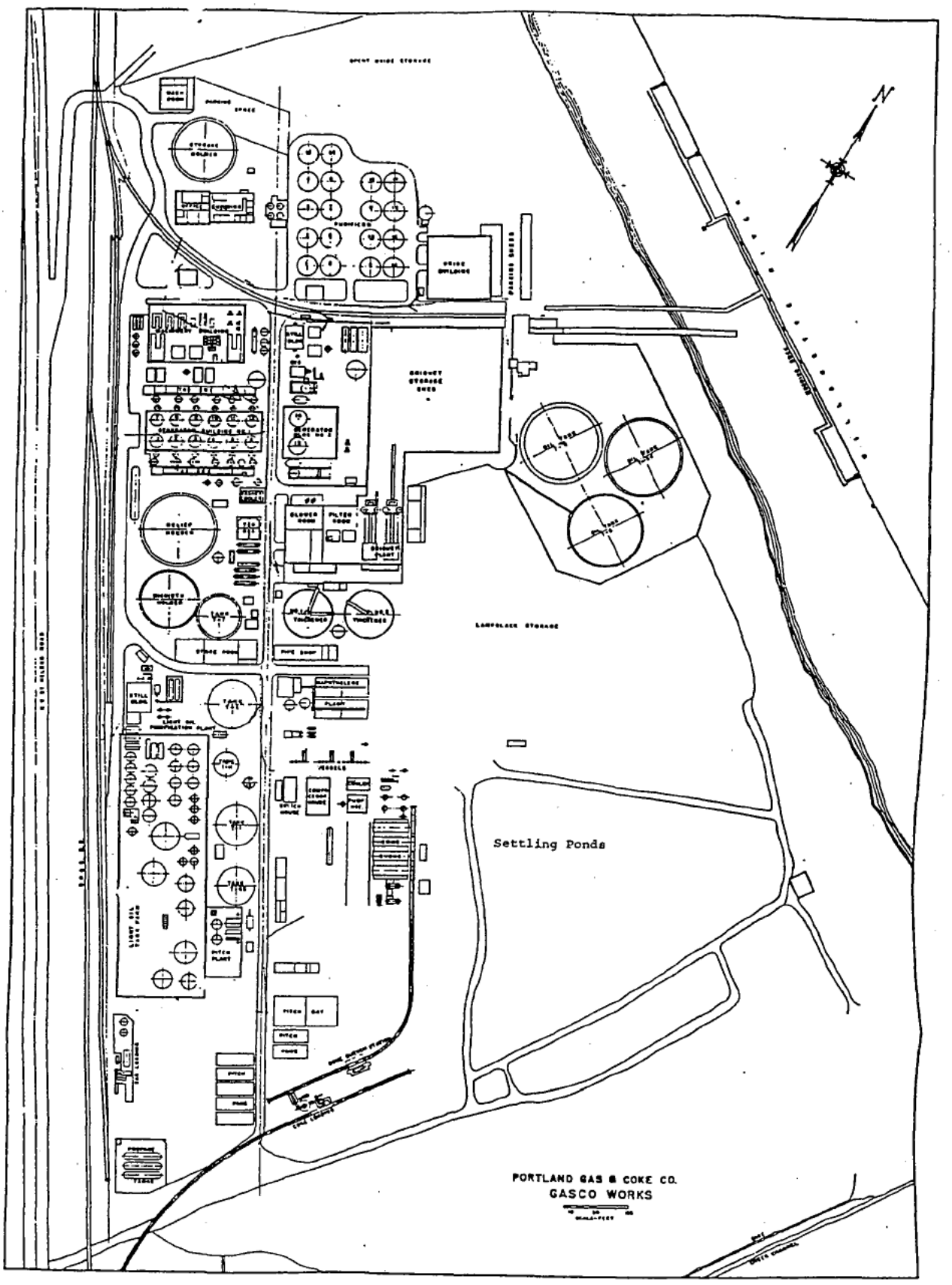
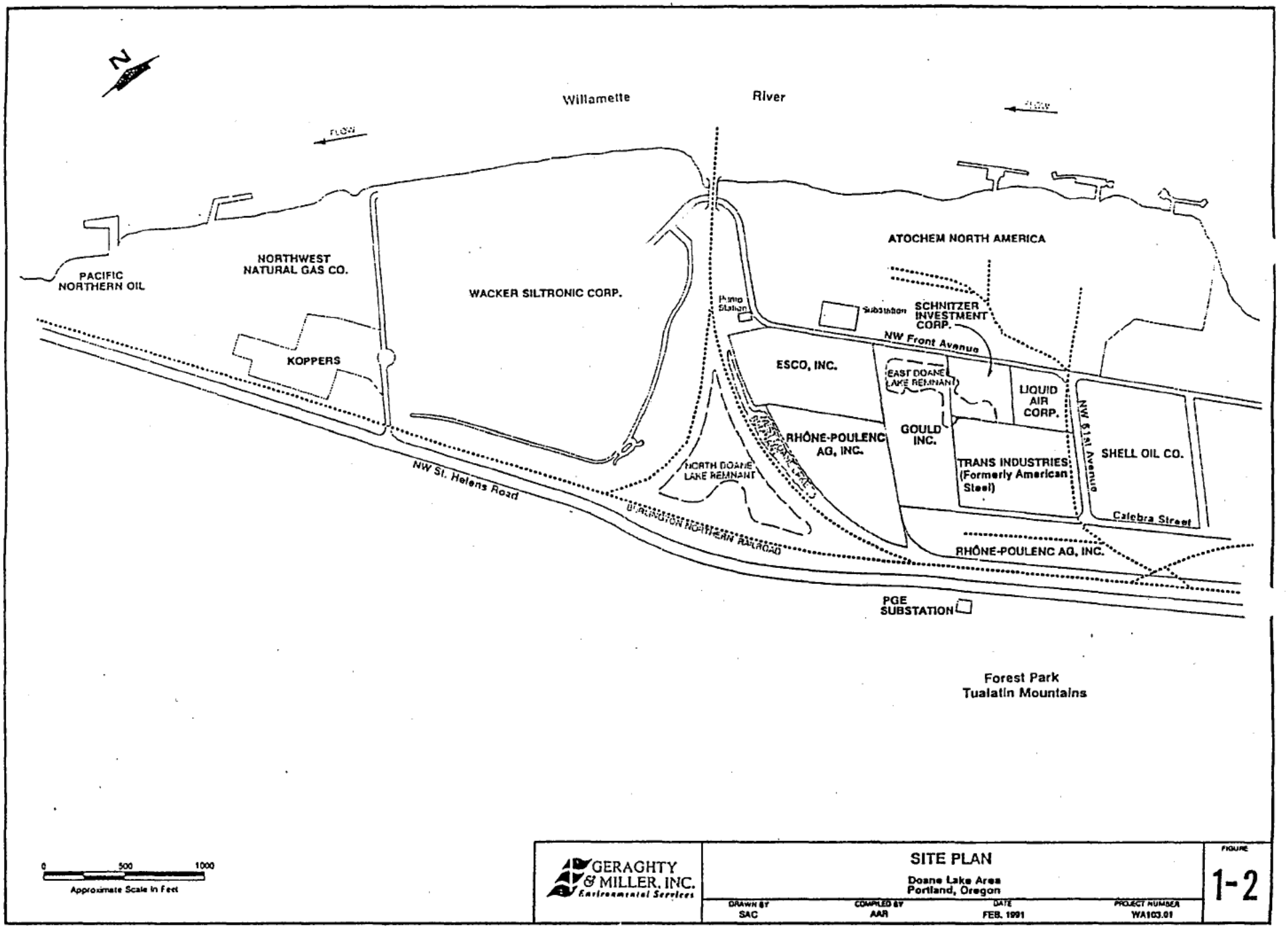


FIGURE 2-10: Plant Layout at Closure

ATTACHMENT 5

DOANE LAKE AREA MAP



GERAGHTY & MILLER, INC.
Environmental Services

SITE PLAN

Doane Lake Area
Portland, Oregon

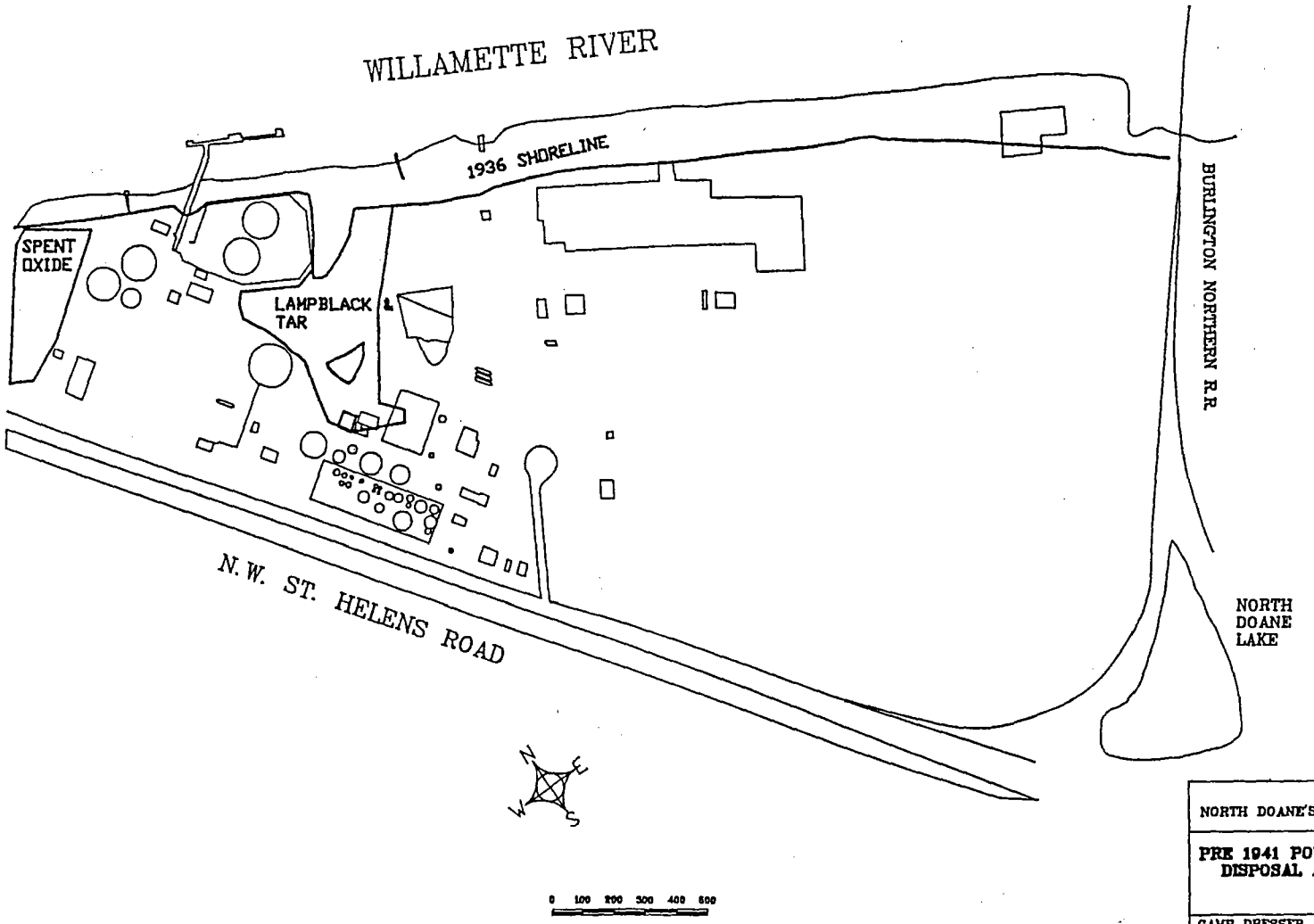
DRAWN BY	COMPILED BY	DATE	PROJECT NUMBER
SAC	AAR	FEB. 1991	WA103.01

FIGURE 1-2

SCOEPA00003341

ATTACHMENT 6

PRE-1941 DISPOSAL AREAS



NORTH DOANE'S LAKE SITE INVESTIGATION

PRE 1941 POTENTIAL WASTE DISPOSAL AREAS

CAMP DRESSER & McKEE INC
8200 13th STREET
SUITE 400
DENVER, COLORADO 80202

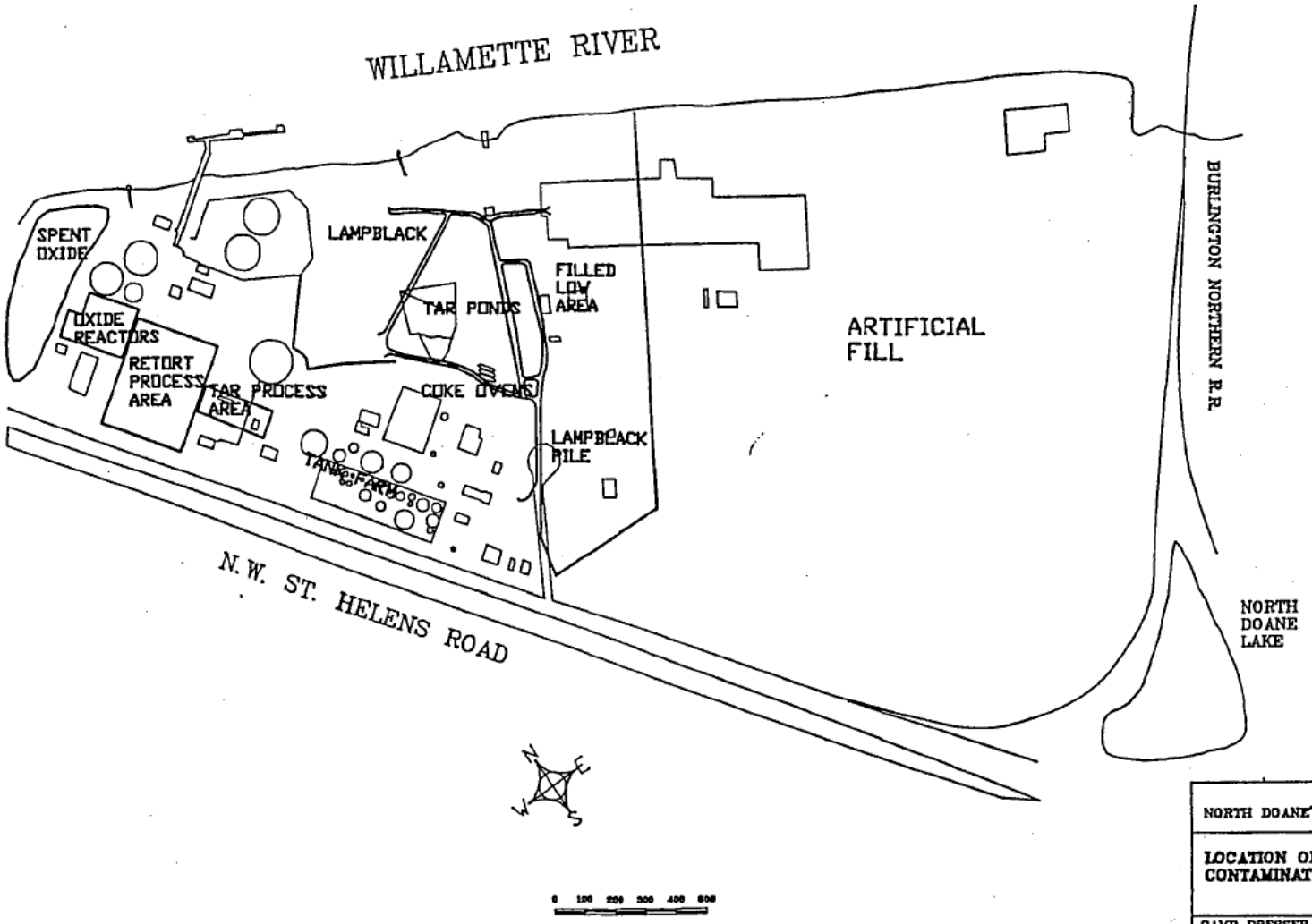
SHEET NO.
2-9

CDM 8455-110

SCOEPA00003343

ATTACHMENT 7

POST-1941 DISPOSAL AREAS



NORTH DOANE'S LAKE SITE INVESTIGATION

LOCATION OF POTENTIALLY CONTAMINATED AREAS

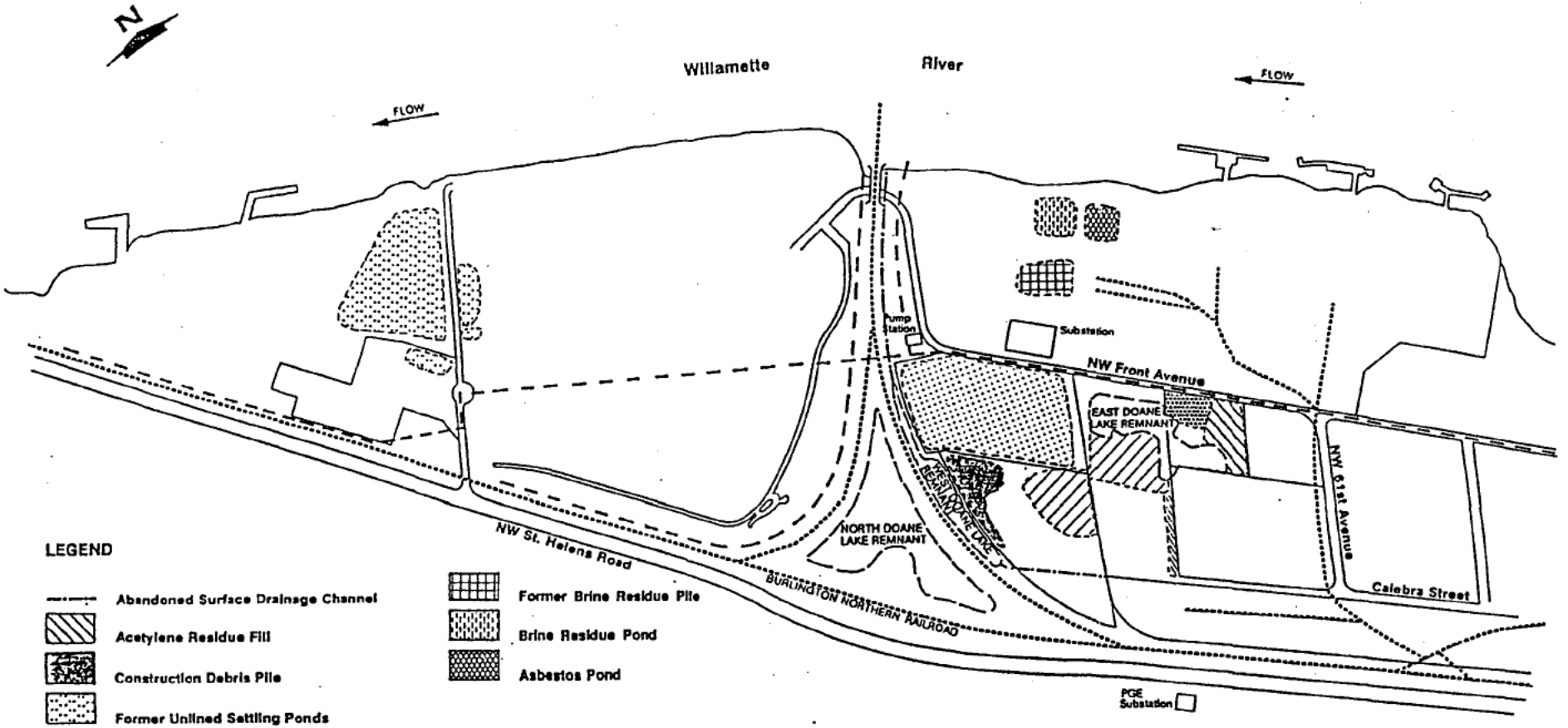
CAMP DRESSER & McKEE INC
8200 13th STREET
SUITE 400
DENVER, COLORADO 80202

SHEET NO.
2-11

CDM 8433-110

ATTACHMENT 8

GENERAL WASTE DISPOAL AREAS



LEGEND

- Abandoned Surface Drainage Channel
- Acetylene Residue Fill
- Construction Debris Pile
- Former Unlined Settling Ponds
- Foundary Casting Sands Fill
- Shredded Auto Body Fill
- Smelter Matte and Battery Casing Fill
- Suspected Battery Casing Fill
- Utility Trench Backfill
- Former Brine Residue Pile
- Brine Residue Pond
- Asbestos Pond

0 500 1000
Approximate Scale in Feet

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

SCOEPA00003347

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)

Dec. 1988

WACKER SILTRONICS
Chronology of Past Events and Incidents

pre 1900 Wacker site remained essentially undisturbed with the exception of railroad building activity.

1940's Portland Gas and Coke may have begun using a low strip along the northwest edge of the property to dispose of some residual products from their operation.

1970's Wacker site was filled to construct industrial buildings.

1976 Wacker representatives first observation of site.

1977 to 1978 A total of ten test borings were made in the site, all prior to purchase

April 17, 1978 Wacker purchases Multnomah County property from Portland Development Commission as part of an urban renewal of the area.

Oct 1978 Wacker Siltronic begins construction of silicon wafer plant.

~~July 5, 1978 DEQ okays associated parking plan.~~

Feb 12, 1979 Interoffice memo indicating a groundwater contamination problem regarding two areas where oil had been found. The oil was only in pits located in the NW corner of the property adjacent to Kopper's Company.

March 2, 1979 Meeting between DEQ, Wacker, and CH2M Hill regarding oil found during construction on the Wacker Site. Oil exists in a free state, appears relatively recent.

March 10, 1979 Oil is found near Olympic's pipeline.

March 12, 1979 DEQ Analysis - Oil sample dug directly over Olympic Pipeline #5 (sample D-200) containing more than 30 hydrocarbons components were detected in the C_8 to C_{19} range with C_{12} being the midpeak. Does not match with sample 6260 (taken from Olympic pipeline) which had hydrocarbon components in the C_{10} to C_{22} range with C_{15} being the mid peak.

Sept 25, 1979 Representatives of the EPA and DEQ met to discuss the completed inventory forms of possible sources of hazardous waste.

Dec 1979 Construction on plant was completed.

March 1980 Operation at plant begins.

July 8, 1980 Waste water plant operator (Wacker) noticed clarifier was a green color. Lab results indicated 12 ppm total chromium in neutralizer tank and 21 ppm in the clarifier. Estimates indicate that 1/2 to 2 pounds of metal chrome entered the Willamette River. Conc. about 21 ppm probably entered river.

Nov 19, 1980 Applied as a generator of hazardous waste; RCRA permit application.

Dec 16, 1980 Chromic acid spill - total initial chromium at 67 ppm. Stayed in waste water treatment plant collection tank. Shipped to Arlington.

Feb 25, 1981 Chromic acid tank overflow spill - 6,000 gallons of chrome and nitric acid (est. 20 ppm each). Material entered a floor drain which connects with a neutralizing tank. Spill site was not observed.

Aug 3, 1983 Uncontrolled release of a diluted nitric/hydrofluoric acid mixture to Willamette River. About 45 gallons of a 65% acid mixture was flushed with 120,000 gallons of normal outfall flow.

Oct 1983 Wacker announced a five year expansion program involving the purchase of new equipment and new construction.

Dec 21, 1983 TCE spill - degreaser bath overflowing with TCE onto the floor. Estimated 40 ppm TCE, total amount 10 to 20 gallons. Most TCE remained on floor. An anonymous complaint filed indicated 100 gallons of TCE spilled, ~~that~~ was cleaned up and then dumped outside on the ground. Inspection of complaint found no evidence of this.

Dec 21, 1983 Spill of chromic acid into waste water system. 20 gallons of dilute chromic waste ran out on the floor. 10 gallons of this waste containing 1.5 pounds of 1.5 ppm chromic acid entered the waste system and discharged into the river.

Dec 27, 1983 Spill of chromic acid into waste water system. 10 lbs of chromic acid with a conc. 2.0 ppm entered the waste system and was discharged into the river.

April 1984 Wacker expansion program was increased.

May 28, 1984 Total of an estimated 3.7 pounds of neutralized chromic acid was discharged over a period of 11 hours with an average hexavalent chromium concentration of 1.2 ppm at the outfall. This was diluted with 250,000 gallons of water. Some spill on equipment room floor. Most of the water was discharged into the river.

Oct 1984 Wacker announces its intentions to build facilities at

a location west of the existing plant to produce polycrystalline material from ferrosilicon feedstock.

Dec 3, 1984 Spill of an estimated 0.33 gallons (conc. 1,300 ppm or .13%) of TCE around stripper unit with 359.67 gallons of water. Most of spill seeped into ground. Original estimate; 700 gallons of waste water, 7 gallons (1%) of TCE. No clean up.

Dec 31, 1984 Spill of an estimated 11.6 gallons (19,000 ppm or 1.9%) of TCE from stripper unit with 888.4 gallons of water. Ground frozen allowing for surficial runoff down to asphalt road ~~into sewage drain.~~ Original estimate; 500 gallons of waste water with 10% TCE. Removal of soil around tank and development of holding pen in early months of 1985.

June 14, 1985 Wacker officially (news release) postponed plans to build a new ~~$ 80 million~~ plant in NW Portland based on initial tests showing the presence of toxic chemicals below ground surface.

June 20, 1985 Wacker soil samples from monitoring wells in potential western expansion area show various levels of contaminants.

Sept 17, 1985 8 hour composite sample - 0.034 mg/L TCE; 0.002 mg/L trans-1,2,-dichloroethylene.

Nov 13, 1985 Concern from state aquatic toxicologist that short-term test indicate acute responses to waste water effluent. Concerned about long-term chronic effects.

Dec 20 1985 Northwest Test Labs - Wacker waste water; TCE 330 ppb.

Jan. 17, 1986 Letter from Wacker - waste water analysis; TCE above tracer limits, below 1.37 mg/L limit. Actual concentration not given.

April 30, 1986 Final effluent grab sample; sample B0251 - 0.086 ppm TCE, ?? ppm trans-1,2- dichloroethylene, 0.003 ppm chloroform.

June 17, 1986 Evaluation report - since startup, Wacker has had difficulty consistently meeting BOD and TSS concentration and loading limits of the permit.

April 1987 North Doane Lake site characterization plan, final draft.

June 3, 1987 Combined outfall sample indicate TCE conc. of 0.022 mg/L. Sample B2745.

June 27, 1987 Organic Waste Water (OWW) line in the south yard plugged up causing waste water to back and run across gravel

yard onto main roadway crossing. Very weak concentration of detergents. Estimated 2,000 gallons went to river.

Oct 1987 Preliminary assessment report, Wacker Siltronic - Ecology and Environment.

Sept 1988 Final scope of work, hydrogeological investigation, NL/Gould - Tetra Tech Inc.

Dec 12, 1988 Wacker's use of TCE has stopped. Waste TCE is being stored on site until job is done.

RELEVANT INFORMATION

Wacker has three basic hazardous waste streams:
- Chromic from the HF etching process
- TCE from "cleaning process"
- Freon from electronic cleaning and degreassing

Wacker Siltronic used some 29 process chemicals and four herbicides on site. Detailing of handling, storage, transportation and disposal are presented in the written analysis for the Wacker Siltronic site.

Wacker has had at least six incidents since 1979 involving the discharge of hazardous materials from their facility. These discharges have included chromic acid (7/80, 12/80, 5/84), TCE (12/83, 12/84), and waste water (6/87).

30 WACKER

Department of Environmental Quality

811 SW SIXTH AVENUE, PORTLAND, OREGON 97204-1390 PHONE (503) 2

TO: Larry Edelman, Dept of Justice August 15, 1989
FROM: Rick Malin, ECD:DEQ
Subject: North Doane Lake site investigation

In reviewing the site history of North Doane Lake, I came across the following information regarding Wacker Siltronics preconstruction investigation from the City of Portland, Building Inspections Document Control files.

Aug 1977 - Three soil test borings and three penetrometer probes were conducted on the Wacker site. Testing concentrated on the area of what is now the processing building. This sampling was conducted by CH2M HILL and submitted in a September 1977 Geotechnical and Vibration Monitoring Investigation report to Wacker. In the boring log legend section of the report, each boring log has multiple references to bitumen. Bitumen is a generic term applied to natural inflammable substances of variable color, hardness, and volatility, composed principally of a mixture of hydrocarbons substantially free from oxygenated bodies. Petroleums, asphalts, natural mineral waxes, and asphaltites are all considered bitumens. The undisturbed sample description table in the report has similar observations. Copies of the logs are attached.

April 1978 - Wacker purchases the Multnomah County property from the Portland Development Commission as part of an urban renewal of the area.

Aug 1978 - Seven soil test borings and nine penetrometer probes were conducted to expand and supplement the earlier data. These boring logs use the terms "oil saturated" or "oily" in their descriptions of contaminated sections encountered in the test borings. This information was submitted to Wacker in a CH2M HILL report titled Second Phase Geotechnical Investigation

I was only able to review the geotechnical sections of these reports. The principal concern was the degree of settlement that would potentially occur and therefore how much preloading would be required, and how much vibration was created by the nearby railroad. In the small portion of text I was able to review there was no discussion on this bituminous material encountered.

Please contact me or Sandra Anderson at 229-6744 if you have any questions. We are continuing our investigation of the North Doane Lake area and will keep you informed of our findings.

cc: Sandra Anderson, ECD:DEQ

DEQ-1

KOPPER COMPANY, INC.

Summarization of Data

Files Reviewed:
NW Region
Site Assessment
Air Quality

The Koppers Company operates a creosote transfer and repackaging facility on land it leases from Northwest Natural Gas. This site is the area on which Northwest Natural Gas operated a coal coking oven in the early part of this century. Situated on or near this property are believed to be the remains of coal tar pits used to dispose of unwanted coke production by-products.
- Interoffice memo, to:file, from Dennis Adamczyk, 12/26/86.

The above company has been investigated previously under the abandoned hazardous waste disposal site inventory in 1982. One set of samples were taken from five groundwater monitoring wells in 1982 for phenols. The wells surround an area which up until ten years ago received waste coal tar distillates. There was a benzene plant at this location which operated in the 1940's?
- Interoffice memo, to:Gary Calaba, from CHGray, 8/27/84.

Plant disposed of waste coal tar distillates in a disposal area close to the Wacker property boundary and NW Front Ave. Area is approximately 40 ft x 70 ft. Monitoring wells results 7/19/82. Amounts in mg/l.

Constituent	Well#1	Well#2	Well#3	Well#4
Phenol	0.59	24.0	0.12	0.44

summary of monitoring well results 12/19/84. Analysis for Acid extractables, base/neutral extractables, pesticides, and GC/MS scan. Amounts in mg/l. Extractables not listed <1 mg/l. Soil sample was also taken 18 inches below surface, Kopper's storm runoff basin (see map). Sampled 9/7/84. Amounts in mg/kg.

Constituent	Well#1	Well#2	Well#3	Well#4	Soil
Naphthalene	48	3	2	4.2	140
Acenaphthene	45	3	-	1.2	150
Florene	65	3	3	1.9	280
Phenathrene	240	11	9	5.5	840
Anthracene	330	9	47	13.1	1350
Flouranthene	110	4	3	1.8	140
Pyrene	88	3	2	-	120
Chrysene	-	1	2	0.5	30
Ethylbenzene	3800	-	24	51	-
1,2-Dimethylbenzene	2600	0.3	314?	22	-
Dibenzofuran	-	0.1	6	8	230

2-Methylnaphthalene	-	-	8	14	-
9H-Carbazole	-	-	20	10	300
4-Methylphenanthrene	-	-	2	-	70
3-Methylphenanthrene	-	-	5	2	-
1-Methylnaphthalene	-	-	-	-	180
1,3-Benzenedicarbonithrile		-	-	-	20
1,4-Dihydro-1,4-Methanonapthalene			-	-	120
1,1'-biphenyl	-	-	-	-	60
2-Ethylnapthalene	-	-	-	-	20
1,7-Dimethylnapthalene		-	-	-	60
1,4-Dimethylnapthalene		-	-	-	35
2,7-Dimethyloctane	-	-	-	-	10
1,3,6-Trimethylnapthalene		-	-	-	20
2-Methyl-1,1'-Biphenyl		-	-	-	30
9,10-Dihydrophenanthrene		-	-	-	20
Dibenzothiophene	-	-	-	-	40
4-Methyldibenzothiophene		-	-	-	30
2-Methylphenanthrene	-	-	-	-	130
2,5-Dimethylphenanthrene		-	-	-	30
2,3-Dimethylphenanthrene		-	-	-	30

- From NW Region file

Process Waste: Dehydration water and wet oil from the still are collected in tanks #23 and #18 respectively. Oil-free water is drained from these tanks to the existing adjacent sump, along with water from the pump room floor drains and the laboratory sink drains. As existing sump pump transfers the water to an 18 ft. diameter x 24 ft. high surge tank. The surge tank is located next to a drain field which has been divided into three sections. Each section has a central ditch which feeds furrows plowed at right angles. Water is admitted to one end of the ditch through an 8" pipe line with a quick opening valve. When the valve is opened, the ditch fills and overflows into the furrows flooding the section. The Effluent Services Group of the Koppers Research Department at Monroeville has studied treatment methods for handling these process waste waters. The most promising method being soil irrigation or soil percolation. The waste waters are also biodegradable using extended aeration.

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PA Report, Koppers Site, EPA Region X, 10/87.

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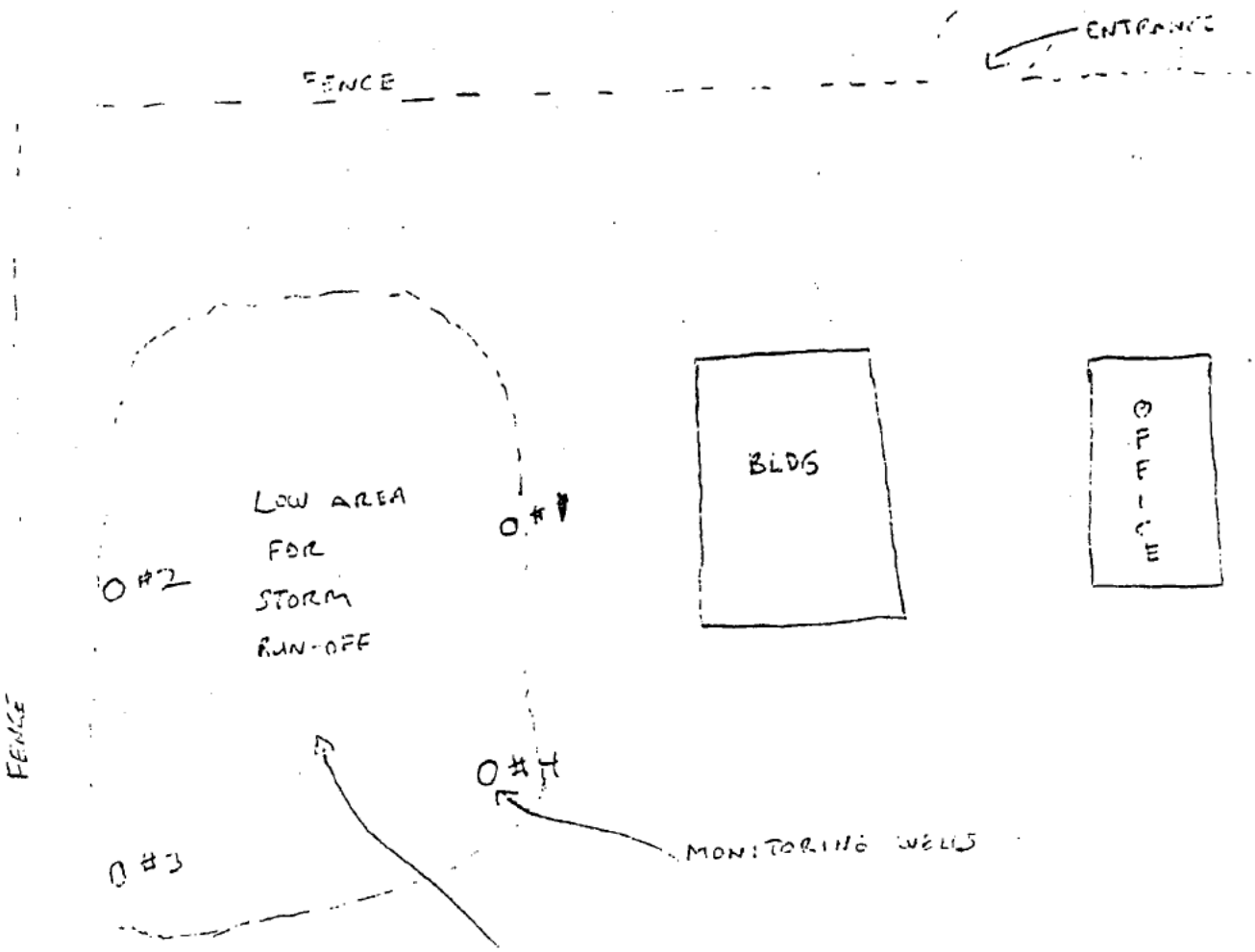

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Dec 1973 Production facilities at the plant were shut down because of lack of raw materials.

April 1975 Oil contaminated waters being discharged from Kopper property - oily waste deposited on property such that it is entering or likely to enter public water.

Dec 23 1975 Kopper notifies DEQ that they are no longer producing industrial pitch (roof pitch).

June 28 1976 Kopper notifies DEQ that the volume if unprocessed coal tar remaining at the facility is 720,000 gallons.

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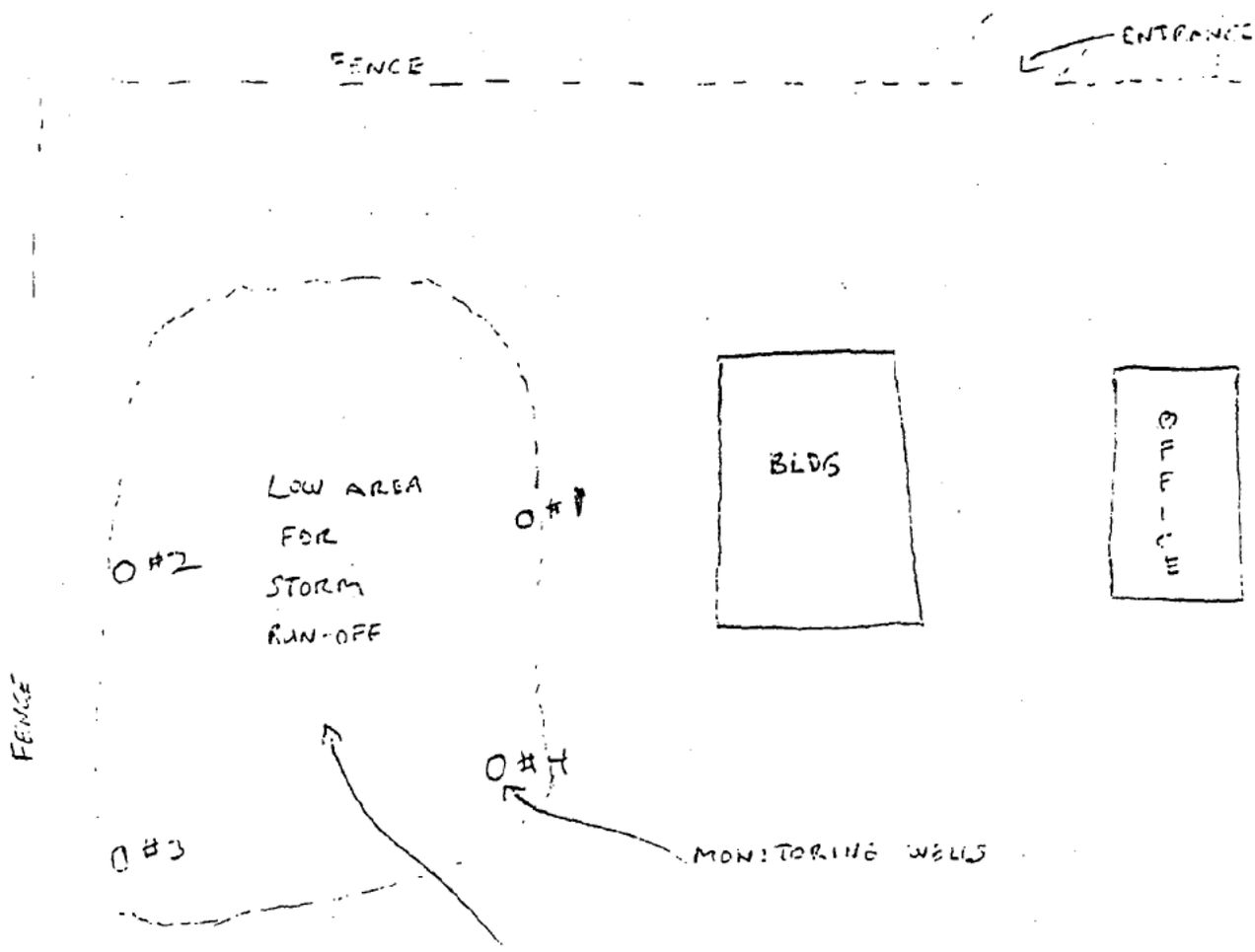

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LIQUID AIR CORPORATION - Acetylene Plant

Summarization of Data

Files Reviewed:
Site Assessment File
NW Region file

Acetylene plant use to discharge lime waste water to Doane Lake. In 1976 company installed a recirculation pond to contain and reuse its waste water and lime (Doane Lake diked off). 10% lime slurry from manufacture of acetylene -- prior to 1979 dumped into Doane Lake, 1976 to present lime waste water reused and recirculated.

- from inventory of possible sources of hazardous waste, site assess. file, by Elaine Glendening, 8/21/79.

The principle wastes disposed of on site are calcium hydroxide solids (in the presence of water, corrosive with high pH of 11 to 13) from the acetylene manufacturing process and shredded auto wastes (non-magnetic separables: glass, plastic, rubber, some oil and sludges, paints, etc.) from Schnitzer's metal scrap operations. The exact quantity of the wastes is unknown. It has been estimated that the northern half of the property was landfilled, half each with shredded auto wastes and calcium hydroxide solid waste. The high pH values created by the calcium hydroxide may potentially cause reaction with other landfill materials.

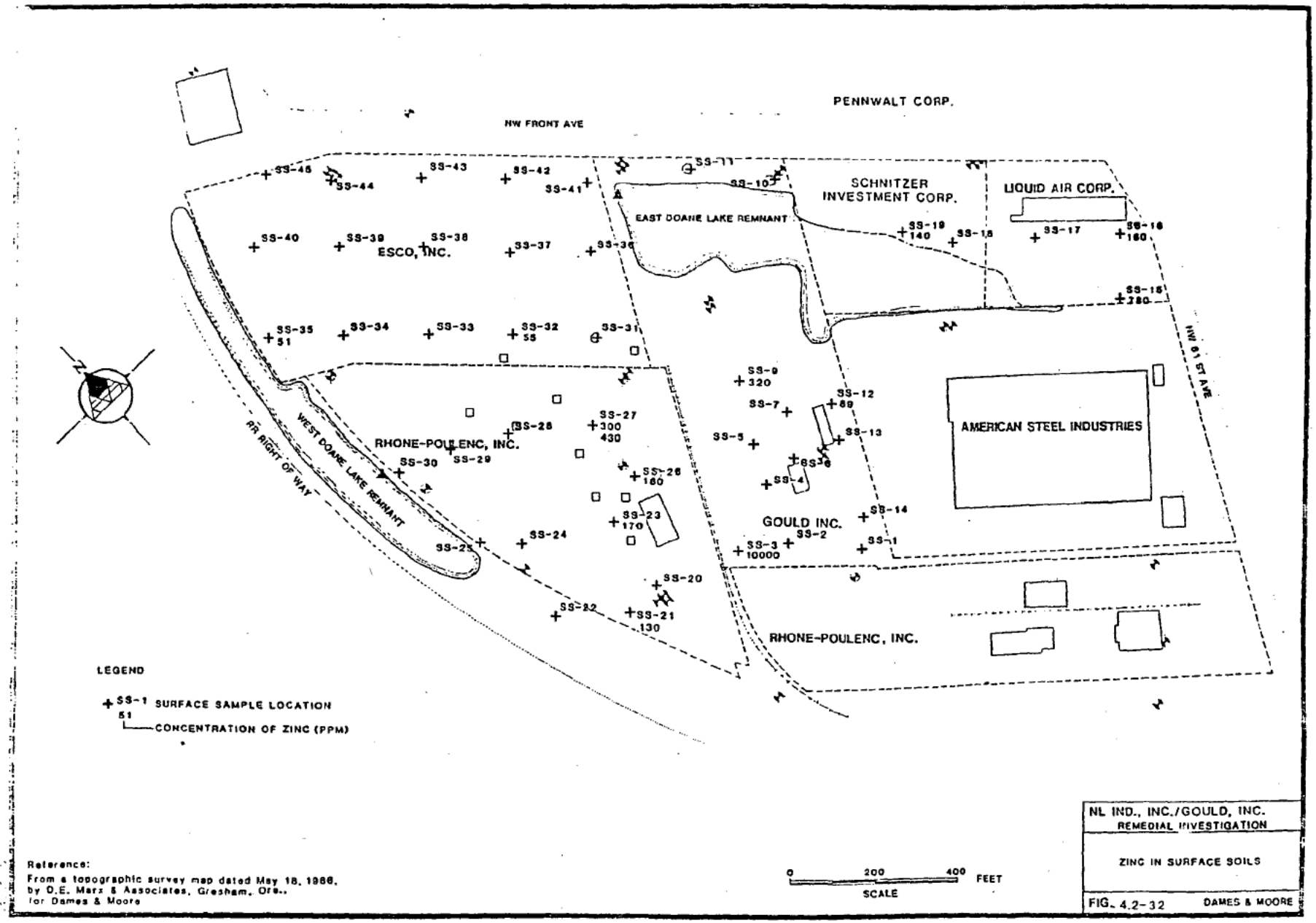
Surface soil sampling results - from NL Ind., Inc/ Gould Inc. RI sampled Aug - Sept 1986. In ppm

Constituent	SS-15	SS-16	SS-17
Iron	31000	37000	-
Zinc	780	160	-
Chromium	390	170	-
Cadmium	2.5	1.8	-
Arsenic	7.8	16.0	-
Lead	230	120	230
pH	8.4	8.4	8.6
Sulfate	34	21	-

Surface Water and Groundwater Monitoring - from NL Ind., Inc./ Gould Inc. RI, sampled Aug - Sept 1986. In mg/l U - below detection limit, value indicates detection limit. Samples from second aquifer.

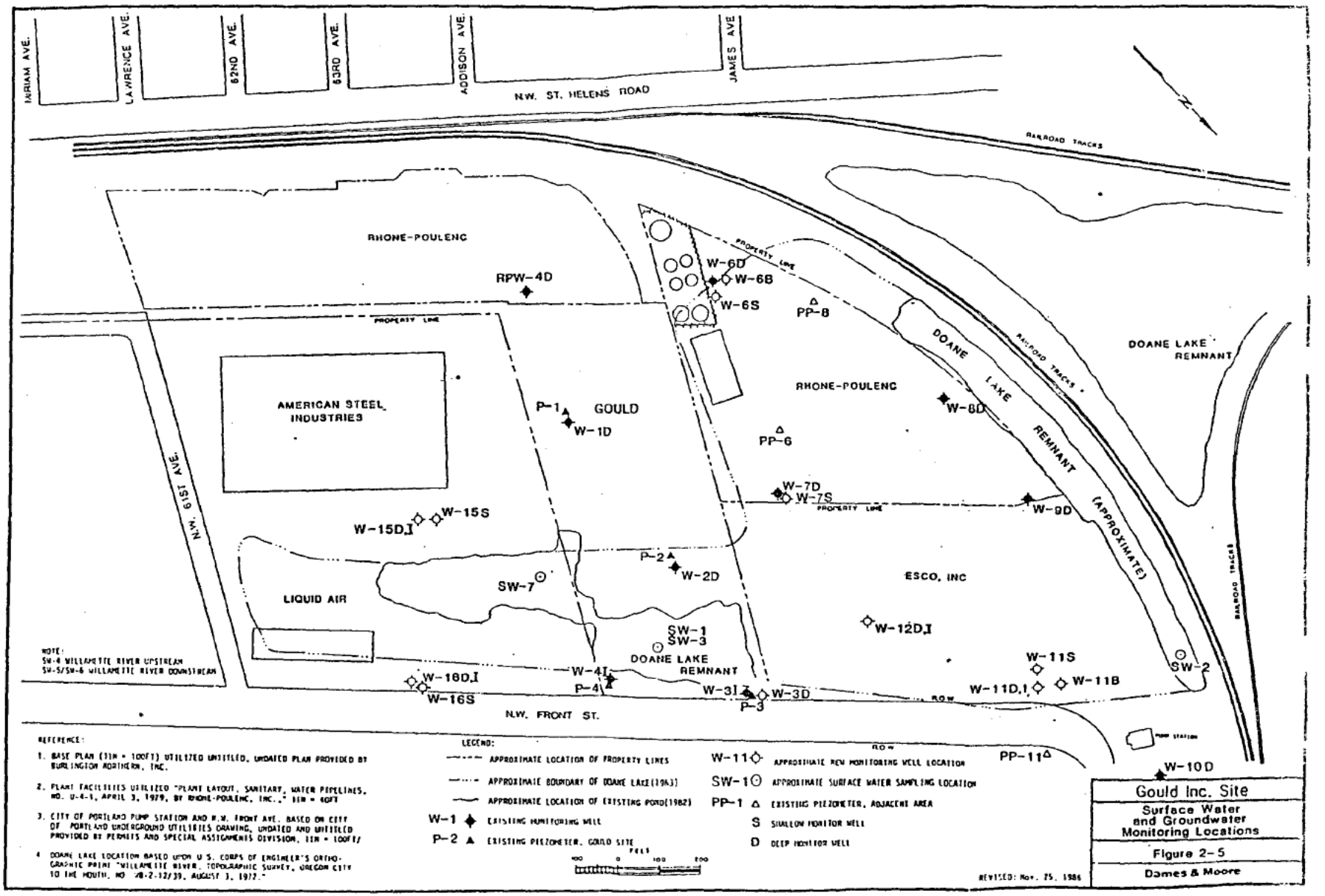
Constituent	W-15S(2) up-gradient?	W-16S(2) down-gradient?
pH	12.3 field 12.0 lab	7.8 field 12.5 lab
Lead	0.01	0.01
Magnesium	0.01U	28.0
Arsenic	0.005U	0.018
Phosphate	0.016	0.100
Cadmium	0.002U	0.002U
Calcium	130.0	47.0
Chromium	0.005U	0.005U
Potassium	12.0	9.8
Zinc	0.033	0.017
Iron	0.01U	0.01U
Sulfate	17.0	14.0
Sodium	63	55
TOC	8.7	16
Chlorine	19	43
Nitrate	0.83	0.32
EC (umho/cm)	2000	770

- from Preliminary Assessment, by DEQ to EPA 7/24/87.



Reference:
From a topographic survey map dated May 18, 1986, by O.E. Marx & Associates, Gresham, Ore., for Dames & Moore

SCOEPA00003364



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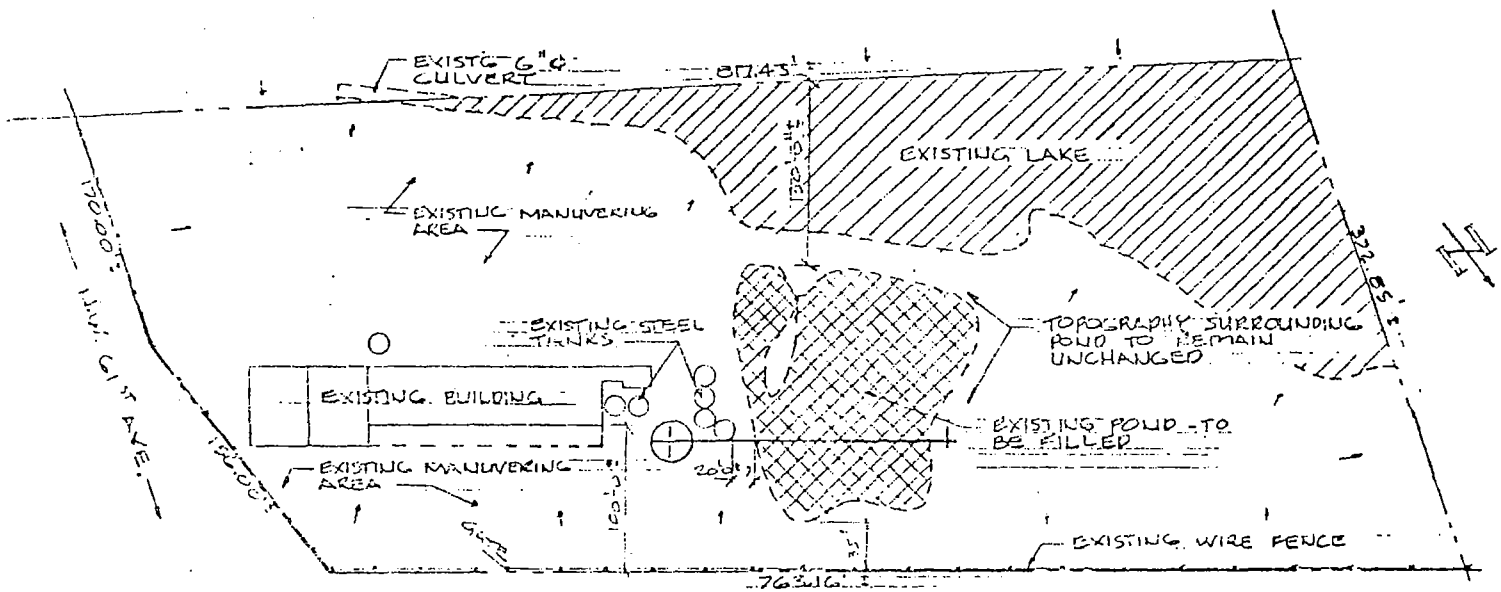

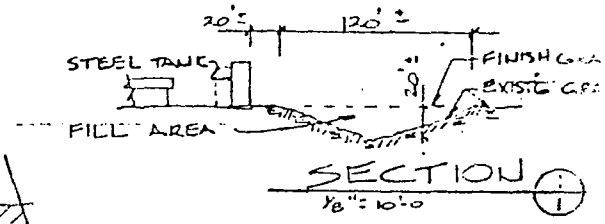

NOTE:

1. EXCESS DEBRIS, LIME, & WATER TO BE REMOVED FROM FILL AREA PRIOR TO FILLING.
2. FILL TO BE PLACED IN APPROXIMATELY 18" LIFTS, COMPACTING EACH LAYER AS THE FILL PROGRESSES. (90% COMPACTION)
3. FILL TO BE OF SUBSTANTIAL MATERIAL LENDING ITSELF WELL TO COMPACTION. (NOT A DEGRADABLE SUBSTANCE)
3. APPROXIMATE FILL QUANTITY IS 4500 CUBIC YARDS.

LEGAL DISCRIPTION
SEC. 13 IN IW LOT 33 (6.32 ACRES)

BUREAU OF PLANNING
CU 2-82
CITY OF PORTLAND

RECEIVED
DEC 29 1981
City of Portland
Bureau of Planning

1 12/21/81 GEN. REVISION

EN KROMBEIN CONSULTING ENGINEER 45 SE 3rd AVE. PORTLAND	SITE FILL @ 6501 N.W. FRONT AVENUE FOR SCHNITZER INVEST. CO.	REGISTERED PROFESSIONAL ENGINEER 2622 OREGON	DATE 16 DEC-'81	SHEET 1

SCOEPA00003366

LIQUID AIR CORPORATION - Acetylene Plant

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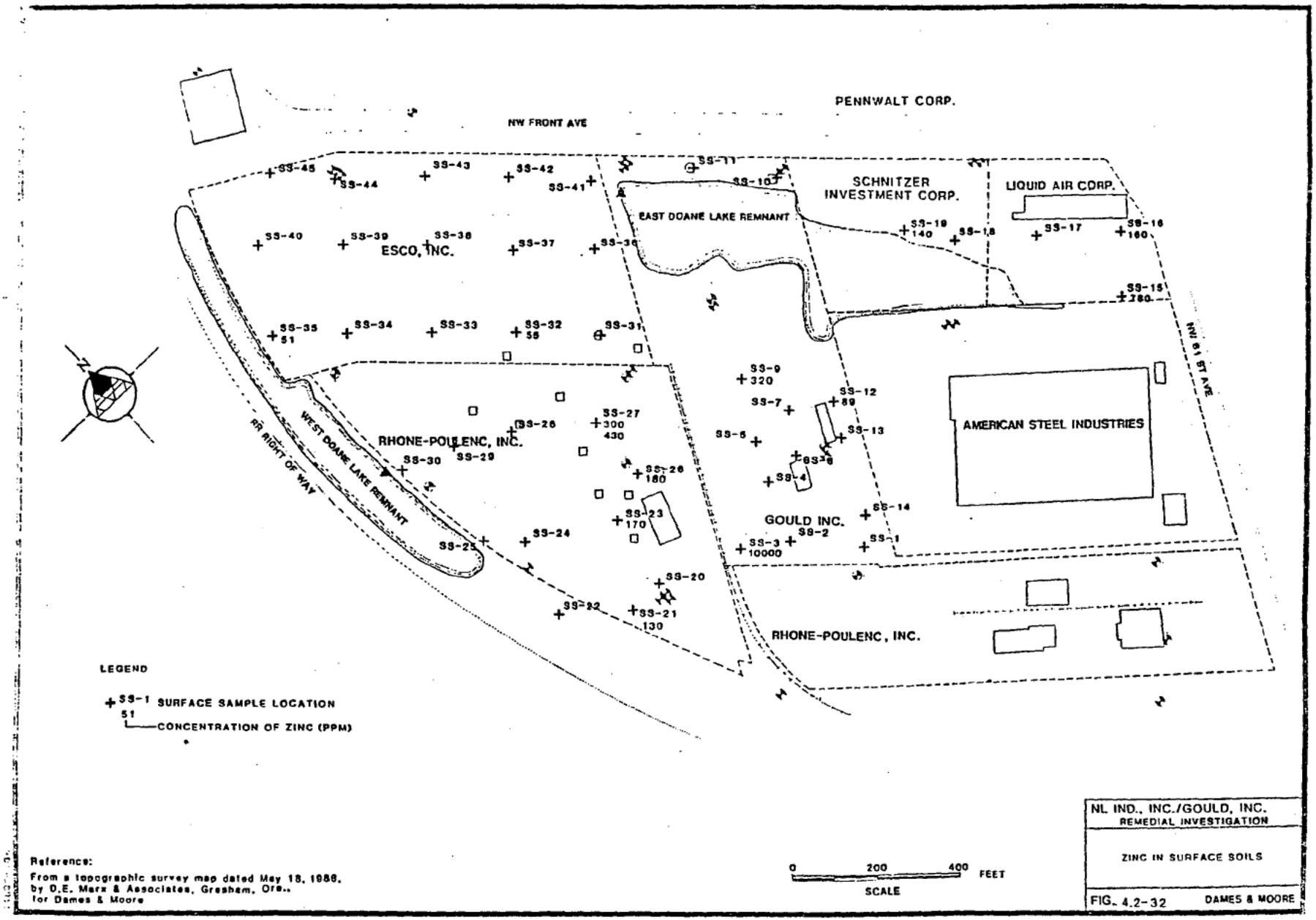
Surface soil sampling results - from NL Ind., Inc/ Gould Inc. RI sampled Aug - Sept 1986. In ppm

Constituent	SS-15	SS-16	SS-17
Iron	31000	37000	-
Zinc	780	160	-
Chromium	390	170	-
Cadmium	2.5	1.8	-
Arsenic	7.8	16.0	-
Lead	230	120	230
pH	8.4	8.4	8.6
Sulfate	34	21	-

Surface Water and Groundwater Monitoring - from NL Ind., Inc./ Gould Inc. RI, sampled Aug - Sept 1986. In mg/l U - below detection limit, value indicates detection limit. Samples from second aquifer.

Constituent	W-15S(2) up-gradient?	W-16S(2) down-gradient?
pH	12.3 field 12.0 lab	7.8 field 12.5 lab
Lead	0.01	0.01
Magnesium	0.01U	28.0
Arsenic	0.005U	0.018
Phosphate	0.016	0.100
Cadmium	0.002U	0.002U
Calcium	130.0	47.0
Chromium	0.005U	0.005U
Potassium	12.0	9.8
Zinc	0.033	0.017
Iron	0.01U	0.01U
Sulfate	17.0	14.0
Sodium	63	55
TOC	8.7	16
Chlorine	19	43
Nitrate	0.83	0.32
EC (umho/cm)	2000	770

- from Preliminary Assessment, by DEQ to EPA 7/24/87.



Reference:
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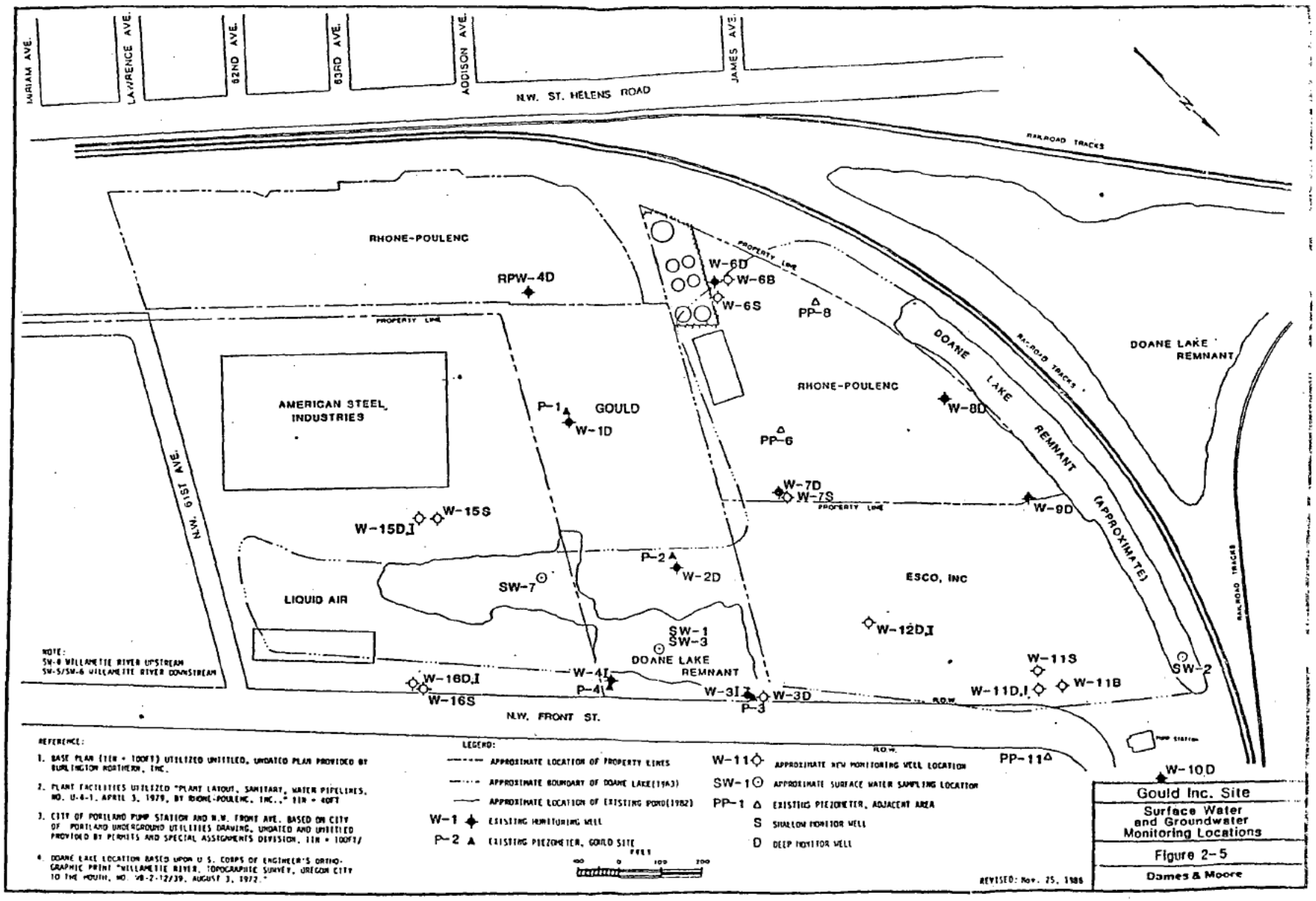

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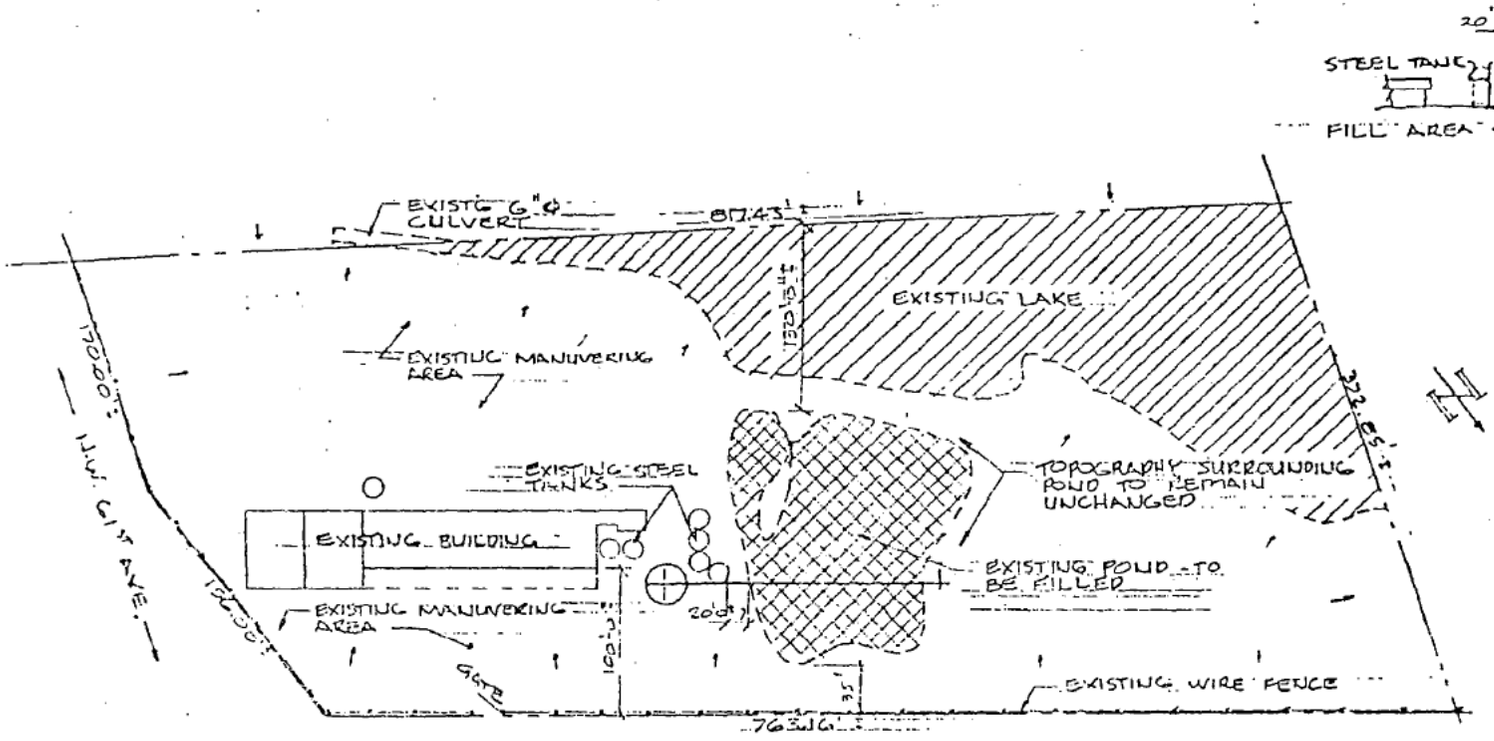
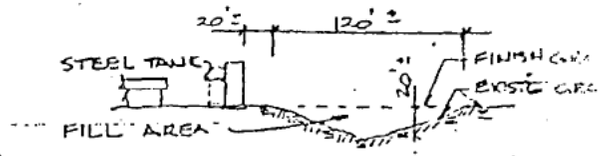


SITE PLAN
1/8" = 10'-0"



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NOTE:

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2. FILL TO BE PLACED IN APPROXIMATELY 18" LIFTS, COMPACTING EACH LAYER AS THE FILL PROGRESSES. (90% COMPACTION)
3. FILL TO BE OF SUBSTANTIAL MATERIAL LENDING ITSELF WELL TO COMPACTION. (NOT A DEGRADABLE SUBSTANCE)
3. APPROXIMATE FILL QUANTITY IS 4500 CUBIC YARDS.

LEGAL DISCRIPTION
SEC. 13 IN IW LOT 33 (6.32 ACRES)

BUREAU OF PLANNING
CU 2-82
CITY OF PORTLAND

RECEIVED
DEC 29 1981
City of Portland
Bureau of Planning

⚠1 12/21/81 GEN. REVISION

EN KROMBEIN CONSULTING ENGINEER 445 SE 6th AVE. PORTLAND 239-4080	SITE FILL @ 6501 N.W. FRONT AVENUE FOR SCHNITZER INVEST. CO. PORTLAND OREGON	REGISTERED PROFESSIONAL ENGINEER 2022 OREGON AUGUST 22 1975 EDWARD E. KROMBEIN, P.E.	DATE 16 DEC-'81	SHEET 1

SCOEPA00003371

LIQUID AIR CORPORATION - Acetylene Plant

Summarization of Data

Files Reviewed:
Site Assessment File
NW Region file

Acetylene plant use to discharge lime waste water to Doane Lake. In 1976 company installed a recirculation pond to contain and reuse its waste water and lime (Doane Lake diked off). 10% lime slurry from manufacture of acetylene -- prior to 1979 dumped into Doane Lake, 1976 to present lime waste water reused and recirculated.

- from inventory of possible sources of hazardous waste, site assess. file, by Elaine Glendening, 8/21/79.

The principle wastes disposed of on site are calcium hydroxide solids (in the presence of water, corrosive with high pH of 11 to 13) from the acetylene manufacturing process and shredded auto wastes (non-magnetic separables: glass, plastic, rubber, some oil and sludges, paints, etc.) from Schnitzer's metal scrap operations. The exact quantity of the wastes is unknown. It has been estimated that the northern half of the property was landfilled, half each with shredded auto wastes and calcium hydroxide solid waste. The high pH values created by the calcium hydroxide may potentially cause reaction with other landfill materials.

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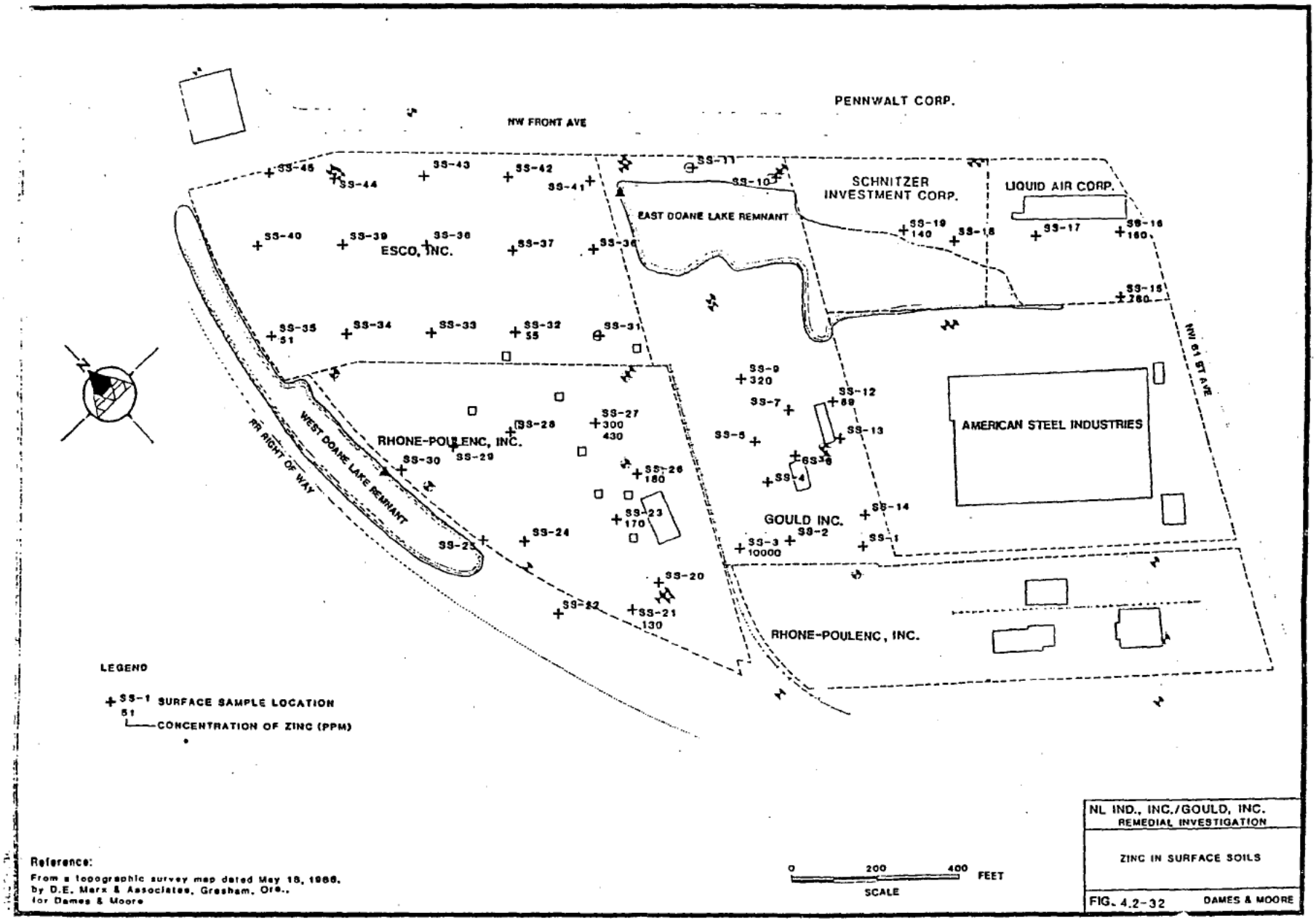

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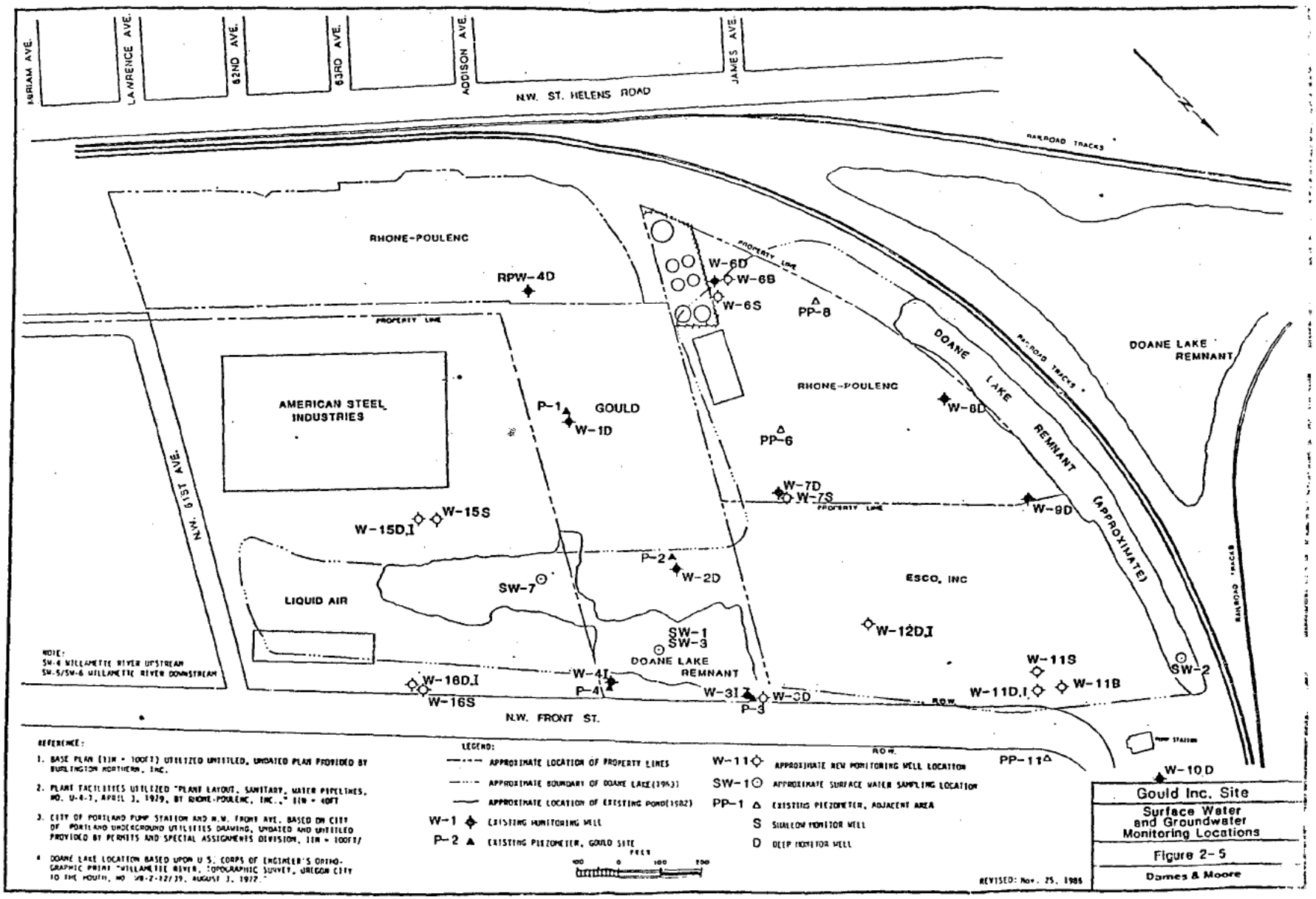

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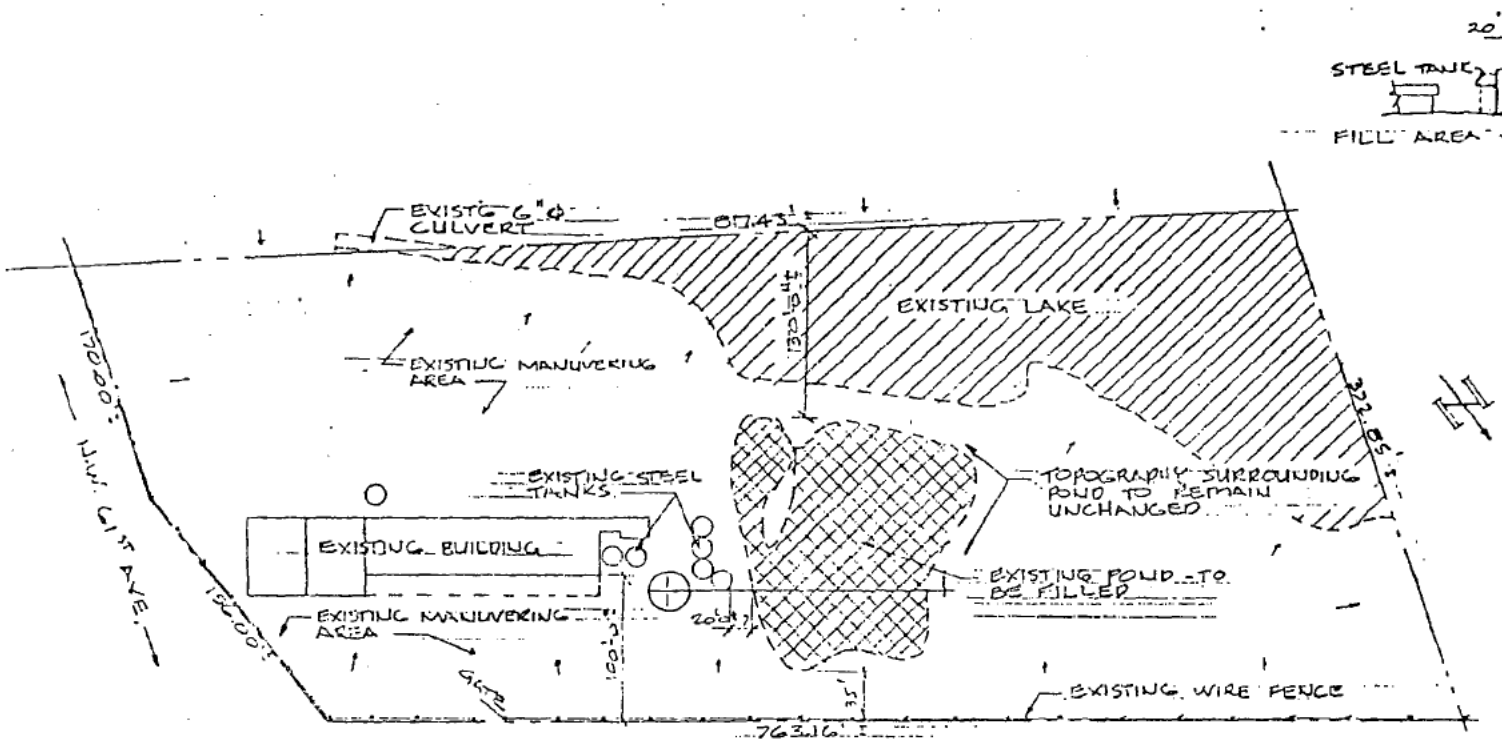
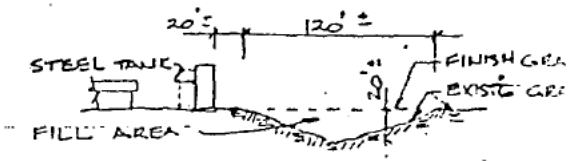


SITE PLAN
1/8" = 10'-0"



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LEN KROMBEIN CONSULTING ENGINEER [illegible] SE 6TH AVE. PORTLAND 239-4080	SITE FILL @ 6501 N.W. FRONT AVENUE FOR SCHNITZER INVEST. CO. PORTLAND OREGON	REGISTERED PROFESSIONAL ENGINEER 2622 OREGON AUGUST 12 1975 LEONARD F. KROMBEIN, P.E.	DATE 16 DEC-'81	SHEET 1

SCOEPA00003376

KOPPER COMPANY, INC.

Summarization of Data

Files Reviewed:
NW Region
Site Assessment
Air Quality

The Koppers Company operates a creosote transfer and repackaging facility on land it leases from Northwest Natural Gas. This site is the area on which Northwest Natural Gas operated a coal coking oven in the early part of this century. Situated on or near this property are believed to be the remains of coal tar pits used to dispose of unwanted coke production by-products.
- Interoffice memo, to:file, from Dennis Adamczyk, 12/26/86.

The above company has been investigated previously under the abandoned hazardous waste disposal site inventory in 1982. One set of samples were taken from five groundwater monitoring wells in 1982 for phenols. The wells surround an area which up until ten years ago received waste coal tar distillates. There was a benzene plant at this location which operated in the 1940's?
- Interoffice memo, to:Gary Calaba, from CHGray, 8/27/84.

Plant disposed of waste coal tar distillates in a disposal area close to the Wacker property boundary and NW Front Ave. Area is approximately 40 ft x 70 ft. Monitoring wells results 7/19/82. Amounts in mg/l.

Constituent	Well#1	Well#2	Well#3	Well#4
Phenol	0.59	24.0	0.12	0.44

summary of monitoring well results 12/19/84. Analysis for Acid extractables, base/neutral extractables, pesticides, and GC/MS scan. Amounts in mg/l. Extractables not listed <1 mg/l. Soil sample was also taken 18 inches below surface, Kopper's storm runoff basin (see map). Sampled 9/7/84. Amounts in mg/kg.

Constituent	Well#1	Well#2	Well#3	Well#4	Soil
Naphthalene	48	3	2	4.2	140
Acenaphthene	45	3	-	1.2	150
Florene	65	3	3	1.9	280
Phenathrene	240	11	9	5.5	840
Anthracene	330	9	47	13.1	1350
Flouranthene	110	4	3	1.8	140
Pyrene	88	3	2	-	120
Chrysene	-	1	2	0.5	30
Ethylbenzene	3800	-	24	51	-
1,2-Dimethylbenzene	2600	0.3	314?	22	-
Dibenzofuran	-	0.1	6	8	230

2-Methylnaphthalene	-	-	8	14	-
9H-Carbazole	-	-	20	10	300
4-Methylphenanthrene	-	-	2	-	70
3-Methylphenanthrene	-	-	5	2	-
1-Methylnaphthalene	-	-	-	-	180
1,3-Benzenedicarbonithrile		-	-	-	20
1,4-Dihydro-1,4-Methanonapthalene			-	-	120
1,1'-biphenyl	-	-	-	-	60
2-Ethylnapthalene	-	-	-	-	20
1,7-Dimethylnapthalene		-	-	-	60
1,4-Dimethylnapthalene		-	-	-	35
2,7-Dimethyloctane	-	-	-	-	10
1,3,6-Trimethylnapthalene		-	-	-	20
2-Methyl-1,1'-Biphenyl		-	-	-	30
9,10-Dihydrophenanthrene		-	-	-	20
Dibenzothiophene	-	-	-	-	40
4-Methyldibenzothiophene		-	-	-	30
2-Methylphenanthrene	-	-	-	-	130
2,5-Dimethylphenanthrene		-	-	-	30
2,3-Dimethylphenanthrene		-	-	-	30

- From NW Region file

Process Waste: Dehydration water and wet oil from the still are collected in tanks #23 and #18 respectively. Oil-free water is drained from these tanks to the existing adjacent sump, along with water from the pump room floor drains and the laboratory sink drains. As existing sump pump transfers the water to an 18 ft. diameter x 24 ft. high surge tank. The surge tank is located next to a drain field which has been divided into three sections. Each section has a central ditch which feeds furrows plowed at right angles. Water is admitted to one end of the ditch through an 8" pipe line with a quick opening valve. When the valve is opened, the ditch fills and overflows into the furrows flooding the section. The Effluent Services Group of the Koppers Research Department at Monroeville has studied treatment methods for handling these process waste waters. The most promising method being soil irrigation or soil percolation. The waste waters are also biodegradable using extended aeration.

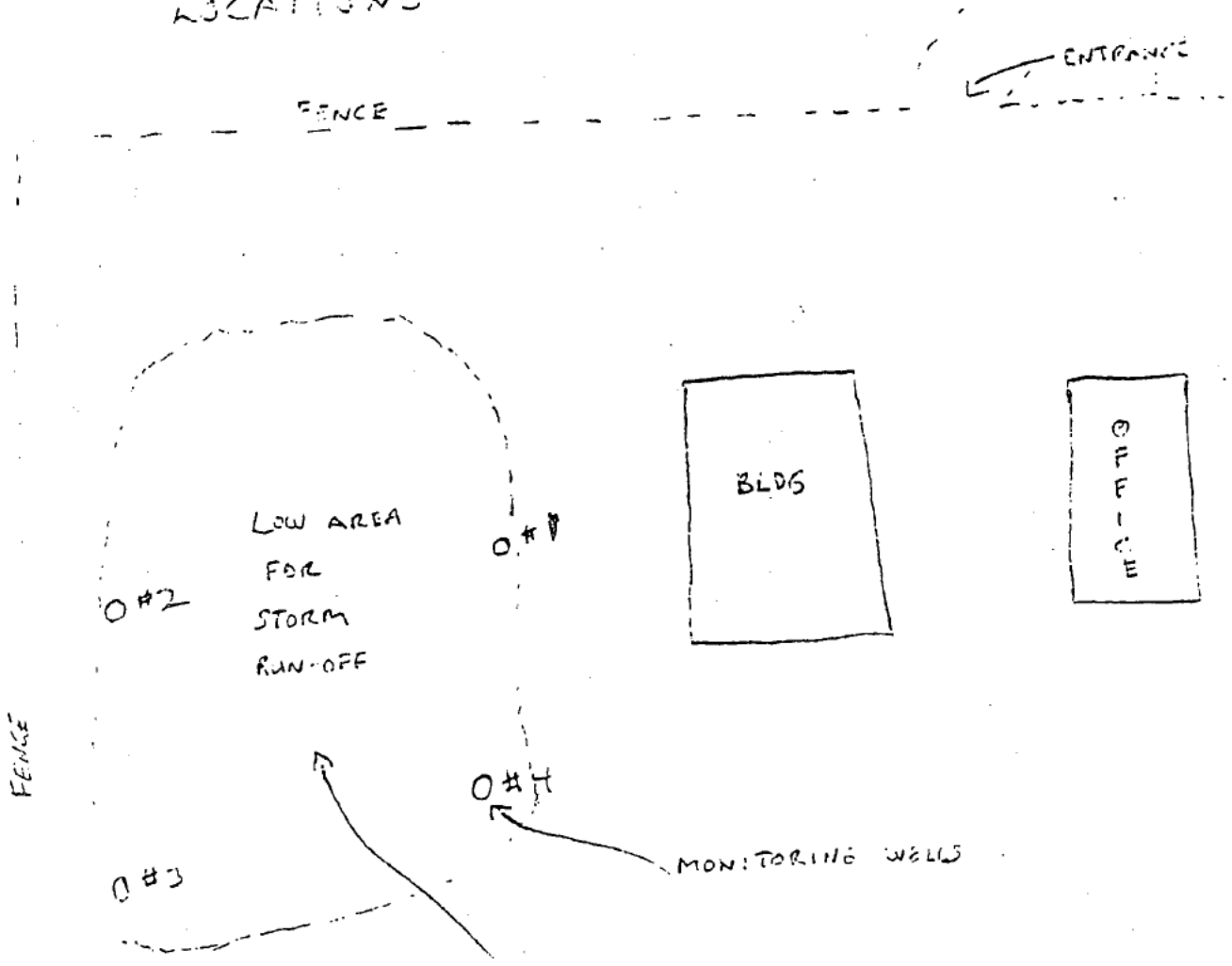
-Effluent Water Handling for Northwest Tar Plant at Portland, Oregon, 1/20/66. NW Region file. It is unclear if this system was actually implemented.

The EPA site file indicates that in the past the plant generated approximately 200 cubic yards per year of wastes which were disposed on the Koppers Site. The process sources of waste generation are unknown. Limited data is available on waste composition. In the past, the tank farm area probably resulted in subsurface contamination by various coal tar products. It is possible that before 1975 industrial waste waters from the plant were disposed beneath the site.

-

PA Report, Koppers Site, EPA Region X, 10/87.

KOPPERS CO. SAMPLING
LOCATIONS



ALSO SOIL IS BLACK COLORED
FROM PAST PRACTICES - ONE
SOIL SAMPLE TAKEN HERE
ON 9-7-84

KOPPER COMPANY, INC.
Chronology of Past Events and Incidents

Aug 11 1966 Start of production of the Kopper's facility in Portland.

Sept 13 1966 Health problems and complaints created by pitch loading operation.

1966- mid 1970's Multiple air emission complaints - apparently very bad at times.

Nov 7, 1969 U.S. Coast Guard complaint of pitch dust entering the Willamette River from Koppers.

Dec 18 1970 Memo - Koppers presently discharges approximately 20 gpm into a pond on NWNG property. As waste flow through the pond , an oily film is apparently retained.

Dec 1973 Production facilities at the plant were shut down because of lack of raw materials.

April 1975 Oil contaminated waters being discharged from Kopper property - oily waste deposited on property such that it is entering or likely to enter public water.

Dec 23 1975 Kopper notifies DEQ that they are no longer producing industrial pitch (roof pitch).

June 28 1976 Kopper notifies DEQ that the volume if unprocessed coal tar remaining at the facility is 720,000 gallons.

Dec 28 1976 Kopper notifies DEQ that the volume of unprocessed coal tar remaining at the facility is 102,000 gallons

June 28 1977 Kopper notifies DEQ that there is no longer any unprocessed coal tar remaining at the facility.

Dec 23 1980 Emission control testing, data shows 0.072 lb./day of copper and 0.015 lb./day of chromium are emitted.

Aug 26 1985 Complaint - Lid left open on rail car containing 6 million gallons of refined tar being electrically heated.

April 3 1989 Rail car of coal tar creosote spill involving 100 gallons. Exited the car through the top manhole. Most of the material was contained on the asphalt pad that surrounds the rail track.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

March 7, 1995

Reply to
Attn of: HW-114

Jim D'Sorbo
Wacker Siltronic Corporation
P.O. Box 83180
Portland, Oregon 97283-0180

RE: Wacker Siltronic Corporation Site
CERCLIS Number ORD096253737

Dear Mr. D'Sorbo:

The U.S. Environmental Protection Agency (EPA), and its contractor, URS Consultants, have reviewed files and other pertinent information relevant to the above referenced site. Enclosed is a copy of the Site Inspection Prioritization (SIP) Report for this site. Based on this review, EPA does not anticipate further investigation under the Federal Superfund program. You should be aware, however, that EPA's "No Further Action" designation under the Federal Superfund program does not relieve your facility from complying with the appropriate Oregon state regulations.

If you have any questions regarding this matter, please contact me at (206) 553-1271.

Sincerely,

John Meyer
Site Assessment Manager
Site Evaluation Section

Enclosure

cc: Heather Schijf, ODEQ-ECD
Chip Humphrey, EPA OOO
Gary Oxman, Multnomah County Health Department

Printed on Recycled Paper

URS CONSULTANTS, INC.

MEMORANDUM

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73.b1

To: John Meyer, Site Assessment Manager HW-114, EPA Region 10

From: Libby Goldstein, ARCS Site Lead, URS Consultants, Inc.

Date: October 28, 1994

Subject: Site Inspection Prioritization (SIP) Report for Wacker Siltronic, Inc., Site (CERCLIS No. ORD096253737)

Contact: Mr. Jim D'Sorbo
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon 97229

Reference: Contract No. 68-W9-0054
Work Assignment No. 54-18-0JZZ

Introduction

Pursuant to the United States Environmental Protection Agency (EPA) Contract No. 68-W9-0054, URS Consultants, Inc., (URS) is conducting this Level I SIP of the Wacker Siltronic site (Wacker) located in the city of Portland, Multnomah County, Oregon. The purpose of this SIP is to determine the potential threat to public health and the environment presented by Wacker. The site was evaluated based on historical waste management practices and current information regarding the site and the surrounding environment. The information in this report is supplied to help the EPA determine if the site is eligible for further investigation under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

The subject of this report is the Wacker Siltronic site located at 7200 N.W. Front Street, Multnomah County, Portland, Oregon. The site occupies approximately 85 acres and is geographically located in the southwest quarter of Section 12, Township 1 north, Range 1 west. The approximate site coordinates are 45°34'30.6" north latitude and 122°45'16.6" west longitude (USGS 1961). Refer to Appendix A for the site location map.

Site Location and Description

Wacker is located in the northwest industrial district of Portland (Figure 3) commonly referred to as "Doane Lake." The Doane Lake area previously included two lakes: Doane Lake to the north and Guild Lake to the south.

Near the turn of the century, the area was filled with dredge sands and mud from the Willamette River and industrial wastes to provide additional land for development.

The Doane Lake area includes a number of industrial plants including Wacker, Gould Battery, Pennwalt, Rhone-Poulenc, Koppers, Inc., Northwest Natural Gas, and an ESCO landfill. These companies have produced or handled numerous toxic materials over the past 40 years, including creosote, flammable hydrogen gas, hydrochloric acid, and dioxin-tainted chemicals. The Gould Battery site is listed on the EPA's National Priorities List. Currently, Wacker, Koppers Inc., and Northwest Natural Gas are working under ODEQ guidance to develop a plan for a comprehensive study of past practices in this area (E&E 1987). It is not known at the writing of this report what the status for the Doane Lake study area is.

Wacker is located at 7200 N.W. Front Street in the northwest portion of the city of Portland in Multnomah County, Oregon. The 85-acre site is bordered on the east by the Willamette River, on the west by Highway 30 (St. Helen's Road), on the north by Koppers, Inc., and Northwest Natural Gas, and on the south by the Burlington Northern Railroad Bridge.

The land now owned by Wacker is a portion of the old Portland Gas and Coke (PG&C) site. The PG&C plant was in operation from 1913 to 1956. Since 1956, the PG&C property has been owned by Northwest Natural Gas (NNG). In 1976, Wacker purchased the southeast portion of the property and began construction of its facility (E&E 1987).

Wacker has a processing plant and offices in two buildings adjacent to the river and a wastewater treatment facility along the northwest boundary of the property. A Portland General Electric (PGE) substation is located between the treatment facility and the process building. The southwestern portion of the site is undeveloped but is the proposed location for Wacker's Polysilicon Plant. Access to the site is limited due to the site's close proximity to the river and the railroad grades that border the site on two sides. The active portions of the site were fenced, and the area was patrolled by private security personnel at the time the PA was conducted in 1987. (Refer to Appendix A for site map.)

Site Operations

Wacker manufactures silicon wafers used in the production of integrated circuits. The plant grows and processes single crystals of silicon from high purity polycrystalline silicon. The Wacker facility is listed under the Resource Conservation and Recovery Act (RCRA) as a generator of industrial wastes. The facility has an NPDES permit for the processing and discharging of wastewater to the Willamette River and an air contaminant discharge permit. Both permits are issued by the Oregon Department of Environmental Quality (ODEQ) (E&E 1987).

An oil gasification plant operated on site from 1913 to 1956 producing approximately 200 cubic yards of coal tars per year.

These coal tars are believed to have been deposited on site in unlined surface impoundments, which were later backfilled as part of the abandonment procedures conducted on the site by Northwest Natural Gas or its predecessor.
Coal tars consist primarily of polycyclic aromatic hydrocarbons (PAH), volatile organic compounds (VOCs), and phenols, and they may contain inorganic materials such as ammonia, lead, and cyanide. Tar deposits can exist in four fractions: solid/semi-solid, light nonaqueous phase liquid (LNAPL), dense nonaqueous phase liquid (DNAPL), and water soluble fraction.

Wacker, an active RCRA facility, has operated on the site from 1976 until the present, manufacturing silicon wafers used in the production of integrated circuits. The operations generate the following waste products: trichloroethylene (TCE), freon, chromic acid, waste caustic, and waste acid. In addition, Wacker holds an NPDES permit for the processing and discharge of wastewater and an air contaminant discharge permit.

Wastes deposited as part of the PG&C operation are below the present ground surface at a depth of 10 to 20 feet. Wastes from current operations are captured and recycled or treated in the on-site wastewater treatment unit.

Previous Studies and Investigations

The Doane Lake area has a history of waste disposal problems. Prior to regulatory action by the ODEQ and the EPA, wastes from local industries were discharged to the air, the ground- and surface water, and landfilled in the immediate area. Wastes from the old PG&C plant's production of coal gas were landfilled on the lots now occupied by Wacker and Koppers. ODEQ has identified abandoned coal tar disposal pits on the Koppers site, but the history and extent of past waste disposal on the Wacker site have never been delineated.

Oil has been discovered in the groundwater and soil of the property twice since 1976. In 1979, oil was found in two excavations in the northwest corner of the property adjacent to the Koppers site. The oil seepage was contained and thought to be isolated to the northwest portion of the site. Test borings in 1985 for a proposed plant expansion encountered petroleum products, coal tar, and pesticides at seven locations in the western portion of the site. Generally, the contaminants were encountered at depths of 10 to 20 feet below ground surface and did not appear to be migrating toward the Willamette River (approximately 1,400 feet to the east). Analyses of groundwater samples from monitoring wells completed in the test borings detected low levels of volatile organics and base neutral extractables. Wacker proposed that the low levels of contaminants posed no threat to human health or to the environment. ODEQ has requested further investigation of the site (E&E 1987).

Wacker has had at least six incidents since 1976 involving the discharge of hazardous materials from their facility. These discharges have included chromic acid (July 1980, December 1980, May 1984), and TCE (December 1983 and 1984). Repairs were made on equipment and systems to prevent further spills of TCE, chromic acid, and wastewater. Standard operating procedures have been amended to prevent accidental spills or releases. The cumulative effect of on-site spills of hazardous materials by Wacker is unknown (E&E 1987).

In 1985, Wacker contracted with CH2M HILL to conduct a soil and groundwater study on the southern portion of their property to evaluate the location for the proposed polysilicon plant

(Figure 2 in Appendix A). CH2M HILL collected soil and groundwater samples from seven monitoring wells installed as part of the study.
Volatile and semivolatile organic compounds associated with petroleum products, coal tar constituents, and pesticides were detected in the soil and groundwater samples collected.

In 1987, a preliminary assessment (PA) was conducted by Ecology and Environment for EPA (E&E 1987). Ecology and Environment recommended no further action occur on the site under the CERCLA pre-remedial program. This recommendation was based on the assumption that the Wacker site would be evaluated as part of the Doane Lake area investigation (E&E 1987).

New and Updated Information

CH2M HILL collected additional soil samples during two phases of sampling in 1990 as part of Wacker's plant expansion plans. Phase 1 groundwater and soil gas samples were collected in October 1990 to assess whether Olympic Pipeline Co. pipelines that run beneath the Wacker property were leaking (Appendix A, Figure 2). Total petroleum hydrocarbon compounds, benzene, toluene, and ethylbenzene, were detected at levels that exceeded MCLs. Olympic claimed that the contamination does not match the product in the pipeline even though one of their lines failed the hydrostatic test conducted by the company. ODEQ believes further action is warranted on the Wacker site and recommended in their September 1993 Strategy Recommendation that any future evaluation be coordinated with voluntary investigation/cleanup being conducted by Northwest Natural Gas on the Koppers, Inc., site adjacent to the Wacker site (Appendix C)(Schijf 1993). Wacker has not responded to the Strategy Recommendation (Blischke 1994). ODEQ did not receive the analytical results from the Phase 2 samples (Schijf 1993).

Current Regional Information

Drinking water for the site area is supplied by the city of Portland. The primary source of water for the city of Portland is the Bullrun watershed, located approximately 27 miles east of the city of Portland. No drinking water wells are located within 4 miles of the Wacker site.

The 2-year, 24-hour rainfall event for the city of Portland is estimated to be 2.6 inches by the United States Department of Commerce (Precipitation Frequency). The net annual precipitation in Portland is 37.3 inches as estimated by the National Climatic Data Center (Climatic Data).

There are no daycare centers or schools within 200 feet of the site. The site is located in an industrialized area of Portland (Appendix A Figure 3), bordered on the northeast by the Willamette River and on the Southwest by Forest Park. There are approximately 2,492 residents within 1 mile and 60,620 residents within 4 miles of the site.

Upgradient site drainage encompasses approximately 500 acres. Surface water runoff from the site flows overland for approximately 10 to 1,400 feet before discharging into the Willamette

River. Several creeks originate in the Tulatin Mountains to the southwest, merge in the Forest Park area, and flow beneath St. Helens Road onto the site.

The Willamette River at Willamette Harbor is a viable fishery within 1 mile of the Wacker Siltronic site. Annual production is estimated at 708,070 pounds per year, and the mean flow rate for the Willamette River is 21,000 cubic feet per second.

There are approximately 6 acres of wetlands located within 1 mile of the site and 1,117 acres within 5 miles of the site. There are no identified threatened or endangered species within a 4-mile radius of the site.

The Wacker Siltronic site is surrounded by a security fence and locking gates, limiting access to the property. There are approximately 1,400 workers on a 24-hour shift at the site.

REFERENCES

Correspondence from E. Blischke (Blischke 1994) ODEQ to B. Blair, URS Consultants, Inc. RE: Wacker Siltronic, September 29, 1994

Correspondence from H. Schijf (Schijf 1993) ODEQ to R. Staudigl, Wacker Siltronic, September 8, 1993: Strategy Recommendation.

Ecology and Environment, Inc. (E&E), 1987. *Preliminary Assessment Report for Koppers Site, Portland, Oregon.* December 23, 1987.

Ecology and Environment, Inc. (E&E), 1987. *Preliminary Assessment Report for Wackers Siltronic Inc., Portland, Oregon.* October 1987.

National Climatic Data Center. (Climatic Data) 1992. Climatography of the United States #81, "Monthly Station Normals 1961-1990," Ashville, North Carolina.

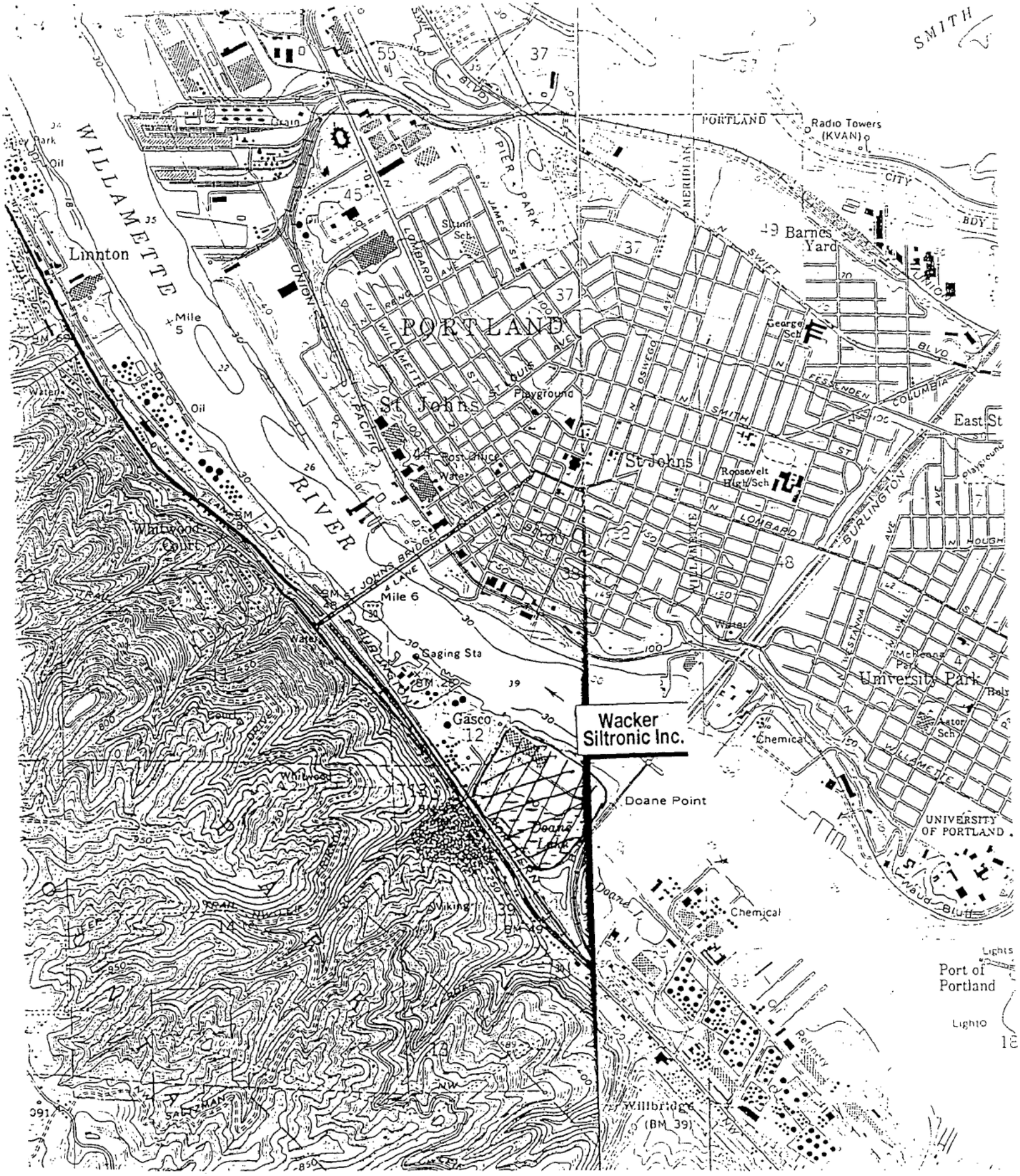
United States EPA Region 10 Geographic Information Section: Wacker Siltronic, April 5, 1994.

United States Department of Commerce. 1973. "Precipitation Frequency Atlas of the Western United States," (Precipitation Frequency) J.F. Miller, R.H. Frederick, and R.J. Tracey.

United States Geological Survey (USGS). 1961. 7.5 Minute Topographic Quadrangle of Portland, Oregon-Washington.

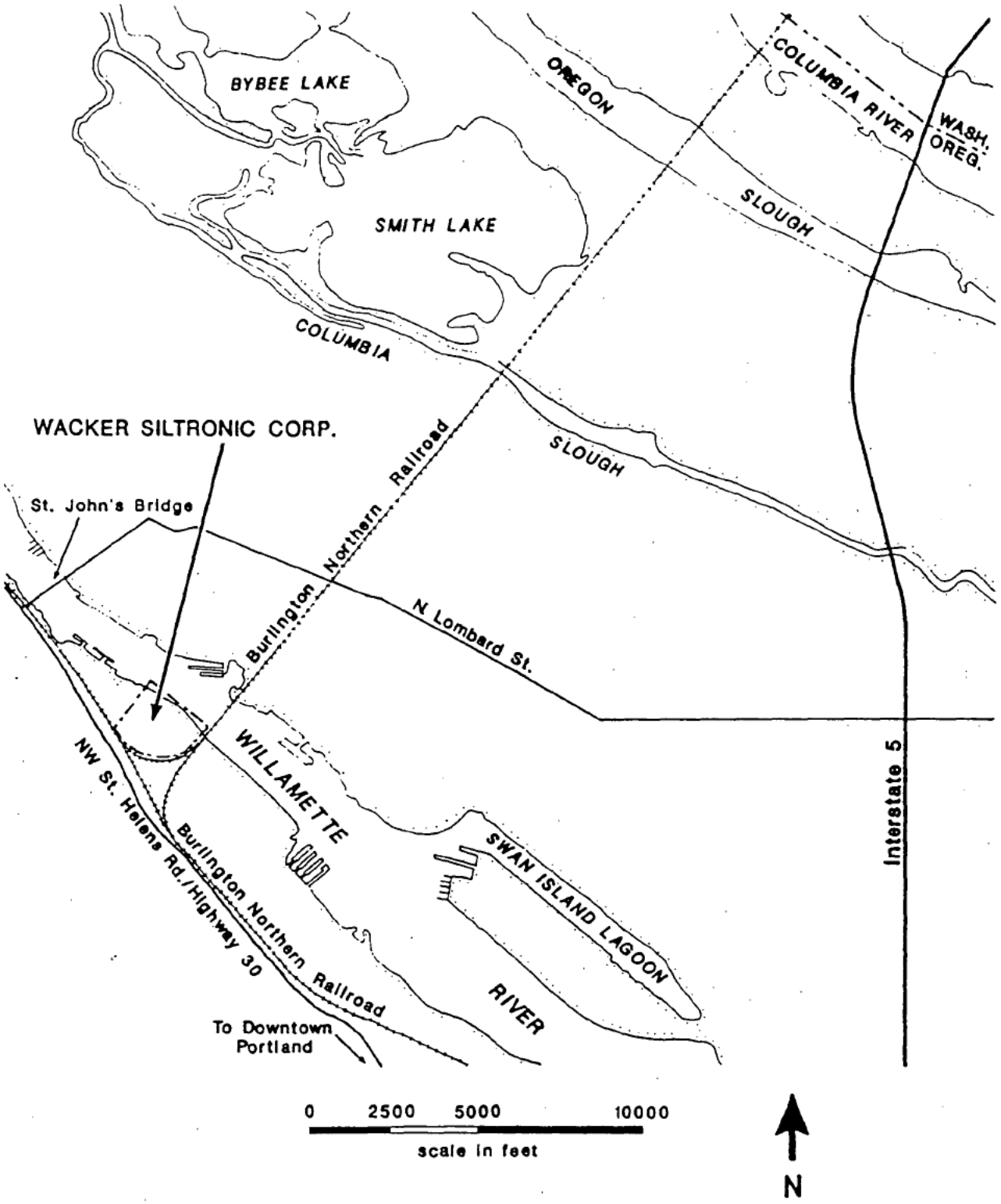
APPENDIX A

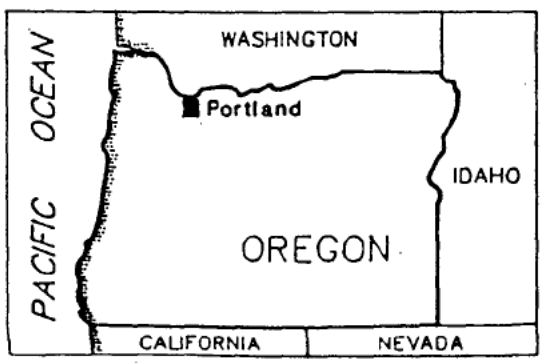
MAPS



URS CONSULTANTS, INC.	NORTH	Vicinity Map	Wacker Siltronic Inc. Portland, OR

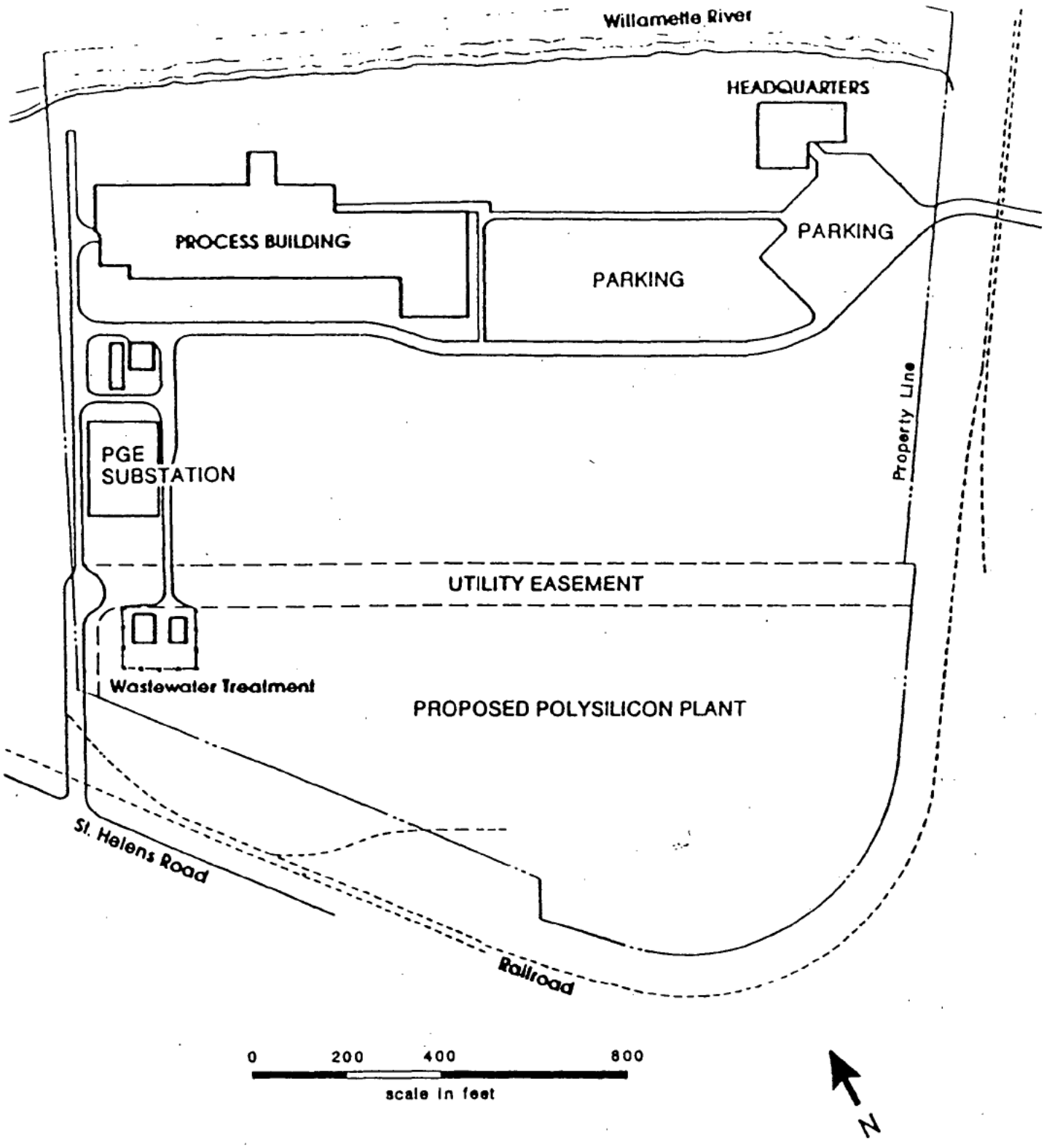
SCOEPA00003389





ecology & environment, Inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

FIGURE 1
LOCATION MAP
WACKER SILTRONIC CORP.
Portland, OR

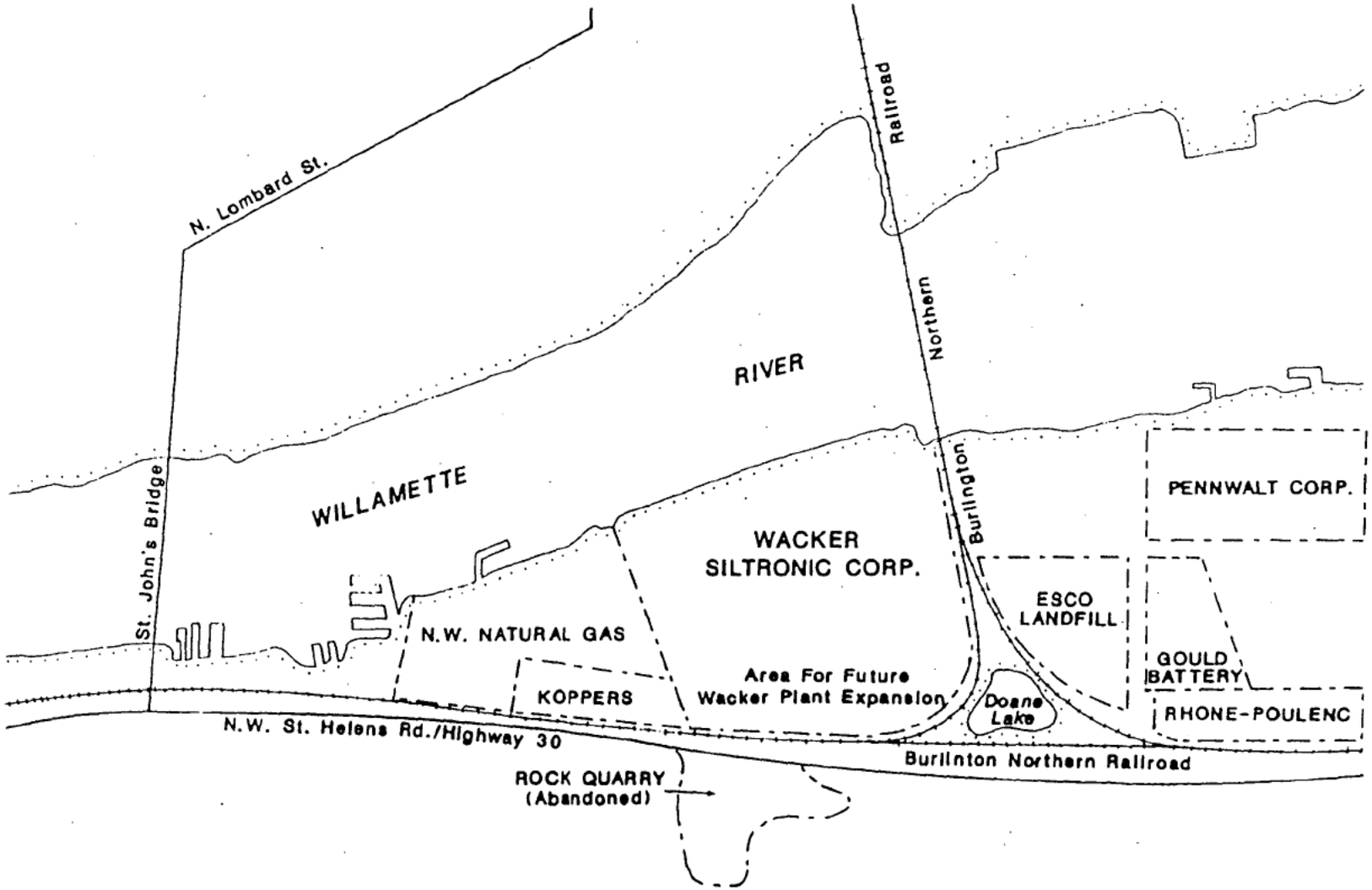


ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

FIGURE 2
SITE MAP
WACKER SILTRONIC CORP.
Portland, OR

Source: CH2M Hill

SCOEPA00003391



LEGEND

— · — Property line

0 500 1000 2000

scale in feet

N

ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/27/1987

FIGURE 3
VICINITY MAP (1983)
WACKER SILTRONIC CORP.
Portland, OR

SCOEPA00003392

APPENDIX B

SAMPLING RESULTS

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, SWQ
2-Chlorophenol	ND	7.8	0.08	0.26	ND	ND	0.13	ND	0.14	NR	pp, SWQ
2-Nitrophenol	ND	0.20	ND	ND	ND	ND	ND	ND	ND	NR	pp, SWQ
2,4-Dimethylphenol	ND	3.1	ND	ND	ND	0.22	0.17	ND	ND	NR	pp, SWQ
2,4-Dichlorophenol	ND	2.7	ND	ND	ND	0.24	ND	ND	ND	NR	pp, SWQ
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	0.22	ND	ND	ND	NR	pp, SWQ
2,4-Dinitrophenol	ND	ND	ND	ND	ND	0.81	ND	ND	ND	NR	pp, SWQ
Pentachlorophenol	ND	ND	ND	ND	0.31	6.9	5.1	ND	ND	NR	pp, SWQ, SIW
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, SIW, 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

PDR956.031.1

SCOEPA00003394

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	BD	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.

PD8956.031.2

APPENDIX C

STRATEGY RECOMMENDATION

DEQ SITE ASSESSMENT SECTION - STRATEGY RECOMMENDATION

Site Name: Wacker Siltronic Corp.

Site CERCLIS Number: 096253737

DEQ ECSI Number: 183

Site Address: 7200 NW Front Ave.
Portland, OR 97210

Recommendation By: Kevin Dana, Environmental Specialist, Site Assessment Section

Approved By: Heather Schijf, Coordinator, Site Assessment Section

Date: May 19, 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, near the shores of Doane Lake. Northwest Natural Gas razed most of the production facilities in the late 1960's and built a liquified natural gas plant in their place. About 1973, the coal tar pits and part of Doane Lake were buried to a depth of about 10 feet by a mixture of overburden and spent oxide. (For more information on the Northwest Natural Gas Company site, see ECSI #84).

Although the file information is sketchy, by 1976 most or all of the fill area apparently wound up in the hands of the Portland Development Commission (PDC), which hoped to resell the property as part of an "urban renewal" of the area. Wacker Siltronic Corporation was interested in purchasing the site. In August 1977, CH2M Hill was hired to take three soil test borings in an area where Wacker hoped to build its facility. "Bitumen" was encountered. Bitumen is a generic term for hydrocarbons such as petroleum or asphalt. Apparently unaware of this, Wacker purchased the site in 1978 and constructed its process building in the sample area.

Wacker Siltronic manufactures silicon wafers from high purity polycrystalline silicon. The silicon wafers are produced in a "process building" adjacent to the Willamette River. Three waste streams are generated in the process. Trichloroethylene (TCE), used to clean the silicon wafers, is pumped from the process building to a diked, above ground storage tank, where it is temporarily stored before being shipped off-site. Freon is also temporarily stored in an outside above ground storage tank, before being poured into 55-gallon drums and shipped off-site. Finally, chromic acid, used during the etching of the silicon wafers, is pumped to a treatment building, where it is neutralized and separated. The liquid effluent is treated in Wacker's on-site wastewater treatment unit (WWTU). The sludge is dried and disposed of off-site. The WWTU discharges to both the Willamette River and the sewers, and is regulated by an NPDES permit.

In February 1979, oil was found in two excavations adjacent to the Koppers Company (which leases property from Northwest Natural Gas). Within a month, oil was found near the "Olympic fuel line corridor". The Olympic Pipe Line Company owns an underground easement that runs across the middle of the Wacker site, south of the process building. Believing that the oil came from the pipeline, DEQ took samples. But the spilled oil did not match the oil in the pipeline. The sample results are not on file.

In 1985, Wacker hired CH2M Hill to perform subsurface soil sampling on the vacant southern half of the site, where Wacker was planning on constructing a polysilicon plant. CH2M took samples at five foot intervals from seven boreholes. However, only nine samples were analysed. Contaminants, primarily polycyclic aromatic hydrocarbons (PAHs) were concentrated at the 10 and 20-foot levels, with lesser amounts at 15 feet. Of the dozen or so individual compounds detected, six exceeded SOCLEAN's industrial soil cleanup standards: benzo(a)pyrene (120 ppm), benzo(b)fluoranthene & benzo(k)fluoranthene (total 120 ppm), chrysene (92 ppm), and indeno(1,2,3-cd)pyrene & dibenzo(a,h)anthracene (total 270 ppm). 2,4-toluenediamine (aka 2,4-D), a herbicide, was also detected, at 160 ppm. (After sampling was completed, the boreholes were converted into groundwater monitoring wells).

Ecology and Environment, Inc. (E&E) performed a PA on the site for EPA in 1987. After quickly summarizing the site operations and known contamination, E&E recommended deferring to State authority. DEQ was planning to study groundwater contamination in the Doane Lake area, looking at the possibility of an area-wide cleanup. About a dozen corporations were involved in the voluntary study. Wacker declined to be an active participant, insisting that it wasn't liable for any contamination. Wacker claimed that it qualified under the "innocent landowner" provisions of ORS 466.567, since it was unaware of the contamination when it purchased the property. Fred Hansen and the Attorney General's office disagreed, believing that Wacker had not taken "all appropriate inquiry" into the previous ownership and uses of the property. (The Doane Lake Study concluded in 1990 with a recommendation that sites in the

area be evaluated and remediated separately. See ECSI #36 for more information).

In May 1990, Wacker was planning to build an expansion near the silicon wafer plant. Wacker asked DEQ to review the project, (called "FAB 2"), because Wacker knew that the excavations might encounter subsurface contamination. No agreement with DEQ could be immediately reached, however. Still, Wacker hired CH2M Hill to take two soil samples. The samples were taken in June about 20 feet bgs. Seven substances were detected that exceeded SOCLEAN: benzene (29 ppm), benzo(a)anthracene (210 ppm), benzo(a)pyrene (240 ppm), benzo(b)fluoranthene (180 ppm), benzo(k)fluoranthene (120 ppm), chrysene (280 ppm), and indeno(1,2,3-cd)pyrene (160 ppm). (For comparison, the SOCLEAN standard for most of these substances is 1 ppm).

Two months later, in August, Wacker planned to take more soil samples in the contruction area, this time at levels 4-10 feet bgs. DEQ was to review the project under its Voluntary Cleanup Program. However, the agreement between DEQ and Wacker was terminated within a month. DEQ does not have the results of the sampling program, and it is unclear whether the sampling was even carried out.

In October 1990, Wacker hired CH2M Hill to take 26 groundwater and three "soil gas" samples from an area around the Olympic pipelines. Wacker was concerned that the pipelines may have leaked and contributed to the contamination observed at the FAB 2 site. CH2M Hill tested for TPH and BTEX. Total Petroleum Hydrocarbons were found at a maximum of 89 ppm. Benzene (max. 23.3 ppm), toluene (max. 5.96 ppm), and ethylbenzene (max. 4.68 ppm) were found at levels that violated the MCLs for drinking water (however, only one of the ethylbenzene samples exceeded the MCL). The contaminants were concentrated in an area near the pipeline. Wacker considered this to be evidence of a leak and notified Olympic and DEQ. Olympic performed a hydrostatic test on its lines, and one of them failed. However, it is unclear whether the pipe was leaking before the test failure. Olympic claims that no contaminants were observed during replacement of the pipe, and that the contamination found by Wacker does not match what was flowing through the pipe.

Due to the subsurface contamination, Wacker decided to change its plans so that the FAB 2 building could be constructed "above" the contamination, necessitating the removal of less than 10 cubic yards of contaminated soil. Wacker sought DEQ's permission for this in June 1991 and apparently got it, although Mike Rosen of DEQ felt that the contamination should be more extensively characterized. (Earlier, in February 1991, Wacker had asked if the new facility and accompanying parking lots could be considered a "cap" for the contamination. Wacker was worried that it might have to tear out its new building in a future cleanup action. Fred Hansen replied in March that DEQ would have to make an "independent determination" of the contamination to see if a cap would qualify as an appropriate remedial action).

Recommendation/Action:

The Site Assessment Section has reviewed file information related to this site. The site was placed on the Confirmed Release List and the Inventory in October 1992. Soil and groundwater contamination at the site is extensive. However, the soil is under about 10 feet of fill, and groundwater in the area is not used for drinking or industrial purposes. The contamination may pose a threat to the environment, particularly the Willamette River, if it migrates. Most of the contamination probably results from coal tars, which are normally stable. But leaks of fuel oil from Olympic's pipelines could mobilize the coal tars. Since the coal tars were deposited by the predecessor company of Northwest Natural Gas, that company should lead any investigation or cleanup of the tars. Site Assessment recommends that any further actions involving the Wacker Siltronic site be coordinated with the investigation/cleanup at the Northwest Natural Gas Company site.

Referrals Within or Outside DEQ:

The Northwest Natural Gas Company site (ECSI #84) has been referred to the Voluntary Cleanup Section (VCS) and the Site Response Section (SRS) for further action. Site Assessment has recommended that the investigation/cleanup of coal tar contamination on the Northwest Natural Gas Company site include the coal tar contamination on the Wacker Siltronic Corp. site.

Other:

This site is currently listed in DEQ's ECSI database. The database will be updated with information contained in this decision document and will reflect Site Assessment's decision for further action at the site.

September 8, 1993

Rudolf Staudigl, President
Wacker Siltronic Corporation
P.O. Box 83180
Portland, OR 97283-0180

Post-it™ Fax Note 7871	Date 9/29/94	# of pages ▸ 6
To BARRY BLAIR	From ERIC BLISCHKE	
Co./Dept. URS	Co. DEQ	
Phone # (303) 291-8293	Phone # (503) 229-6012	
Fax # (303) 296-6117	Fax #	

Dear Mr. Staudigl:

The Oregon Department of Environmental Quality (DEQ) has completed a Preliminary Assessment Equivalent (PAE) for the Wacker Siltronic Corp. 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 predecessor company of Northwest Natural Gas. Although the investigation will focus on property owned by Northwest Natural Gas, your property at 7200 NW Front Ave. will also need to be sampled in order for the DEQ to fully determine the extent of the contamination.

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 occured 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

- 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 independantly 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 persue 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. The site has already been listed on the Department's Confirmed Release List and Inventory of hazardous substances site list.

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, Coordinator,
Site Assessment Section
Environmental Cleanup Division

Enclosure: Strategy Recommendation

cc: Leslie Kochan, Northwest Region
Karla Urbanowicz, Voluntary Cleanup Section
Mike Rosen, Voluntary Cleanup Section
Thomas Miller, Site Response Section
SAS file #183

RECEIVED
NOV 2 2 1996
JIM ELLIS

Oregon
DEPARTMENT OF
ENVIRONMENTAL
QUALITY
NORTHWEST REGION

November 20, 1996

Mr. Rudolph Staudigl
President
Wacker Siltronic Corp.
P. O. Box 83180
Portland, Oregon 97283-0180

RE: Remedial Investigation and Feasibility Study
6200 NW St. Helens Road, Portland, OR
Request for Information on:

(1) Current and Reasonably Likely Future Land Use
(2) Current and Reasonably Likely Future Beneficial Use of Surface Water and Groundwater

Dear Mr. Staudigl:

The Department of Environmental Quality (DEQ) is overseeing investigation and cleanup of Rhone-Poulenc Ag Company's former pesticide manufacturing plant site located at 6200 NW St. Helens Road, in northwest Portland. Rhone-Poulenc is conducting a Remedial Investigation and Feasibility Study (RI/FS) of the site and affected surrounding areas under a Consent Order with DEQ.

As part of the RI/FS, Rhone-Poulenc must evaluate chemicals that have come from their site, wherever they may be present in soil and water. Rhone-Poulenc must assess any risk of exposure these chemcials may pose to humans and the environment. As part of their risk evaluation, Rhone-Poulenc must compile information on the current and reasonably likely future land uses and current and reasonably likely future uses of surface water and groundwater in the locality of the site. This information will be used to determine what level of remediation will be required.

When Rhone-Poulenc has completed their RI/FS, now expected for September of 1998, DEQ will select a cleanup remedy and will initiate a public comment process. A map of the general area is attached, along with a copy of the most recent Environmental Cleanup Project Bulletin describing the Rhone-Poulenc site, hazardous substances that have been released to the environment, and the current status of the RI/FS work.

As a property owner in the neighborhood of the Rhone-Poulenc site, DEQ would like your input on land and water use associated with your property. Your property may be located upgradient of the site with respect to surface water and groundwater flow. DEQ is seeking the following information:

John A. Kitzhaber
Governor

2020 SW Fourth Avenue
Suite 400
Portland, OR 97201-4987
(503) 229-5263 Voice
TTY (503) 229-5471

1. historic land, surface water and groundwater uses,
2. current land uses and beneficial uses of surface water and groundwater, and
3. reasonably likely future land uses and beneficial uses of surface water and groundwater.

To make your reply easier, DEQ has prepared the enclosed response postcard and would appreciate if you would complete the postcard and return it by December 11, 1996. DEQ will consider your comments, along with those of agencies and other neighborhood property owners, to ensure that the cleanup remedy to be proposed by Rhone-Poulenc will be protective.

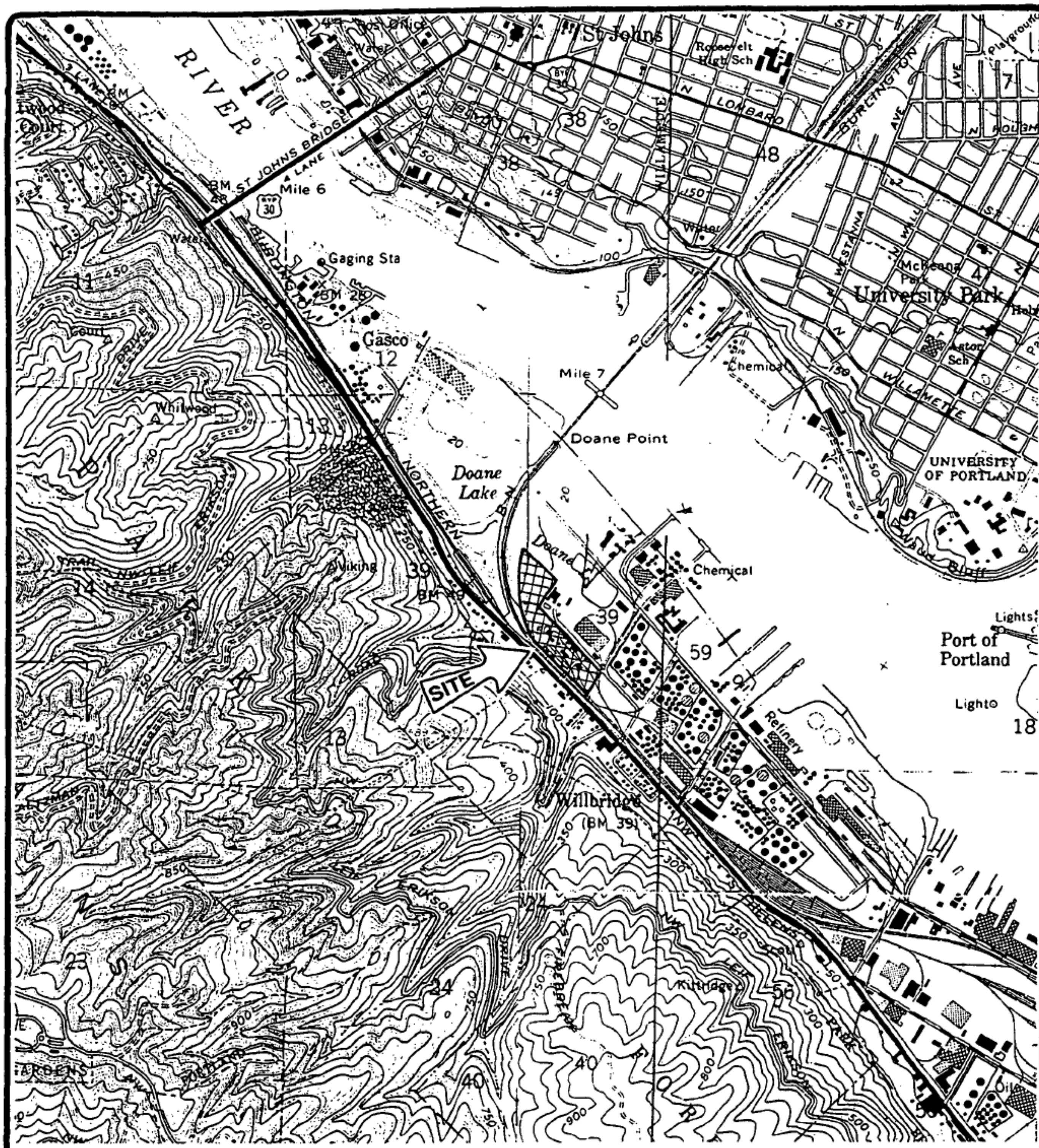
Please call me at (503)229-5071 if you have any questions or need additional information.

Sincerely,

Mavis D. Kent

Mavis D. Kent
DEQ Project Manager

Attachments: Area Map, Cleanup Bulletin, land/water use response form



Base map from U.S.G.S. topographic 7.5' quadrangles, Portland, OR., 1977 & Linnton, OR., 1984.

Contour interval 10 ft.
Datum is mean sea level.

OREGON

QUADRANGLE LOCATION

N

0 2000 4000

Scale in Feet

EMCON Northwest, Inc.

DATE 11/91
DWN. MMM
APPR. VRD
REVIS.
PROJECT NO. 0240005.16

Figure 1-1
RHÔNE POULENC AG COMPANY
QUARTERLY PROGRESS REPORT - NO. 2

SITE LOCATION MAP

Cleanup Project Bulletin

Quarterly Report November, 1996

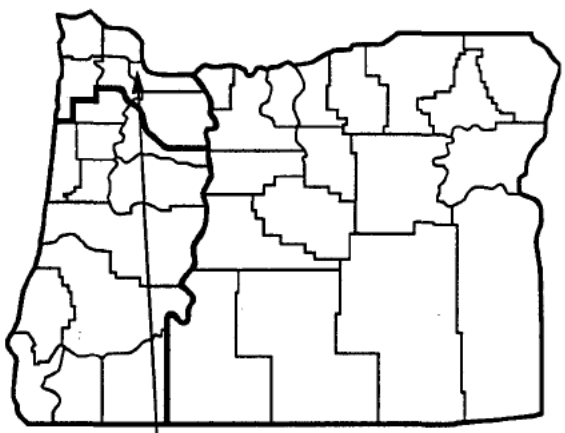
Rhone-Poulenc Ag Company

Project Overview

Rhone-Poulenc Ag Company (RPAC) owns the property at 6200 St. Helens Road where they operated an agrochemical facility from the mid-1940s until manufacturing ceased in the fall of 1990. During operation, the plant manufactured and packaged a variety of herbicides and insecticides, most recently producing only bromoxynil octanoate. Past product and waste spills and disposal of wastes have resulted in contamination of surface water, groundwater and soil. Releases at the site have been primarily through leaks and spills of liquid waste and product into storm drainages discharging into West and East Doane Lake, and historic releases of treated waste water into West Doane Lake and the Willamette River.

An EPA Field Investigation Team sampled the site in 1982 and identified 37 priority pollutants and over 100 non-priority pollutants. The main contaminants are 2,4-D and other pesticides, dichlorobenzene and isomers, chlorinated phenols, chlorinated cresols, other phenolic compounds, benzene, toluene, ethyl benzene, TCE, methylene chloride, dioxin/furans and metals. RPAC began investigation of the site in 1980, and installed a shallow groundwater recovery and treatment system in 1984.

In summer 1992, most of the plant structures and storage facilities were demolished. What remains are the administrative building, two small storage buildings, one of which houses drummed soil cuttings waste, and tanks, piping and machinery related to their stormwater and groundwater treatment facility. Drummed soil waste is regulated under RCRA rules described in Consent Order Addendum 1. Waste water treatment and discharge is regulated under an existing NPDES Permit.



Rhone-Poulenc Ag Company
NW Portland (ECSI # 155)
DEQ Project Manager:
Mavis D. Kent
(503)229-5071

The site is adjacent to the NL/Gould Superfund site, and battery cases related to the Gould site are buried in portions of the northern third of RPACs property. NL/Gould site cleanup has occurred in RPACs Lake Area from late 1993 through late 1994 with excavation of some of the battery casing waste. An NL/Gould ROD amendment, recently out for public comment, would require no further excavation of battery casings, and placement of clean fill in the existing excavation and a cap across the Lake Area. A draft ROD for the NL/Gould site is expected to be out for public comment during the third quarter.

DEQ approved a workplan to complete the RI/FS in October, 1994. RI work, ongoing since the late 1980's, resumed in November, 1994. Additional groundwater monitoring wells were installed by late 1995. Groundwater sampling was conducted in fall of 1995 and again in Spring of 1996. A second Addendum to the existing Consent Order, effective on February 1, 1995, revised the overall RI/FS

schedule. A third Addendum to the Consent Order, effective on September 6, 1996, expanded the scope of RI, Risk Assessment (RA) and FS work to include investigation of East Doane Lake organic contamination, and revised the due dates for the draft and final RI/EA and FS reports, and added necessary RI, EA and FS tasks.

RPAC submitted sampling plans (SAPS) for East Doane Lake sediment and groundwater. These SAPS were approved by DEQ in September, 1996. RPAC submitted a draft East Doane Lake Interim Remedial Measure work plan in October, 1996, including the approved sediment and groundwater SAPS. DEQ review comments on the work plan are pending. Field work for East Doane Lake sediment and groundwater sampling is expected to begin before the end of 1996, as soon as property access is secured.

Environmental Concerns

The risk of exposure to site chemicals for both human and ecological receptors is being addressed by RPAC. A determination of current and reasonably likely future land use and current and reasonably likely future beneficial use of surface and groundwater onsite and offsite will be made to identify and confirm appropriate human health and ecological risk exposure scenarios. This determination will be based on land and water use information that has been submitted by RPAC and will be collected by DEQ.

Site contaminants have been detected in surface water, including North, West, and East Doane Lakes (remnants of an older and larger Doane Lake), and in groundwater seepage into the Willamette River some 2000 feet to the east of the site. Site contaminants have also been detected in groundwater beneath the site and on downgradient properties.

Other potential pathways for exposure include contaminated surface and shallow soil in the Herbicide and Insecticide Areas and some areas of shallow soil in the Lake Area. Air discharges from the existing onsite waste water treatment system, currently treating both storm discharge and extracted contaminated groundwater, will be assessed during remedial alternative development and evaluation.

Non-aqueous phase liquids are present in soil at and below the water table beneath the plant area of the site, the existing waste water treatment plant, in western portions of the Lake Area and the northwesternmost corner of the NL/Gould property. Groundwater beneath the main plant area and portions of the Lake Area may provide a pathway for contamination to reach nearby surface water bodies.

WACKER SILTRONIC CORP

Property:	T1N, R1W, Sec 13 (AREA 12) 7200 NW Front Ave

Your Telephone Number for Contact by DEQ:
(503) 241-7532 TOM McCUE

Check all of the boxes below that apply to your property and return by mail to DEQ

Historic	Current	Planned	Land Activity/Use
			Residential
			Commercial
X	X	X	Industrial
			Agricultural
			Recreational
			Other (describe)
			Water Uses
	X	X	Drinking Water
	X	X	Irrigation/Landscape
	X	X	Industrial PRocess
			Recreational
			Aesthetic (decorative)
			Wildlife
			Other (describe)
			Water Sources(s)
	X	X	Municipal Supply
			Small Supplier (<5)
			On-site well
			Surface water

Additional Comments?

For more information contact Mavis D. Kent (503)229-5071
DEQ, NWR, 2020 SW 4th Ave., Ste. 400, Portland OR 97201

Oregon

September 10, 1993

CERTIFIED MAIL NO. P-915-447-128
RETURN RECEIPT REQUESTED

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

Ms. Sandra Hart
Northwest Natural Gas Co.
220 NW 2nd Ave.
Portland, OR 97209

RECEIVED
SEP 16 1993
WACKER SILTRONIC
Environmental Health & Safety

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

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 Saling, 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.

EXCEPT WSC

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

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.

CONFLICTS WITH WSC SITE ASSESSMENT

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.

Oregon

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

NORTHWEST REGION

FAX COVER LETTER

DATE: 8/10/95 TIME: 3:50

COVER PAGE PLUS 2 PAGES

TO: Tom McCue

FAX NUMBER: 241-7599 PHONE: 241-7532

FROM: Sandy Steele

FAX: (503)229-6899 PHONE: (503) 229-5530

MESSAGE: Say hi to Jim Ellis for me — Thanks, Sandy

If all pages are not received, please notify sender.

2020 SW Fourth Avenue
Suite 400
Portland, OR 97201-4987
(503) 229-5263 Voice/TDD

DEQ-1

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

March 7, 1995

Reply to
Attn of: HW-114

Jim D'Sorbo
Wacker Siltronic Corporation
P.O. Box 83180
Portland, Oregon 97283-0180

RE: Wacker Siltronic Corporation Site
CERCLIS Number ORD096253737

Dear Mr. D'Sorbo:

The U.S. Environmental Protection Agency (EPA), and its contractor, URS Consultants, have reviewed files and other pertinent information relevant to the above referenced site. Enclosed is a copy of the Site Inspection Prioritization (SIP) Report for this site. Based on this review, EPA does not anticipate further investigation under the Federal Superfund program. You should be aware, however, that EPA's "No Further Action" designation under the Federal Superfund program does not relieve your facility from complying with the appropriate Oregon state regulations.

If you have any questions regarding this matter, please contact me at (206) 553-1271.

Sincerely,

John Meyer
Site Assessment Manager
Site Evaluation Section

Enclosure

cc: Heather Schijf, ODEQ-ECD
Chip Humphrey, EPA OOO
Gary Oxman, Multnomah County Health Department

Printed on Recycled Paper

URS CONSULTANTS, INC.

MEMORANDUM

4162770.63.20.566
73.b1

To: John Meyer, Site Assessment Manager HW-114, EPA Region 10

From: Libby Goldstein, ARCS Site Lead, URS Consultants, Inc.

Date: October 28, 1994

Subject: Site Inspection Prioritization (SIP) Report for Wacker Siltronic, Inc., Site (CERCLIS No. ORD096253737)

Contact: Mr. Jim D'Sorbo
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon 97229

Reference: Contract No. 68-W9-0054
Work Assignment No. 54-18-0JZZ

Introduction

Pursuant to the United States Environmental Protection Agency (EPA) Contract No. 68-W9-0054, URS Consultants, Inc., (URS) is conducting this Level I SIP of the Wacker Siltronic site (Wacker) located in the city of Portland, Multnomah County, Oregon. The purpose of this SIP is to determine the potential threat to public health and the environment presented by Wacker. The site was evaluated based on historical waste management practices and current information regarding the site and the surrounding environment. The information in this report is supplied to help the EPA determine if the site is eligible for further investigation under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

The subject of this report is the Wacker Siltronic site located at 7200 N.W. Front Street, Multnomah County, Portland, Oregon. The site occupies approximately 85 acres and is geographically located in the southwest quarter of Section 12, Township 1 north, Range 1 west. The approximate site coordinates are 45°34'30.6" north latitude and 122°45'16.6" west longitude (USGS 1961). Refer to Appendix A for the site location map.

Site Location and Description

Wacker is located in the northwest industrial district of Portland (Figure 3) commonly referred to as "Doane Lake." The Doane Lake area previously included two lakes: Doane Lake to the north and Guild Lake to the south.

Near the turn of the century, the area was filled with dredge sands and mud from the Willamette River and industrial wastes to provide additional land for development.

The Doane Lake area includes a number of industrial plants including Wacker, Gould Battery, Pennwalt, Rhone-Poulenc, Koppers, Inc., Northwest Natural Gas, and an ESCO landfill. These companies have produced or handled numerous toxic materials over the past 40 years, including creosote, flammable hydrogen gas, hydrochloric acid, and dioxin-tainted chemicals. The Gould Battery site is listed on the EPA's National Priorities List. Currently, Wacker, Koppers Inc., and Northwest Natural Gas are working under ODEQ guidance to develop a plan for a comprehensive study of past practices in this area (E&E 1987). It is not known at the writing of this report what the status for the Doane Lake study area is.

NOT WORKING ON PLAN

GROUPED TOGETHER

Wacker is located at 7200 N.W. Front Street in the northwest portion of the city of Portland in Multnomah County, Oregon. The 85-acre site is bordered on the east by the Willamette River, on the west by Highway 30 (St. Helen's Road), on the north by Koppers, Inc., and Northwest Natural Gas, and on the south by the Burlington Northern Railroad Bridge.

The land now owned by Wacker is a portion of the old Portland Gas and Coke (PG&C) site. The PG&C plant was in operation from 1913 to 1956. Since 1956, the PG&C property has been owned by Northwest Natural Gas (NNG). In 1976, Wacker purchased the southeast portion of the property and began construction of its facility (E&E 1987).

Aug 1978

Wacker has a processing plant and offices in two buildings adjacent to the river and a wastewater treatment facility along the northwest boundary of the property. A Portland General Electric (PGE) substation is located between the treatment facility and the process building. The southwestern portion of the site is undeveloped but is the proposed location for Wacker's Polysilicon Plant. Access to the site is limited due to the site's close proximity to the river and the railroad grades that border the site on two sides. The active portions of the site were fenced, and the area was patrolled by private security personnel at the time the PA was conducted in 1987. (Refer to Appendix A for site map.)

Site Operations

Wacker manufactures silicon wafers used in the production of integrated circuits. The plant grows and processes single crystals of silicon from high purity polycrystalline silicon. The Wacker facility is listed under the Resource Conservation and Recovery Act (RCRA) as a generator of industrial wastes. The facility has an NPDES permit for the processing and discharging of wastewater to the Willamette River and an air contaminant discharge permit. Both permits are issued by the Oregon Department of Environmental Quality (ODEQ) (E&E 1987).

An oil gasification plant operated on site from 1913 to 1956 producing approximately 200 cubic yards of coal tars per year. ?

These coal tars are believed to have been deposited on site in unlined surface impoundments, which were later backfilled as part of the abandonment procedures conducted on the site by Northwest Natural Gas or its predecessor.
Coal tars consist primarily of polycyclic aromatic hydrocarbons (PAH), volatile organic compounds (VOCs), and phenols, and they may contain inorganic materials such as ammonia, lead, and cyanide. Tar deposits can exist in four fractions: solid/semi-solid, light nonaqueous phase liquid (LNAPL), dense nonaqueous phase liquid (DNAPL), and water soluble fraction.

Wacker, an active RCRA facility, has operated on the site from ~~1976~~ 1980 until the present, manufacturing silicon wafers used in the production of integrated circuits. The operations generate the following waste products: trichloroethylene (TCE), freon, chromic acid, waste caustic, and waste acid. In addition, Wacker holds an NPDES permit for the processing and discharge of wastewater and an air contaminant discharge permit. NO LONGER PRESENT

Wastes deposited as part of the PG&C operation are below the present ground surface at a depth of 10 to 20 feet. Wastes from current operations are captured and recycled or treated in the on-site wastewater treatment unit.

Previous Studies and Investigations

The Doane Lake area has a history of waste disposal problems. Prior to regulatory action by the ODEQ and the EPA, wastes from local industries were discharged to the air, the ground- and surface water, and landfilled in the immediate area. Wastes from the old PG&C plant's production of coal gas were landfilled on the lots now occupied by Wacker and Koppers. ODEQ has identified abandoned coal tar disposal pits on the Koppers site, but the history and extent of past waste disposal on the Wacker site have never been delineated.

ONE SW ?

Oil has been discovered in the groundwater and soil of the property twice since 1976. In 1979, oil was found in two excavations in the northwest corner of the property adjacent to the Koppers site. The oil seepage was contained and thought to be isolated to the northwest portion of the site. Test borings in 1985 for a proposed plant expansion encountered petroleum products, coal tar, and pesticides at seven locations in the western portion of the site. Generally, the contaminants were encountered at depths of 10 to 20 feet below ground surface and did not appear to be migrating toward the Willamette River (approximately 1,400 feet to the east). Analyses of groundwater samples from monitoring wells completed in the test borings detected low levels of volatile organics and base neutral extractables. Wacker proposed that the low levels of contaminants posed no threat to human health or to the environment. ODEQ has requested further investigation of the site (E&E 1987).

ALL CLEANED UP W/ DEQ SUPERVISION

Wacker has had at least six incidents since 1976 involving the discharge of hazardous materials from their facility. These discharges have included chromic acid (July 1980, December 1980, May 1984), and TCE (December 1983 and 1984). Repairs were made on equipment and systems to prevent further spills of TCE, chromic acid, and wastewater. Standard operating procedures have been amended to prevent accidental spills or releases. The cumulative effect of on-site spills of hazardous materials by Wacker is unknown (E&E 1987).

In 1985, Wacker contracted with CH2M HILL to conduct a soil and groundwater study on the southern portion of their property to evaluate the location for the proposed polysilicon plant

(Figure 2 in Appendix A). CH2M HILL collected soil and groundwater samples from seven monitoring wells installed as part of the study.
Volatile and semivolatile organic compounds associated with petroleum products, coal tar constituents, and pesticides were detected in the soil and groundwater samples collected.

In 1987, a preliminary assessment (PA) was conducted by Ecology and Environment for EPA (E&E 1987). Ecology and Environment recommended no further action occur on the site under the CERCLA pre-remedial program. This recommendation was based on the assumption that the Wacker site would be evaluated as part of the Doane Lake area investigation (E&E 1987).

New and Updated Information

CH2M HILL collected additional soil samples during two phases of sampling in 1990 as part of Wacker's plant expansion plans. Phase 1 groundwater and soil gas samples were collected in October 1990 to assess whether Olympic Pipeline Co. pipelines that run beneath the Wacker property were leaking (Appendix A, Figure 2). Total petroleum hydrocarbon compounds, benzene, toluene, and ethylbenzene, were detected at levels that exceeded MCLs. Olympic claimed that the contamination does not match the product in the pipeline even though one of their lines failed the hydrostatic test conducted by the company. ODEQ believes further action is warranted on the Wacker site and recommended in their September 1993 Strategy Recommendation that any future evaluation be coordinated with voluntary investigation/cleanup being conducted by Northwest Natural Gas on the Koppers, Inc., site adjacent to the Wacker site (Appendix C)(Schijf 1993). Wacker has not responded to the Strategy Recommendation (Blischke 1994). ODEQ did not receive the analytical results from the Phase 2 samples (Schijf 1993). SUGGESTS THAT WSC MAY HAVE BEEN UNCOOPERATIVE

Current Regional Information

Drinking water for the site area is supplied by the city of Portland. The primary source of water for the city of Portland is the Bullrun watershed, located approximately 27 miles east of the city of Portland. No drinking water wells are located within 4 miles of the Wacker site.

The 2-year, 24-hour rainfall event for the city of Portland is estimated to be 2.6 inches by the United States Department of Commerce (Precipitation Frequency). The net annual precipitation in Portland is 37.3 inches as estimated by the National Climatic Data Center (Climatic Data).

There are no daycare centers or schools within 200 feet of the site. The site is located in an industrialized area of Portland (Appendix A Figure 3), bordered on the northeast by the Willamette River and on the Southwest by Forest Park. There are approximately 2,492 residents within 1 mile and 60,620 residents within 4 miles of the site.

Upgradient site drainage encompasses approximately 500 acres. Surface water runoff from the site flows overland for approximately 10 to 1,400 feet before discharging into the Willamette

River. Several creeks originate in the Tulatin Mountains to the southwest, merge in the Forest Park area, and flow beneath St. Helens Road onto the site.

The Willamette River at Willamette Harbor is a viable fishery within 1 mile of the Wacker Siltronic site. Annual production is estimated at 708,070 pounds per year, and the mean flow rate for the Willamette River is 21,000 cubic feet per second.

There are approximately 6 acres of wetlands located within 1 mile of the site and 1,117 acres within 5 miles of the site. There are no identified threatened or endangered species within a 4-mile radius of the site. CURRENT SALMON SPECIES

The Wacker Siltronic site is surrounded by a security fence and locking gates, limiting access to the property. There are approximately ~~1,400~~ workers on a 24-hour shift at the site.
1050

REFERENCES

Correspondence from E. Blischke (Blischke 1994) ODEQ to B. Blair, URS Consultants, Inc. RE: Wacker Siltronic, September 29, 1994

Correspondence from H. Schijf (Schijf 1993) ODEQ to R. Staudigl, Wacker Siltronic, September 8, 1993: Strategy Recommendation.

Ecology and Environment, Inc. (E&E), 1987. *Preliminary Assessment Report for Koppers Site, Portland, Oregon.* December 23, 1987.

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National Climatic Data Center. (Climatic Data) 1992. Climatography of the United States #81, "Monthly Station Normals 1961-1990," Ashville, North Carolina.

United States EPA Region 10 Geographic Information Section: Wacker Siltronic, April 5, 1994.

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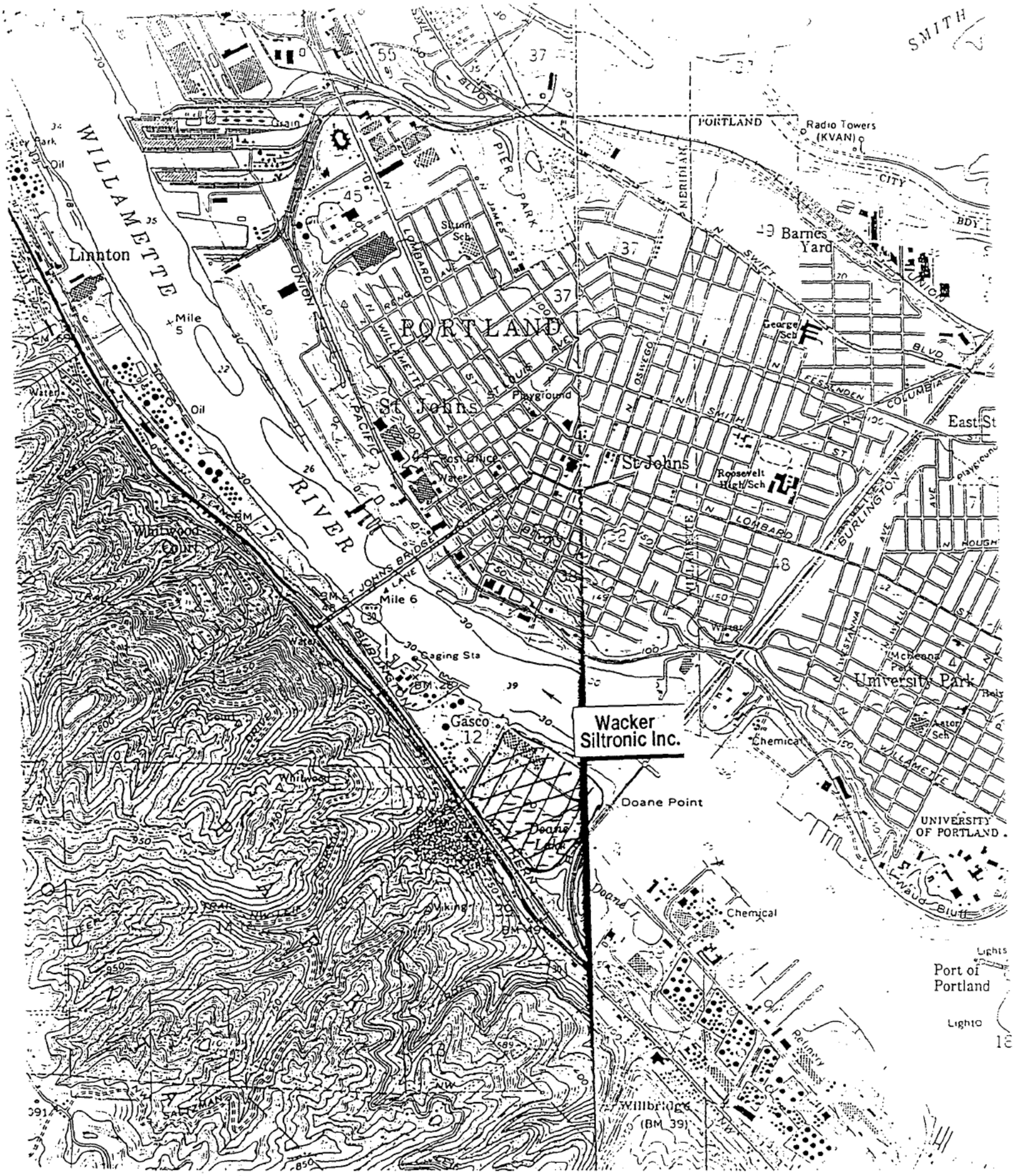
United States Geological Survey (USGS). 1961. 7.5 Minute Topographic Quadrangle of Portland, Oregon-Washington.

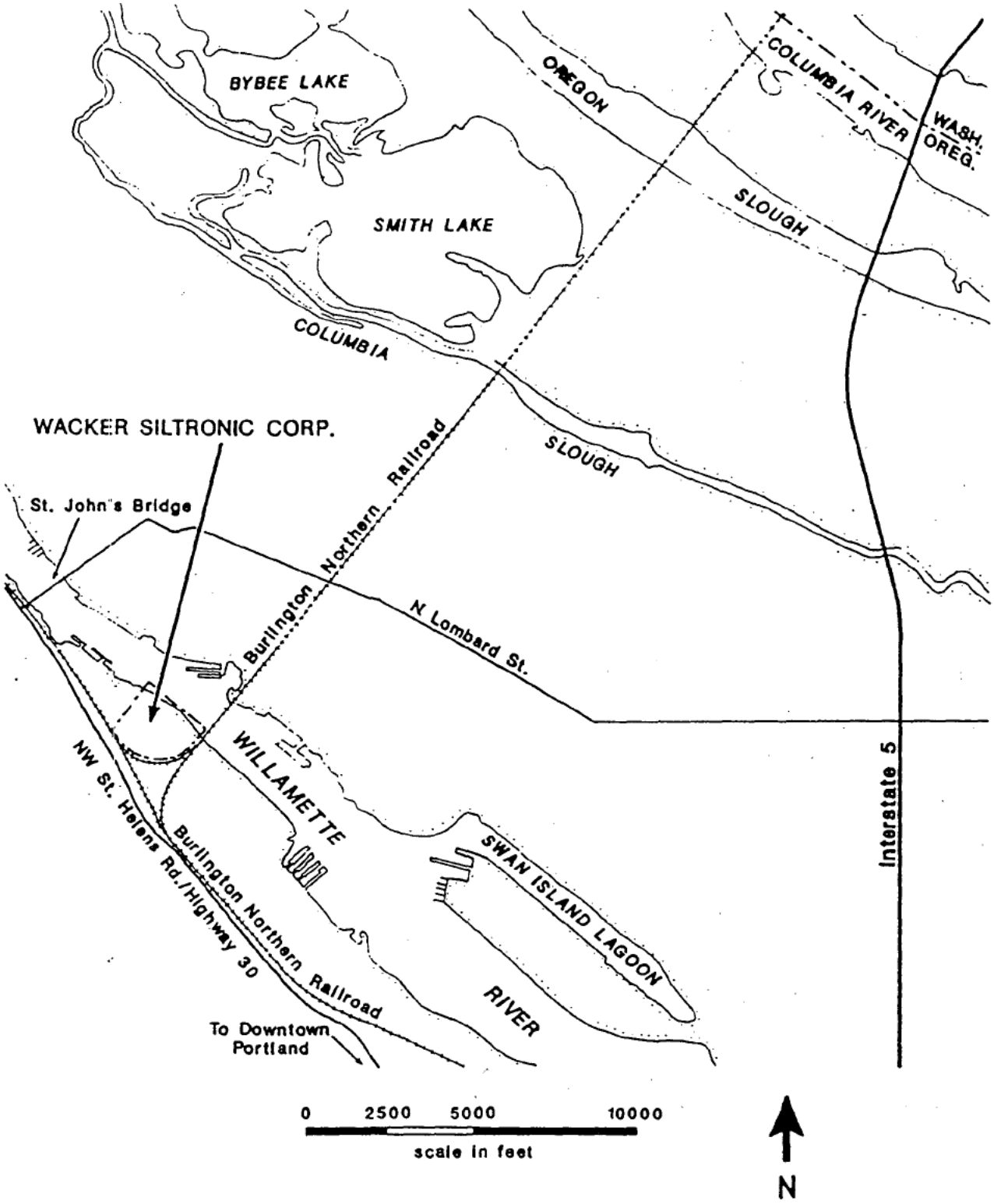
APPENDIX A

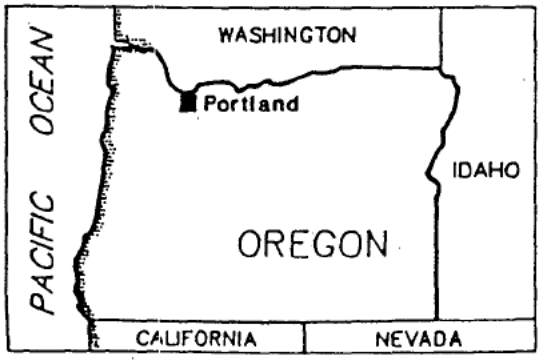
MAPS



URS CONSULTANTS, INC.	NORTH	Vicinity Map	Wacker Siltronic Inc. Portland, OR

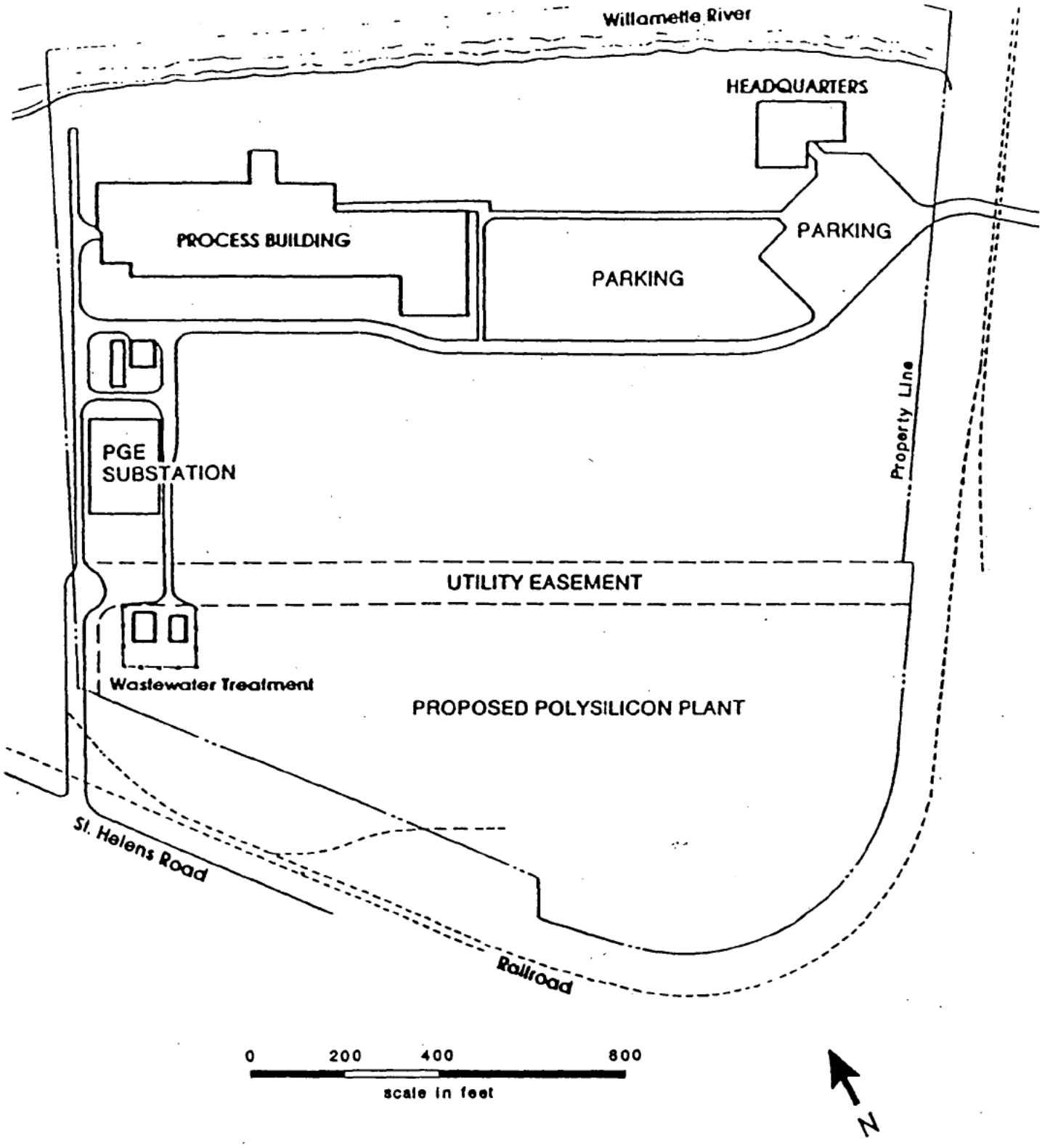
SCOEPA00003427





ecology & environment, Inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

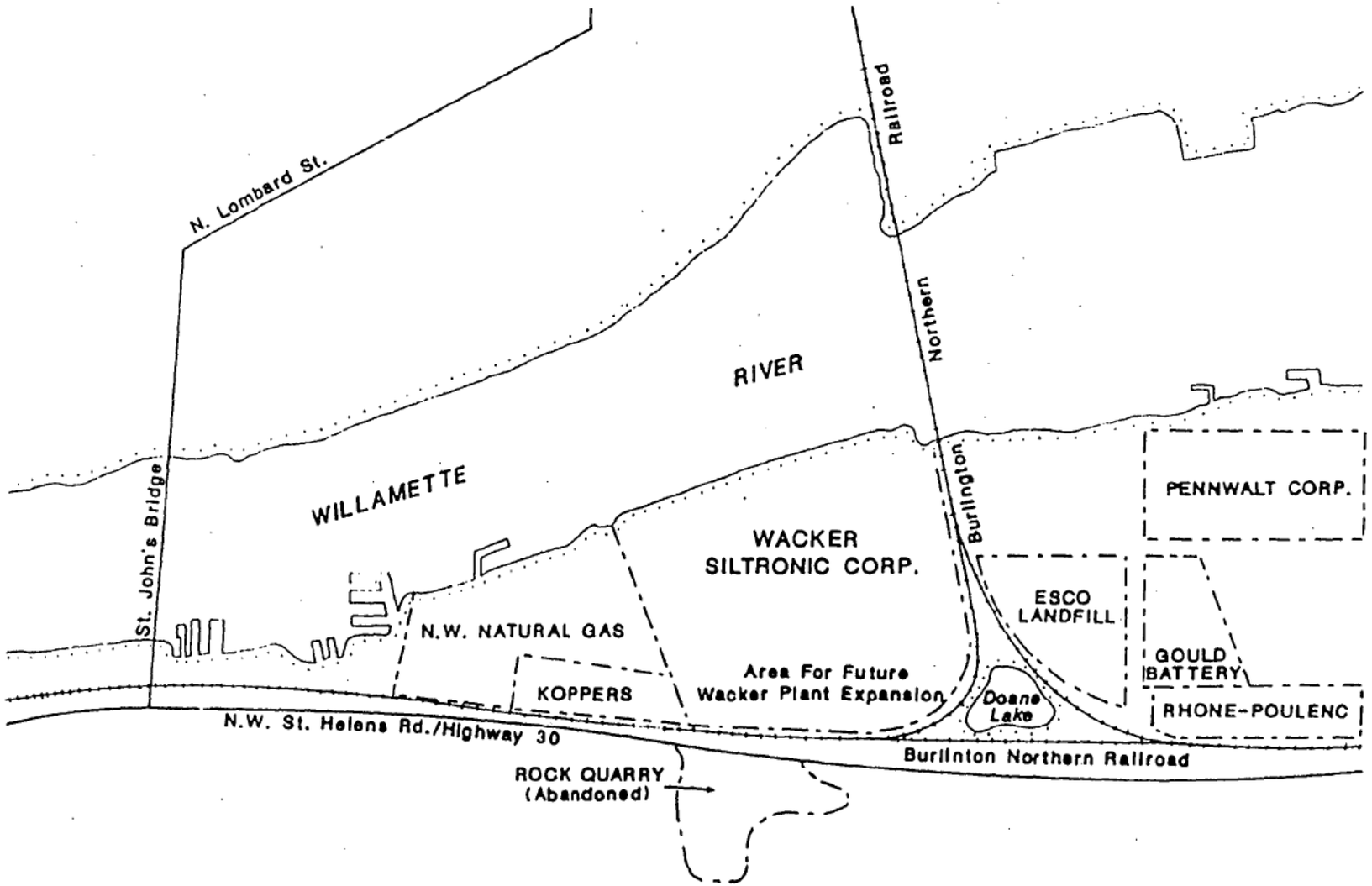
FIGURE 1
LOCATION MAP
WACKER SILTRONIC CORP.
Portland, OR



ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

FIGURE 2
SITE MAP
WACKER SILTRONIC CORP.
Portland, OR

Source: CH2M HILL



LEGEND

— · — Property line

ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/27/1987

FIGURE 3
VICINITY MAP (1983)
WACKER SILTRONIC CORP.
Portland, OR

SCOEPA00003430

APPENDIX B

SAMPLING RESULTS

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	BD	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

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											
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	
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-Dimethylphenol	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), SIW
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
Pesticides (EP Toxicity)											
Gamma BHC (Lindane)	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.04	pp, SIW, 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

PDK956.031.1

SCOEPA00003433

APPENDIX C

STRATEGY RECOMMENDATION

DEQ SITE ASSESSMENT SECTION - STRATEGY RECOMMENDATION

Site Name: Wacker Siltronic Corp.

Site CERCLIS Number: 096253737

DEQ ECSI Number: 183

Site Address: 7200 NW Front Ave.
Portland, OR 97210

Recommendation By: Kevin Dana, Environmental Specialist, Site Assessment Section

Approved By: Heather Schijf, Coordinator, Site Assessment Section

Date: May 19, 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, near the shores of Doane Lake. Northwest Natural Gas razed most of the production facilities in the late 1960's and built a liquified natural gas plant in their place. About 1973, the coal tar pits and part of Doane Lake were buried to a depth of about 10 feet by a mixture of overburden and spent oxide. (For more information on the Northwest Natural Gas Company site, see ECSI #84).

Although the file information is sketchy, by 1976 most or all of the fill area apparently wound up in the hands of the Portland Development Commission (PDC), which hoped to resell the property as part of an "urban renewal" of the area. Wacker Siltronic Corporation was interested in purchasing the site. In August 1977, CH2M Hill was hired to take three soil test borings in an area where Wacker hoped to build its facility. "Bitumen" was encountered. Bitumen is a generic term for hydrocarbons such as petroleum or asphalt. Apparently unaware of this, Wacker purchased the site in 1978 and constructed its process building in the sample area.

Wacker Siltronic manufactures silicon wafers from high purity polycrystalline silicon. The silicon wafers are produced in a "process building" adjacent to the Willamette River. Three waste streams are generated in the process. Trichloroethylene (TCE), used to clean the silicon wafers, is pumped from the process building to a diked, above ground storage tank, where it is temporarily stored before being shipped off-site. Freon is also temporarily stored in an outside above ground storage tank, before being poured into 55-gallon drums and shipped off-site. Finally, chromic acid, used during the etching of the silicon wafers, is pumped to a treatment building, where it is neutralized and separated. The liquid effluent is treated in Wacker's on-site wastewater treatment unit (WWTU). The sludge is dried and disposed of off-site. The WWTU discharges to both the Willamette River and the sewers, and is regulated by an NPDES permit.

ELIMINATED 1988

ELIMINATED 1991

In February 1979, oil was found in two excavations adjacent to the Koppers Company (which leases property from Northwest Natural Gas). Within a month, oil was found near the "Olympic fuel line corridor". The Olympic Pipe Line Company owns an underground easement that runs across the middle of the Wacker site, south of the process building. Believing that the oil came from the pipeline, DEQ took samples. But the spilled oil did not match the oil in the pipeline. The sample results are not on file.

In 1985, Wacker hired CH2M Hill to perform subsurface soil sampling on the vacant southern half of the site, where Wacker was planning on constructing a polysilicon plant. CH2M took samples at five foot intervals from seven boreholes. However, only nine samples were analyzed. Contaminants, primarily polycyclic aromatic hydrocarbons (PAHs) were concentrated at the 10 and 20-foot levels, with lesser amounts at 15 feet. Of the dozen or so individual compounds detected, six exceeded SOCLEAN's industrial soil cleanup standards: benzo(a)pyrene (120 ppm), benzo(b)fluoranthene & benzo(k)fluoranthene (total 120 ppm), chrysene (92 ppm), and indeno(1,2,3-cd)pyrene & dibenzo(a,h)anthracene (total 270 ppm). 2,4-toluenediamine (aka 2,4-D), a herbicide, was also detected, at 160 ppm. (After sampling was completed, the boreholes were converted into groundwater monitoring wells).

Ecology and Environment, Inc. (E&E) performed a PA on the site for EPA in 1987. After quickly summarizing the site operations and known contamination, E&E recommended deferring to State authority. DEQ was planning to study groundwater contamination in the Doane Lake area, looking at the possibility of an area-wide cleanup. About a dozen corporations were involved in the voluntary study. Wacker declined to be an active participant, insisting that it wasn't liable for any contamination. Wacker claimed that it qualified under the "innocent landowner" provisions of ORS 466.567, since it was unaware of the contamination when it purchased the property. Fred Hansen and the Attorney General's office disagreed, believing that Wacker had not taken "all appropriate inquiry" into the previous ownership and uses of the property. (The Doane Lake Study concluded in 1990 with a recommendation that sites in the

area be evaluated and remediated separately. See ECSI #36 for more information).

In May 1990, Wacker was planning to build an expansion near the silicon wafer plant. Wacker asked DEQ to review the project, (called "FAB 2"), because Wacker knew that the excavations might encounter subsurface contamination. No agreement with DEQ could be immediately reached, however. Still, Wacker hired CH2M Hill to take two soil samples. The samples were taken in June about 20 feet bgs. Seven substances were detected that exceeded SOCLEAN: benzene (29 ppm), benzo(a)anthracene (210 ppm), benzo(a)pyrene (240 ppm), benzo(b)fluoranthene (180 ppm), benzo(k)fluoranthene (120 ppm), chrysene (280 ppm), and indeno(1,2,3-cd)pyrene (160 ppm). (For comparison, the SOCLEAN standard for most of these substances is 1 ppm).

Two months later, in August, Wacker planned to take more soil samples in the contruction area, this time at levels 4-10 feet bgs. DEQ was to review the project under its Voluntary Cleanup Program. However, the agreement between DEQ and Wacker was terminated within a month. DEQ does not have the results of the sampling program, and it is unclear whether the sampling was even carried out.

ERROR NEVER ENTERED VCP ABOVE

In October 1990, Wacker hired CH2M Hill to take 26 groundwater and three "soil gas" samples from an area around the Olympic pipelines. Wacker was concerned that the pipelines may have leaked and contributed to the contamination observed at the FAB 2 site. CH2M Hill tested for TPH and BTEX. Total Petroleum Hydrocarbons were found at a maximum of 89 ppm. Benzene (max. 23.3 ppm), toluene (max. 5.96 ppm), and ethylbenzene (max. 4.68 ppm) were found at levels that violated the MCLs for drinking water (however, only one of the ethylbenzene samples exceeded the MCL). The contaminants were concentrated in an area near the pipeline. Wacker considered this to be evidence of a leak and notified Olympic and DEQ. Olympic performed a hydrostatic test on its lines, and one of them failed. However, it is unclear whether the pipe was leaking before the test failure. Olympic claims that no contaminants were observed during replacement of the pipe, and that the contamination found by Wacker does not match what was flowing through the pipe.

ALL DATA SUBMITTED

Due to the subsurface contamination, Wacker decided to change its plans so that the FAB 2 building could be constructed "above" the contamination, necessitating the removal of less than 10 cubic yards of contaminated soil. Wacker sought DEQ's permission for this in June 1991 and apparently got it, although Mike Rosen of DEQ felt that the contamination should be more extensively characterized. (Earlier, in February 1991, Wacker had asked if the new facility and accompanying parking lots could be considered a "cap" for the contamination. Wacker was worried that it might have to tear out its new building in a future cleanup action. Fred Hansen replied in March that DEQ would have to make an "independent determination" of the contamination to see if a cap would qualify as an appropriate remedial action).

SLANTED

Recommendation/Action:

The Site Assessment Section has reviewed file information related to this site. The site was placed on the Confirmed Release List and the Inventory in October 1992. Soil and groundwater contamination at the site is extensive. However, the soil is under about 10 feet of fill, and groundwater in the area is not used for drinking or industrial purposes. The contamination may pose a threat to the environment, particularly the Willamette River, if it migrates. Most of the contamination probably results from coal tars, which are normally stable. But leaks of fuel oil from Olympic's pipelines could mobilize the coal tars. Since the coal tars were deposited by the predecessor company of Northwest Natural Gas, that company should lead any investigation or cleanup of the tars. Site Assessment recommends that any further actions involving the Wacker Siltronic site be coordinated with the investigation/cleanup at the Northwest Natural Gas Company site.

Referrals Within or Outside DEQ:

The Northwest Natural Gas Company site (ECSI #84) has been referred to the Voluntary Cleanup Section (VCS) and the Site Response Section (SRS) for further action. Site Assessment has recommended that the investigation/cleanup of coal tar contamination on the Northwest Natural Gas Company site include the coal tar contamination on the Wacker Siltronic Corp. site.

Other:

This site is currently listed in DEQ's ECSI database. The database will be updated with information contained in this decision document and will reflect Site Assessment's decision for further action at the site.

September 8, 1993

Rudolf Staudigl, President
Wacker Siltronic Corporation
P.O. Box 83180
Portland, OR 97283-0180

Post-it™ Fax Note 7671	Date 9/29/94	# of pages ▸ 6
To BARRY BLAIR	From ERIC BLISCHKE	
Co./Dept. URS	Co. DEQ	
Phone # (303) 291-9293	Phone # (503) 229-6012	
Fax # (303) 296-6117	Fax #	

Dear Mr. Staudigl:

The Oregon Department of Environmental Quality (DEQ) has completed a Preliminary Assessment Equivalent (PAE) for the Wacker Siltronic Corp. 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 predecessor company of Northwest Natural Gas. Although the investigation will focus on property owned by Northwest Natural Gas, your property at 7200 NW Front Ave. will also need to be sampled in order for the DEQ to fully determine the extent of the contamination.

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 occured 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

- 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 persue 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. The site has already been listed on the Department's Confirmed Release List and Inventory of hazardous substances site list.

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, Coordinator,
Site Assessment Section
Environmental Cleanup Division

Enclosure: Strategy Recommendation

cc: Leslie Kochan, Northwest Region
Karla Urbanowicz, Voluntary Cleanup Section
Mike Rosen, Voluntary Cleanup Section
Thomas Miller, Site Response Section
SAS file #183

project file

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY INTEROFFICE MEMORANDUM

DATE: December 14, 1989

TO: Governor Neil Goldschmidt

FROM: Fred Hansen

SUBJECT: Wacker, legal liabilities for contamination

As you know, the Wacker facility has had some disagreements with our hazardous waste requirements. There really have been three separate issues, one of which is behind us.

1. Wacker had a large TCE spill and there was substantial debate about what, why and how a cleanup was to proceed. (As an indication of the extent of the disagreement it is worthwhile noting that one of Wacker's high ranking German based executives told me, when arguing that they shouldn't have to do anything, that their founder helped discover TCE and believed that the chemical was so safe he would not mind bathing in it. Not a particularly progressive viewpoint.)

This issue has been resolved.

2. In the process of preconstruction/prepurchase work for the original facility, the soil boring logs showed the presence of "bitumen" which should have alerted them to the potential for contamination on the property. Later they found contamination during the initial construction in late 1978/early 1979, but apparently didn't realize the extent or significance until the soil borings that were completed in 1985 in preparation for the planned expansion of the Wacker facility. The source of these pollutants appears to be:

A. Contaminants left by previous owners, principally a coal gasification plant, the predecessor of N.W. Natural Gas.

B. Contaminated fill material.

C. Contaminants migrating from other sources, most likely Koppers, Rhone Poulenc and possibly Gould Battery.

3. The cleanup of the Federal superfund site at Gould Battery requires a general groundwater assessment of groundwater movement and contamination in the whole area (covering 11 different industrial landowners and tenants).

In relation to these last two issues, Wacker has balked. They would like to be exempted from any legal liability for any contamination on site other than that which they created, if there is any. The attached letter is our formal response. (We have had numerous conversations with them since their letter arrived about a year ago, but now believe that we need to respond in writing.)

The legal setting is that an owner/operator under both Federal and state superfund laws is liable. Affirmative defenses may be made if two tests are met:

1. The owner/operator were truly innocent property owners; i.e.,they did not know about the contamination at the time of property purchase; and,

2. The owner/operator conducted a due diligence search of the property to determine if contamination might exist prior to property purchase.

Wacker believes that since the city (read Mayor Neil Goldschmidt) attracted them to the site, that they should not be liable. The real issue is do they meet the two tests to effectively assert an innocent property owner defense. Although we choose not to address the first test, there is some evidence to suggest that when CH2M-Hill conducted preconstruction investigations of the property (which was also pre-purchase) that information was available to Wacker that indicated contamination was potentially on the property--information which was apparently ignored or overlooked by Wacker.

Second, they did not perform due diligence (this is the issue we address in our proposed letter) at the time of purchase. You should know that our letter was prepared under the extensive guidance of an assistant attorney general who works with us on superfund liability issues.

Conclusion

Wacker will not like our letter. We think their complaint is really with the law, although they will continue to dispute our facts as the base of their argument.

Oregon

September 10, 1993

CERTIFIED MAIL NO. P-915-447-128
RETURN RECEIPT REQUESTED

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

Ms. Sandra Hart
Northwest Natural Gas Co.
220 NW 2nd Ave.
Portland, OR 97209

RECEIVED
SEP 16 1993
WACKER SILTRONIC
Environmental Health & Safety

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

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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 Saling, 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

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.

Oregon DEPARTMENT OF ENVIRONMENTAL QUALITY

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Portland, OR 97204-1390

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Address Correction Requested

Tom McCue

RUDOLPH STAUDIGL
WACKER SILTRONIC CORP.
PO BOX 83180
PORTLAND, OR 97283-0180

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SEP 1 6 1993

WACKER SILTRONIC
Environmental Health & Safety

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

IN THE MATTER OF:	)	
	)	DEPARTMENT ORDER AND NOTICE
SITE INVENTORY LISTING OF	)	OF OPPORTUNITY FOR CONTESTED
PROPERTY LOCATED IN	)	CASE HEARING
MULTNOMAH COUNTY, OREGON,	)	
	)	NO. SA-891-183
WACKER SILTRONIC CORP., OWNER	)	
	)	
	)	

Pursuant to ORS 466.557, the Director, Oregon Department of Environmental Quality (DEQ), issues this order placing the property described in this order on the inventory of facilities where a release of a hazardous substance is confirmed (Site Inventory).

I.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

A. Wacker Siltronic Corp. is the owner of the following described property:

7200 N.W. Front, Portland

B. On the basis of laboratory data, DEQ has confirmed that

xylene
toluene
2,4-D
1,1,2,2-tetrachloroethylene
chlorophenol
pentachlorophenol
ethyl benzene
benzo(A)pyrene

have been "released" at the property within the meaning of ORS 466.540(14).

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C. The substance(s)

xylene
toluene
2,4-D
1,1,2,2-tetrachloroethylene
chlorophenol
pentachlorophenol
ethyl benzene
benzo(A)pyrene

are "hazardous substances" within the meaning of ORS 466.540(9).

D. The property is a "facility" within the meaning of ORS 466.540(6).

II.

ORDER

Based upon the above Findings of Fact, Conclusions of Law and supporting documentation in DEQ files, DEQ orders that the above-described property shall be placed on the Site Inventory thirty (30) days from the date of receipt of this order by the owner, except as provided for in Section 3.

III.

OPPORTUNITY FOR HEARING

In accordance with ORS 466.557(4), the owner may request a hearing before the Environmental Quality Commission (EQC) or its hearings officer regarding this order. Any request for a hearing must be made in writing and received by the Director of DEQ within fifteen (15) days from the owner's receipt of this order and notice. Any such request must be accompanied by a written answer admitting or denying all factual matters contained in this order, and must affirmatively allege any and all affirmative claims or defenses the owner might have. Any hearing shall be conducted under ORS Chapter 183 and OAR Chapter 340 Division 11.

If the owner does not request a hearing within fifteen (15) days of receipt of this order and notice, the owner shall waive the right to a

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hearing under ORS Chapter 183, except as provided under OAR 137-03-075(6) and (7). In the absence of a timely answer and request for hearing, this order shall become effective, based on a prima facie case made on agency files and records. If the owner is an agency, corporation, or unincorporated association, the owner must be represented by an attorney licensed in Oregon, except as provided under OAR 340-11-102.

DATED this 30th day of November, 1988.

DEPARTMENT OF ENVIRONMENTAL
QUALITY OF THE STATE OF OREGON

BY: Fred Hansen
Fred Hansen, Director

SCOEPA00003452

Wacker Siltronic Corporation

WACKER

Wacker Siltronic Corporation
P.O. Box 03180
Portland, OR 97203
7200 N.W. Front Ave.
Portland, OR 97210
Phone (503) 243-2020
TWX 910-464-4777
FAX 503 226-0052

December 15, 1988

Department of Environmental Quality
RECEIVED
DEC 15 1988
Environmental Cleanup Division

Mr. Fred Hansen, Director
Oregon Department of Environmental Quality
811 S.W. Sixth Avenue
Portland, Oregon 97204-1334

Re: Wacker Siltronic Corporation -- DEQ Order
Placing Property on Inventory of Sites
Having Confirmed Releases
DEQ No. SA-891-183

Dear Mr. Hansen:

Enclosed herewith is Wacker Siltronic Corporation's Answer and Request for Hearing concerning DEQ's placing Wacker Siltronic's property on the Inventory of Sites having confirmed releases under ORS 466.557.

The issues raised by DEQ's Order are serious and complicated. We have answered within the time permitted and have preserved our rights. We hope, however, to be able to work out this matter with DEQ without the need for a contested hearing.

I am advised by our counsel, Marvin Durning, that he spoke on Wednesday afternoon with Ms. Sara Laumann of your staff about the need to be represented by an attorney licensed in Oregon at this stage. Ms. Laumann told Mr. Durning that by DEQ policy such representation was not necessary at this stage and would not be necessary until the time of the hearing. Ms. Laumann also said that she was preparing a written policy statement to this effect for your signature. We have relied on Ms. Laumann's statement but will, of course, add Oregon counsel at a later stage if that should be necessary. We would appreciate receiving a copy of the policy statement when issued.

Very truly yours,

WACKER SILTRONIC CORPORATION

John Pittman

By: John Pittman
Director of Engineering

Enclosures

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

IN THE MATTER OF:	)	
	)	WACKER SILTRONIC
SITE INVENTORY LISTING OF	)	CORPORATION'S
PROPERTY LOCATED IN	)	ANSWER AND REQUEST
MULTNOMAH COUNTY, OREGON,	)	FOR HEARING
	)	
WACKER SILTRONIC CORP., OWNER	)	NO. SA-891-183
	)	

Wacker Siltronic Corporation answers the allegations of factual matters contained in the Department's Order, and contests the Conclusions of Law and the Order, stating as follows:

ADMISSIONS AND DENIALS

1. Answering paragraph IA., admits it is the owner of property whose street address is "7200 N.W. Front, Portland," but denies that is a sufficient description of the property it owns for purposes of ORS 466.557.

2. Answering paragraph IB., admits that traces of the substances listed in IB. were found in 1985 by chemical laboratory analysis of soil and/or water samples taken in 1985 at certain locations on the property owned by the corporation, but denies that these substances have been "released" at the property within the meaning of ORS 466.540(14).

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3. Answering paragraph IC., denies that the substances are "hazardous substances" within the meaning of ORS 466.540(9).

4. Answering paragraph ID., denies that the property owned by Wacker Siltronic Corporation is a "facility" within the meaning of ORS 466.540(6).

AFFIRMATIVE DEFENSES

5. The Order lacks findings sufficient to lawfully place the property owned by Wacker Siltronic Corporation on the Site Inventory pursuant to ORS 466.547, for the reasons stated above, and additionally,

- because ORS 466.557 states that the inventory "shall include" (and hence requires) certain information, namely:

> (3) The inventory shall include but need not be limited to the following items, if known:
>
> (a) A general description of the facility;
>
> (b) Address or location;
>
> (c) Time period during which a release occurred;
>
> (d) Name of the current owner and operator and names of any past owners and operators during the time period of a release of a hazardous substance;
>
> (e) Type and quantity of a hazardous substance released at the facility;
>
> (f) Manner of release of the hazardous substance;
>
> (g) Levels of a hazardous substance, if any, in ground water, surface water, air and soils at the facility;
>
> (h) Status of removal or remedial actions at the facility; and

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(i) Other items the director determines necessary.

Of these required facts, only the address of the property is stated;

- None of the substances was contributed to the property by Wacker Siltronic Corporation and, pursuant to ORS 466.567, Wacker Siltronic Corporation is not at all liable for remedial action costs or damages arising in connection with them.

- the Order, by its errors, omissions, and ambiguities, will misinform the public and will injure Wacker Siltronic Corporation and will deny it its constitutionally protected rights.

Wherefore, the Order should be dismissed and Wacker Siltronic Corporation should be paid its costs and attorneys' fees in this matter to the extent provided by law.

DATED this 15th day of December, 1988.

WACKER SILTRONIC CORPORATION

By: John Pittman
John Pittman
Director of Engineering
(503) 241-7514

MARVIN B. DURNING, a Professional Service Corporation, Counsel for Wacker Siltronic Corporation

By: Marvin B. Durning
Marvin B. Durning
(206) 233-9616

(C4)033.3

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WACKER

WACKER CHEMICALS CORPORATION

P. O. BOX 03180 PORTLAND, OREGON 97203

TO:

Mr. Fred Hansen, Director
Oregon Department of Environmental Quality
811 S.W. Sixth Avenue
Portland, OR 97204-1334

Wacker Siltronic Corporation WACKER

Wacker Siltronic Corporation
P.O. Box 83180
Portland, OR 97283-0180
Phone (503) 243-2020
FAX (503) 226-0052

February 11, 1992

Fred Hansen, Director
Oregon Department of Environmental Quality
Att'n: Site Assessment Section
Environmental Cleanup Division
811 SW 6th Avenue, 9th Floor
Portland, OR 97204

Re: DEQ Proposal to List Wacker Siltronic Corporation Property on Confirmed Release List and Inventory (SDDB ID #183)

Dear Mr. Hansen:

On November 21, 1991 Wacker Siltronic Corporation (Wacker) received your letter of November 15, 1991 notifying it that the Department of Environmental Quality (DEQ) proposes to list Wacker's plant site in Portland on DEQ's "Confirmed Release List" and on its "Inventory" under Oregon's Environmental Cleanup Law (ORS 465.200 et seq.) Your letter stated that Wacker had 45 days from receipt of the notice to provide comments and that an extension of up to 45 additional days could be given for appropriate reason. Wacker applied for and was given an extension of an additional 45 days. This letter provides Wacker's comments on DEQ's proposed listings of Wacker's Portland plant site.

Enclosed with the notice letter was a "Facility Report" which the letter states "identifies the hazardous contamination at this property as well as other information we plan to include on the lists". The letter also says that the " site assessment report referenced in the caption above provides the basis for the determination that further investigation or cleanup is needed at the site." The report referenced in the caption is "CH2M Hill Findings Report, 12/1/90", a Groundwater and Soil Gas Investigation Report prepared for Wacker to assess the possibility that the Olympic pipeline crossing the Wacker property in a utilities corridor is the source of some hydrocarbons found in the soil along portions of the corridor. The CH2M Hill report was provided to DEQ by Wacker pursuant to its continued cooperation with the DEQ.

Wacker's comments on the proposed listings are as follows:

a. The Facilities Report lists Wacker Siltronic Corporation as "Current Legal Owner" of the plant site, which is correct, but it also lists Wacker-Chemie Gmbh as "Current Owner", which is incorrect. Wacker Siltronic Corporation, an American

corporation, is the owner of the plant site in every respect,and is its operator as well. Wacker-Chemie Gmbh, a German company, is the parent corporation of Wacker Siltronic, but it does not own the plant site, nor any interest in it. All reference to Wacker-Chemie Gmbh should be removed from the Facility Report and should not appear in any DEQ listing about the site.

b. The Facility Report lists Northwest Natural Gas as "Prior Owner/Operator". Northwest Natural Gas was indeed a former owner and operator of the site, but it is not the only former owner or operator. Wacker Siltronic Corporation acquired the property from the Portland Development Commission, which acquired the site from its prior owners and prepared it for use by Wacker. Wacker will be pleased to provide the DEQ any information it has on the chain of title of the property. In addition, available information concerning soil and groundwater contamination at the site indicates that the contamination came from other nearby properties or was caused to be there by other third parties. Wacker is confident that DEQ has the information referred to but would, of course, provide any information available to it which D.E.Q. may not have.

c. The Facility Report lists a number of substances said to have been released at the site, and it appears that all are hazardous substances under Oregon law, except perhaps the TPH if the TPH is not liquid at a temperature of 60° F and a pressure of 14.7 psi absolute. DEQ's information on this subject appears to be from the CH2M Hill report provided to DEQ by Wacker and cited in the caption of DEQ's letter and from certain other reports as well. This information appears to justify inclusion of the site on DEQ's "Confirmed Release List".

d. As stated above, the DEQ notice letter says that the site assessment report referenced in the caption (the CH2M Hill report) "provides the basis for the determination that further investigation or cleanup is needed at the site", and hence provides the basis for listing the site on DEQ's Inventory. There is, however, a great deal more information about the site already known to DEQ, including other information provided by Wacker, information developed by U.S. EPA and by responsible parties in connection with the NL/Gould Superfund site, and information developed by a group of owners of property in the NL/Gould and Doane Lake area pursuant to a consent order with DEQ. On the basis of all available information, it is reasonable to conclude that no further investigation is needed and no remedial action is needed at Wacker's site, and that the property should not be listed on DEQ's inventory.

DEQ has noted on the Facility Report that any contamination at the site is under the surface and that the groundwater under the site is not used. Indeed, any contamination in the soil is many feet under the surface, and appears to be immobile in the subsurface environment. Neither soil nor groundwater contamination at the site poses any threat to any local drinking water.

e. DEQ's notice letter states that "Listing your property does not necessarily mean that you are responsible for the contamination, investigation, or cleanup." In the case of the Wacker property, it is clear from the facts that Wacker has no legal liability for investigation costs, cleanup costs, natural resource damages or other related costs which may arise out of the presence of contamination in the soil or groundwater of its Portland plant site.

The crux of the matter is that Wacker purchased the property from the City of Portland as part of a Portland urban renewal and job development effort in which the Portland Development Commission assembled the property and prepared it for sale to and use by Wacker. Wacker was encouraged to buy the property and build its plant there by Governor Straub of Oregon, Mayor Goldschmidt of Portland, officials of the Port of Portland, the Portland Chamber of Commerce, and many others. Wacker purchased the property long after most of the contamination had come to be in the soil or groundwater. The contamination was buried deep in the site and was not at all evident. Wacker made all appropriate inquiries prior to the purchase but neither knew nor reasonably should have known of any contamination in the site. Some of the hazardous substances which may have come to the site before its purchase and all of the hazardous substances of concern coming to the site after the purchase came by migration from other property not owned by Wacker (including from the Olympic pipeline). All the hazardous substances of concern in the site came there by virtue of acts or omissions of third parties not connected in any way with Wacker.

For all these reasons, under both Oregon and federal law, Wacker is not responsible for any investigation, cleanup, natural resource damage or other similar costs arising from the contamination at the site.

Very truly yours,

WACKER SILTRONIC CORPORATION

John

John Pittman
Director of Engineering
cc: Marvin Durning
Rudy Staudigl
Jim Ellis
Tom McCue

Extra copy for Tom Boyle
3/15/93

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OCT 1992
WACKER SILTRONIC

Oregon

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

October 22, 1992

CERTIFIED MAIL NO. P-915-447-162
RETURN RECEIPT REQUESTED

WACKER SILTRONIC CORP.
PO BOX 03180
PORTLAND OR 97203

NOTICE TO OWNERS AND OPERATORS OF
DECISION TO LIST CONTAMINATED PROPERTY
Wacker Siltronic Corp.
7200 N. W. Front
ECSI ID NO. # 183
CH2M Hill Findings Report, 12/1/90

Dear Property Owner or Operator:

Previously by letter dated November 15, 1991, the Department of Environmental Quality (Department) notified you as an owner or operator of Wacker Siltronic Corporation of the Department's proposal to add this facility to two lists of facilities with confirmed releases of hazardous substances: the Confirmed Release List and Inventory. The notice invited comments on the proposed listing.

We appreciate the information provided with your comments. The Department has incorporated the changes requested in the site ownership information in the Facility Report for the Wacker site. However, given the contaminant levels at the site, we cannot agree that the site poses no significant threat to present or future public health or the environment. The Department has determined that further remedial action is needed at this site and with this notice is adding it to the Confirmed Release List and Inventory. Enclosed are the Department's response to comments on the proposed listing and the Facility Report, which includes the information about Wacker Siltronic Corporation that will appear on the Confirmed Release List and Inventory.

The Department will update the Confirmed Release List and Inventory quarterly and provide copies to area newspapers and to the public upon request. In addition, the Department has begun scoring sites on the Inventory under its new Inventory Ranking Rule developed to rank these sites based on threats to public health and the environment. The Department will notify owners and operators and allow them to comment on the scores proposed for their facilities prior to adding scores to the Inventory.

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Portland, OR 97204-1390
(503) 229-5696
TDD (503) 229-6993
DEQ-1

A facility can be removed from the Confirmed Release List and Inventory after all necessary cleanup is completed, including continuing environmental controls such as groundwater monitoring or special land use restrictions. If you are not already working with the Department but plan to investigate or clean up the site, please contact us. We want to work together to eliminate threats to Oregon from hazardous materials. In any event, we will notify you before initiating any new action at Wacker Siltronics.

As noted in the earlier letter to you, listing your property does not necessarily mean that you are responsible for the contamination, investigation or cleanup. Responsibility for these costs is prescribed by various and complex provisions in state and federal laws. If you want more information regarding these laws, you may want to contact your attorney. You may also contact this office, as described below.

If you have specific questions about the Confirmed Release List or Inventory, or want copies of the statute or regulations governing the Department's site assessment, listing, or cleanup processes, please contact the Site Assessment Section of the Environmental Cleanup Division at (503) 229-6170 or at the address shown on the letterhead.

Sincerely,

Fred Hansen
Director

e\183list.let
Enclosures: Response to Comments
Facility Report
cc: Northwest Region, DEQ
SAS File #183

ENVIRONMENTAL CLEANUP SITE INFORMATION
FACILITY REPORT

October 19, 1992 11:37 am

SITE ID: 183 **NAME:** ** Wacker Siltronic Corp.

LOCATION: 7200 NW Front Ave, Portland, 97210

COUNTY: MULTNOMAH

ASSOCIATED PARTIES

AFFILIATION	PARTY NAME **
Current Legal Owner	Wacker Siltronic Corp.
Prior Owner	Portland Development Commission
Prior Owner/Operator	Northwest Natural Gas

** Not necessarily responsible for contamination.

HAZARDOUS SUBSTANCE INFORMATION

SUBSTANCE	QUANTITY*** RELEASED	MEDIA CONTAMINATED	CONCENTRATION LEVEL	AS VERIFIED BY
BENZENE	Unknown	Groundwater	Up to 23,300 ug/l	Laboratory Data
		Soil	Up to 29 mg/kg	Laboratory Data
BENZO(a)PYRENE	Unknown	Groundwater	Up to 760 ug/l	Laboratory Data
		Soil	Up to 240 mg/kg	Laboratory Data
CHLOROPHENOL	Unknown	Soil	17.5 mg/kg	Laboratory Data
DIMETHYLPHENOL,2,4-	Unknown	Groundwater	Up to 27 ug/l	Laboratory Data
		Soil	Up to 3.1 mg/kg	Laboratory Data
ETHYLBENZENE	Unknown	Groundwater	Up to 4680 ug/l	Laboratory Data
		Soil	Up to 55 mg/kg	Laboratory Data
PENTACHLOROPHENOL	Unknown	Soil	Up to 6.9 mg/kg	Laboratory Data

PETROLEUM HYDROCARBONS	Unknown	Groundwater	Up to 89 mg/l	Laboratory Data
POLYNUCLEAR AROMATIC HYDROCARBONS (PAH)	Unknown	Groundwater	Up to 11,800 ug/l (total PAHs)	Laboratory Data
		Soil	Up to 9970 mg/kg (total PAHs)	Laboratory Data
TETRACHLOROETHYLENE	Unknown	Soil	Up to 11 mg/kg	Laboratory Data
TOLUENE	unknown	Groundwater	Up to 5960 ug/l	Laboratory Data
		Soil	Up to 26 mg/kg	Laboratory Data
TOLUENEDIAMINE,2,4-	Unknown	Soil	Up to 160 mg/kg	Laboratory Data
XYLENEs	unknown	Groundwater	Up to 6450 ug/l	Laboratory Data
		Soil	Up to 146 mg/kg	Laboratory Data

*** Quantity released may include amounts of substances other than hazardous substances.

HOW RELEASED:

Past practices.

STATUS OF REMOVAL OR REMEDIAL ACTION:

Basic Preliminary Assessment completed

TIME PERIOD WHEN RELEASE OCCURRED:

Unknown

ENVIRONMENTAL AND PUBLIC HEALTH THREATS:

Site is located in heavy industrial area. Significant soil and groundwater contamination, but contaminated soil is under surface and groundwater not used. Greatest threat may be to Willamette River and to on-site workers who dig into contaminated soil without adequate personal safety equipment.

REMEDIAL ACTION FUNDED PRIMARILY BY:

Owner, operator or other person under agreement, order or consent decree under ORS 465.200 or 465.420.

(facility.rpt)

RESPONSE TO COMMENTS
ON NOTICE TO LIST SITE ON THE CRL AND INVENTORY

Site: Wacker Siltronic Corporation
SDDB ID No. 183

Comments submitted by:
John Pittman, Director of Engineering, Wacker Siltronics
February 13, 1992

Response prepared by:
Loretta Pickerell, Manager, Site Assessment Section

1. Comment:

The Facility Report should not reference Wacker-Chemie Gmbh as an owner of the site. Wacker-Chemie Gmbh, a German company, is the parent corporation of Wacker Siltronic, the owner of the site. Wacker-Chemie Gmbh does not own any interest in the plant site.

Response:

Reference to Wacker-Chemie Gmbh has been removed from the Facility Report. The Department will identify Wacker-Chemie Gmbh as a parent company of Wacker Siltronic in its files.

2. Comment:

The Facility Report should include Portland Development Commission as a former owner of the site. Others may also be included in the chain of title to the property.

Response:

The Department has added Portland Development Commission as a former owner and may add other former owners in the future.

3. Comment:

The evidence of releases of hazardous substances appears to justify listing the site on the Confirmed Release List. However, the site does not warrant listing on the Inventory. The significant amount of information developed on this and

nearby sites indicate that no further investigation or remedial action are needed at the Wacker site. Contamination at the site is several feet below ground surface and groundwater under the site is not used. Neither soil nor groundwater contamination at the site pose any threat to local drinking water.

Response:

Given the quantities and concentrations of the hazardous substances uncontained at the site, the Department believes that additional investigation and remedial action to address the releases are needed to assure the protection of present and future public health, safety, welfare, and the environment. Remedial action includes long-term environmental or institutional controls, such as deed restrictions, necessary for this protection. This is the finding required to list sites on the Confirmed Release List and Inventory.

4. **Comment:**

Listing the site does not imply that Wacker Siltronics is responsible for investigation or cleanup. In fact, Wacker Siltronics is not responsible. Wacker made appropriate inquiries before purchasing the property and could not reasonably have known about the contamination at that time. In addition, all contaminants of concern on the site have migrated from other properties not owned by Wacker.

Response:

The Department agrees that listing the site does not imply that Wacker Siltronics is responsible for investigation or cleanup of this site. The Department has not determined responsible parties at this time.

REMOVAL ACTION DECISION MEMORANDUM

EAST DOANE LAKE SEDIMENTS

PREPARED BY
OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

MAY 5, 1998

REMOVAL ACTION DECISION MEMORANDUM
EAST DOANE LAKE REMNANT SEDIMENTS

1.0 INTRODUCTION AND PURPOSE

The purpose of this document is to evaluate removal alternatives for East Doane Lake (EDL) that could be performed in conjunction with the EPA remedial action for the Gould Superfund (Gould) site. This document meets the substantive requirements of an engineering evaluation and cost analysis (EECA) as specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300.415.

On June 3, 1997, The United States Environmental Protection Agency (EPA) amended the Record of Decision (ROD) for the Gould site. Components of the remedial action specified in the amended ROD for the Gould site include the excavation and dewatering of EDL sediments, filling EDL, and the construction of an on-site containment facility (OCF) on the Gould property. The amended ROD has provided the opportunity for the excavation and disposal of an additional volume of EDL sediments contaminated with organic chemicals.

Although the EPA remedial action for the Gould site specifically focuses on lead contamination, EDL sediments are also contaminated with organic chemicals. In particular, investigative activities have also identified the presence of polychlorinated dibenzo-dioxins and furans (PCDD/PCDF) in EDL sediments. The origin of these contaminants appear to be related to past waste management practices at the Rhone-Poulenc Ag Company (Rhone-Poulenc) NW St. Helens Road facility. The Oregon Department of Environmental Quality (DEQ) evaluated the risk to human health and the environment from EDL sediments below the excavation depth specified by the EPA remedial action. Risk assessment calculations show that the concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and 2,3,7,8-tetrachlorodibenzo furan (2,3,7,8-TCDF) in deeper EDL sediments represent a risk to future site workers in excess of the acceptable risk level of 10^{-6}. In addition, 2,3,7,8-TCDD has been detected in groundwater downgradient of EDL at concentrations above the acceptable risk level. Preliminary analysis indicates that 2,3,7,8-TCDD has the potential to enter the Willamette River via groundwater transport. The Willamette River is water quality limited for 2,3,7,8-TCDD.

2.0 SUMMARY OF RECOMMENDED REMOVAL ACTION

DEQ has determined that a removal of additional EDL sediments is warranted based on risk assessment results. The removal action will be accomplished in conjunction with the EPA remedial action to be conducted at the Gould Superfund Site in Portland, Oregon. The recommended removal action consists of the following elements:

SCOEPA00003469

- Excavate, dewater, and stockpile approximately 7800 cubic yards of PCDD/PCDF contaminated EDL sediments;
- Backfill EDL; and
- Dispose dewatered EDL sediments in OCF.

The removal action is expected to occur during the summer and fall of 1998. Construction of the OCF and placement of dewatered sediments within the OCF is expected to be completed in 1999.

The recommended removal action is not expected to interfere with the impending EPA remedial action at the Gould Superfund site or with ongoing RI/FS activities at the Rhone-Poulenc facility.

3.0 SITE DESCRIPTION AND SETTING

3.1 Facility Description

EDL is located along Front Avenue in the northwest industrial section of Portland, Oregon (see Figure 1). EDL is a remnant of a larger lake, Doane Lake, that was gradually filled in during the past century (see Figure 2). Currently, three Doane Lake remnants remain - East Doane Lake, West Doane Lake and North Doane Lake. EDL is located on the Gould and Schnitzer properties and is wholly located within the Gould Superfund site.

The Doane Lake area of northwest Portland is characterized by heavy industry. Facilities located in the immediate vicinity of EDL include the former Gould facility (secondary lead smelting and battery recycling), Schnitzer, the inactive Rhone-Poulenc facility (herbicide and insecticide manufacturer), Elf Atochem (chemical manufacturer), Wacker Siltronics (semi-conductor manufacturing), and the Metro solid waste transfer facility. Residential and commercial properties are located across St. Helens road, approximately ¼ mile southwest of EDL.

3.2 Physical Setting and Natural Resources

The site is located in the northern reaches of the Willamette River Valley. The lake is located in an alluvial plain situated between the Willamette River to the northeast and the Tualatin mountains to the southwest. The Willamette River is approximately ¼ mile from EDL. Water from the lake drains to the Willamette River by means of an overflow weir and storm drain located along Front Avenue.

Forest Park, a large enclave of second growth forest, is located approximately ½ mile west of EDL. Sauvie Island, an area of significant wetland habitat, is located approximately 1 mile downstream of EDL near the mouth of the Willamette River.

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The groundwater environment generally consists of artificial fill overlying a layer of alluvial sediments which in turn overlies a thin veneer of cemented gravel and basalt bedrock. The alluvial sediments are approximately 40 to 60 feet thick and consist of sand lenses interbedded with silty clay and clayey silt. A north-south trending bedrock trough also appears to exist below historical Doane Lake. Although the groundwater flow direction in the vicinity of EDL is variable, the ultimate discharge point for groundwater is the Willamette River.

3.3 Land and Water Use

A land and water use report was submitted by Rhone-Poulenc in accordance with OAR 340-122-080. Based on information presented in this report, DEQ determined that the current and reasonably likely land and water use in the vicinity of EDL is unrestricted industrial use. Although direct contact exposure scenarios were not developed for EDL sediments, groundwater exposure scenarios were based on the results of the land and water use determination (see Section 5.5 for a summary of the risk assessment results).

4.0 SITE HISTORY

4.1 Operations and Potential Contaminant Sources

Doane Lake has been a receptacle for waste disposal activities since the 1950's. From 1963 until 1979, the size of Doane Lake changed radically as a result of filling operations conducted by Schnitzer, Gould and Rhone-Poulenc. Prior to 1966, wastewater from the Rhone-Poulenc facility was discharged directly into Doane Lake (and later, West Doane Lake). Overflow from spills on the Rhone-Poulenc facility, may have impacted East Doane Lake prior to filling in and closing off East Doane Lake.

4.2 Studies and Investigations

Numerous studies and investigations have been performed in the vicinity of EDL. These investigations were part of the remedial investigation (RI) for the Rhone-Poulenc facility and the feasibility study (FS) for the Gould Superfund Site. Key investigations that focused on EDL are presented below:

- Sediment samples were collected by Hart Crowser on behalf of Gould in 1994 at 16 locations within EDL. Samples were analyzed for total and extractable lead to estimate the volume of lead contaminated sediment that required remediation. Additional samples were collected in 1995 at the same locations and analyzed for organic compounds including chlorinated pesticides, chlorinated herbicides, PCDD/PCDF and PCBs

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- Surface water from EDL was sampled by Hart Crowser on behalf of Gould in July, 1995. Chemicals detected in the water included metals (cadmium, chromium, lead and zinc); petroleum hydrocarbons; chlorinated herbicides (2,4-D, 2,4,5-T and 2,4,5-TP); and furans.

- Groundwater was sampled by Woodward-Clyde Consultants in December, 1996. Groundwater collected from monitoring well clusters W-3, W-4 and W-16 were analyzed for all Rhone-Poulenc chemicals of potential concern including chlorinated herbicides and pesticides, PCDD/PCDF, volatile organic compounds, arsenic and mercury.

- Sediment samples were collected from the southern end of EDL by Woodward-Clyde Consultants in January 1997. Sediment samples were analyzed for Rhone-Poulenc chemicals of potential concern including chlorinated herbicides and pesticides, PCDD/PCDF, volatile and semivolatile organic compounds, lead, arsenic and mercury.

- Sediment samples were collected by Ecology and Environment on behalf of DEQ in March, 1998 at 12 locations within EDL. Samples were analyzed for chlorinated dioxins and furans, total and extractable lead, and grain size to estimate the volume of organic contaminated sediment that requires remediation.

4.3 Cleanup Actions

4.3.1 Gould Superfund Site

A Record of Decision (ROD) for the Gould Superfund Site Soils Operable Unit was signed March 31, 1988. Excavation and treatment of contaminated material began at the Gould Superfund Site in the summer of 1993. Excavated battery casings were processed to remove and recycle lead while contaminated soil and matte were stabilized and stored on site for future backfilling. In 1994, EPA allowed the Gould PRPs to evaluate alternative remedial actions and conduct studies to improve the efficiency and reliability of the site remedy. A focused feasibility study was prepared to evaluate changes in the treatment process and other potential treatment alternatives. However, EPA determined that additional information and evaluation of organic contamination was necessary to assess the impact of these contaminants on the site remedy. Cleanup activity was suspended pending an EPA determination on changes to the selected remedy.

On June 3, 1997, EPA amended the ROD for the Gould Superfund site. Major components of the amended ROD include the following:

- Perform design studies to evaluate consolidation and settlement, lateral and vertical support of the OCF, dewatering sediments and the hydrogeologic impact of filling EDL;
- Construction of an OCF with a liner, leachate collection system and engineered cap in accordance with 40 CFR Subpart N requirements;

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- Excavation and dewatering of EDL sediments above specified cleanup levels;
- Excavation of the remaining battery casings on the Gould property;
- Treatment of the lead fines stockpile, the screened Gould excavation stockpile and other lead contaminated material identified as principal threat waste;
- Consolidation of contaminated material within the OCF;
- Filling the EDL and the open excavation on Rhone-Poulenc property;
- Institutional controls that restrict future property use to 1) industrial operations or other uses compatible with the site remedy and 2) do not damage the OCF or cause releases of buried materials;
- Groundwater monitoring to ensure the effectiveness of the cleanup and that contaminants were not mobilized during its implementation; and
- Long-term operation and maintenance and reviews to ensure the remedy continues to provide adequate protection of human health and the environment.

Based on the EPA schedule for implementing the amended ROD, the excavation, dewatering and stockpiling of EDL sediment must be completed by October 31, 1998. The construction of the OCF is expected to be completed in 1999.

4.3.2 Rhone-Poulenc Facility

A groundwater recovery system was installed at the Rhone-Poulenc facility in 1983 and began operation in May, 1984. The groundwater recovery system consists of 8 recovery wells and a wastewater treatment plant. A 1993 site assessment prepared for Rhone-Poulenc by S.S. Papadopulos and associates estimated that the groundwater recovery system has removed and treated over 75 tons of organic chemicals during its operation.

5.0 REMOVAL SITE EVALUATION

5.1 Hazardous Substances Present

EDL sediments are contaminated with lead, chlorinated herbicides, chlorinated insecticides, chlorinated benzenes, phenols and PCDD/PCDF. A summary of chemicals detected in EDL sediments is presented in Table 1.

5.2 Sediment Investigation

This removal evaluation is based on four investigations of EDL sediments. The first two investigations were conducted by Hart Crowser in 1994 and 1995 in support of the Gould Superfund site remedial action. The third investigation was conducted by Rhone-Poulenc. The

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final investigation occurred in March, 1998 and was conducted by Ecology and Environment on behalf of the Oregon Department of Environmental Quality. A summary of EDL sediment sample locations is presented in Figure 3.

In 1994, Gould sampled EDL sediments for total and extractable lead. A total of 16 sediment cores were installed. The primary purpose of the investigation was to develop estimates for the volume of lead contaminated sediment that would require removal under the EPA remedial action. Boring depths ranged from 3 to 6 feet below the lake bottom.

The investigation determined that extractable lead concentrations exceeding the EPA action level of 5.0 mg/l were present in shallow EDL sediments. Exceedances were primarily confined to the upper 2 feet of sediment. However, at one location (DLI), an extractable lead concentration of 5.6 mg/L was detected at depth of 3.5 to 4.0 feet.

In 1995, additional samples were collected at the same location and analyzed for organic contaminants. The results of this investigation detected the presence of numerous organic chemicals including phenols, chlorinated insecticides, chlorinated herbicides and PCDD/PCDF. Concentrations and occurrence of organic chemicals also tended to decline with increasing depth. However, deeper sediment samples in the central portion of the lake were found to contain total PCDD/PCDF at concentrations above 10,000 pg/g.

In January, 1997, sediment samples were collected from three locations at the southern end of EDL. Contaminants detected in these samples included PCDD/PCDF, chlorinated herbicides, phenols and volatile organic compounds, lead, mercury and arsenic.

A preliminary analysis conducted by DEQ indicated that the concentrations of 2,3,7,8 -TCDD and 2,3,7,8-TCDF in sediment samples collected from the central portion of the lake (Area 2) may present an unacceptable risk to workers exposed in the future to groundwater during equipment maintenance activities. DEQ analysis also indicated that the levels of 2,3,7,8-TCDD and 2,3,7,8-TCDF present in the northern portion of the lake (Area 1) and the southern portion of the lake (Area 3) did not appear to present a risk to human health. The DEQ analysis was conducted only on deeper sediments that were not likely to be excavated during the EPA remedial action.

In March, 1998, a focused sediment investigation of EDL was conducted by DEQ. The investigation consisted of drilling sediment cores at twelve locations within the northern portions of EDL. Samples were analyzed for total and extractable lead and polychlorinated dibenzo-dioxins and furans. In addition, sediment cores were examined to determine the contact between the unconsolidated sediments and the older and more consolidated sediments.

The sampling program was designed to define the vertical and lateral limits of sediment contamination, confirm the preliminary risk assessment results and determine the volume of

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sediments that would require removal. The vertical extent of contamination was estimated through identification of the contact between unconsolidated sediments forming the modern lake bottom and older and more consolidated sediments. Identification was based on drilling rate measurements and visual observations of the cores. DEQ analysis determined that the depth of the contact ranged from 4 to 7 feet below the level of the lake bottom.

The lateral extent of contamination was determined through chemical analysis and distribution of PCDD/PCDF. The sampling program design was based on the assumption that PCDD/PCDF concentrations exceeded the acceptable risk level of 1.0×10^{-6} in Area 2 but not in Area 1. In order to verify this assumption, seven sediment borings were installed in Area 1 along two transects (Transects 1 and 2) near the Area 1/Area 2 boundary. Analysis of the sediment core logging results suggested a strong stratigraphic variability between Area 1 and Area 2. Logs for five of the seven borings in the eastern part of Area 1 were primarily sand while the five borings in Area 2 were primarily silt. In addition, a strong correlation between elevated levels of PCDD/PCDF and the silt unit was identified. Chemical analysis of the three cores within Area 1 that were comprised primarily of silt detected PCDD/PCDF at concentrations exceeding the acceptable risk level. This result was consistent with previous data collected in Area 2. A summary of the PCDD/PCDF results are presented in Table 2.

Samples were collected at three locations within the central portion of Area 2 and analyzed for EP-Toxicity and total lead. Samples were collected at two depth intervals, 3.0 to 3.5 and 5.0 to 5.5 feet below lake bottom. In addition, three additional samples were analyzed for EP-Toxicity lead. These samples were collected from a depth of 3.0 to 3.5 feet near the Area 1/Area 2 boundary where elevated PCDD/PCDF concentrations were detected. All EP-toxicity lead concentrations were below the EPA target cleanup level of 5.0 mg/l. The maximum total lead concentration detected was 19,700 mg/kg.

Two of the new borings were drilled in the southern portion of Area 2, near previous sample point DLJ. Samples from these two borings, T33 and T34, were similar in composition to other samples taken from Area 3, in that they contained predominantly silty sediment with zones of lime residue identified. The presence of lime residue is consistent with the use of Area 3 in the past as a waste lagoon for the adjacent Liquid Air Corporation acetylene gas manufacturing plant. Area 3 had been evaluated in the previous DEQ risk assessment and found to not pose an unacceptable risk.

Based on the results of this investigation and reevaluation of the previous data collected by Hart Crowser, DEQ concluded that the elevated concentrations of PCDD/PCDF detected in deeper EDL sediments were primarily associated with silty unit located in the central portion of the lake. This contamination is bounded by the lime residues present on the Schnitzer property to the south and the sandy material present in the northern reaches of EDL.

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5.3 Groundwater Investigation

In December, 1996, a limited groundwater investigation was performed by Woodward Clyde on behalf of Rhone-Poulenc. The investigation focused on previously installed monitoring wells located downgradient of EDL. PCDD/PCDF congeners were detected in shallow to intermediate depths in 3 of the 8 monitoring wells sampled. Analysis of groundwater collected from monitoring well W-16-S detected 2,3,7,8-TCDD and 2,3,7,8-TCDF at concentrations of 9.3 and 6.7 pg/L respectively.

5.4 Surface Water

Due to the time constraints associated with the removal action, a full investigation of impacts to surface water, including the Willamette River, has not been performed. However, EDL sediments represent a source of groundwater contamination and the ultimate discharge point for groundwater is the Willamette River.

Analysis of Willamette River sediments collected in the vicinity of the Rhone-Poulenc facility has detected the presence of contaminants similar to those found in EDL sediments. Specifically, PCDD/PCDF and chlorinated herbicides have been detected. In addition, groundwater collected from monitoring wells installed downgradient of EDL have been found to contain similar organic contaminants.

A simple modeling analysis was performed to determine whether contaminants present in EDL sediments could migrate to the Willamette River. The analysis assumed that EDL sediments represented an infinite source of contamination and the contaminant plume had reached steady state conditions. The model utilized a conservative pore water (source) concentration of 45 ng/L 2,3,7,8-TCDD and was calibrated to the 2,3,7,8-TCDD concentration detected in W-16-S. The results of this analysis indicated that under these conditions, groundwater with a concentration of 5 ng/l may be entering the Willamette River. Since the Willamette River is water quality limited for 2,3,7,8-TCDD, additional discharges of 2,3,7,8-TCDD to the Willamette River may result in exceedance of the 2,3,7,8-TCDD loading capacity for the river.

Although the analysis performed is conservative, numerous utility lines downgradient of EDL may provide preferential contaminant migration pathways to the Willamette River. These preferential pathways were not considered in this analysis. In addition, many other contaminants present in EDL sediments also have the potential to migrate to the Willamette River.

5.5 Risk Assessment Results

A limited risk assessment was performed by DEQ to estimate the risks to human health from EDL sediments. Exposure parameters used to quantify exposure were based on exposure assumptions developed by Rhone-Poulenc ***(see Appendices E, F, and G, East Doane Lake***

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Interim Remedial Measure Report, October 24, 1997). The risk assessment evaluated the future risk to workers through exposure to PCDD/PCDF under three reasonably likely future industrial groundwater exposure scenarios. The exposure scenarios evaluated included a maintenance worker, a monitoring well worker and a construction worker. Exposure was expected to occur as a result of dermal absorption of contaminants in groundwater through the hands for the maintenance worker and monitoring well worker and through the hands and feet for the construction worker. Direct contact exposure scenarios for sediment were not evaluated because 1) the depth of the sediments evaluated were below the depth at which direct contact exposures are expected to occur; and 2) the entire lake will be backfilled and covered with the OCF as part of the EPA remedial action for the Gould site. A summary of the risk assessment results is presented in Tables 3 through 5.

PCDD/PCDF groundwater concentrations were estimated through an equilibrium partitioning analysis. It was assumed that an average porewater concentration would be a representative estimate of groundwater concentrations. In addition to considering the silty sediments, the risk associated with the sandy sediments and limey sediments were also evaluated.

The three exposure scenarios described in the RPAC Report employed the upper 90th percent confidence limit of the arithmetic mean as the exposure point concentration for each congener. The risk associated with dermal exposure to groundwater for maintenance, construction and workers engaged in sampling of wells were determined for each congener in accordance with DEQ rules (OAR 340-122-115). In addition, the cumulative risk associated with exposure to all congeners was determined in accordance with DEQ rules (OAR 340-122-115).

The results of the risk analysis determined that the risk to human health exceeded the acceptable risk level of 10^{-6} for the silty sediments. The risk due to exposure to 2,3,7,8-TCDD was estimated at 3.6×10^{-6}. The risk due to exposure to 2,3,7,8-TCDF was estimated at 1.9×10^{-6}. The total risk from exposure to PCDD/PCDF was estimated at 6.3×10^{-6}. Calculated risks for the sandy sediments and the lime residues did not exceed the acceptable risk level for individual carcinogens of 1.0×10^{-6}.

In order to confirm the risk estimates developed based on the results of the sediment concentrations and the porewater analysis, a risk evaluation was performed based on the concentrations of 2,3,7,8-TCDD and 2,3,7,8-TCDF detected in monitoring well W-16-S. The risk associated with dermal exposure to groundwater for maintenance workers were estimated at 1.5×10^{-6}. This result also exceeds the acceptable risk level of 1.0×10^{-6}.

SCOEPA00003477

6.0 DESCRIPTION OF REMOVAL ACTION ALTERNATIVES

6.1 Summary of Media of Concern

The primary media of concern at EDL is groundwater. Removal action alternatives focus on EDL sediments as a source of groundwater contamination. Groundwater contamination in turn represents an unacceptable risk to human health through the reasonably likely future use of groundwater for equipment maintenance purposes. In addition, groundwater may transport EDL sediment contaminants to the Willamette River. The removal action alternatives developed in this section have been developed to reduce the exposure of workers to contaminated groundwater and prevent the migration of contaminants of concern to the Willamette River.

6.2 Removal Action Objectives

The results of the focused human health risk assessment indicates that PCDD/PCDF concentrations present in groundwater may pose an unacceptable risk to human health through the use of groundwater for equipment maintenance purposes. In addition, DEQ analysis indicates that PCDD/PCDF contamination present in EDL sediments may migrate to the Willamette River which is water quality limited for 2,3,7,8-TCDD. 2,3,7,8-TCDD has been detected both in EDL sediments and in groundwater collected downgradient of EDL.

DEQ has developed the following removal action objectives:

1. Reduce human exposure to groundwater contaminated with 2,3,7,8-TCDD and 2,3,7,8-TCDF; and
2. Reduce the migration of 2,3,7,8-TCDD from EDL sediments to the Willamette River.

6.3 Description of Removal Action Alternatives

Three removal action alternatives have been developed for evaluation. Each removal alternative will allow the completion of the EPA remedial action and the completion of the RI/FS for the Rhone-Poulenc facility as a whole. Each removal alternatives is described below:

6.3.1 Alternative 1 - No Action Alternative

The no action alternative generally involves no removal measures. The no action alternative would not achieve the removal action objectives. However, the no action alternative is considered a viable option because the removal action objectives may be met through the partial excavation of contaminated sediments as part of the EPA remedial action or as part of a future remedial action developed during the Rhone-Poulenc RI/FS.

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6.3.2 Alternative 2 - Sediment Removal, Dewatering, Stockpiling and On-Site Containment

This alternative includes the removal, dewatering and stockpiling of EDL sediments with subsequent disposal in an on-site containment facility (OCF) to be constructed within the area of contamination at the Gould site. This removal action would be performed in conjunction with the impending EPA remedial action at the Gould Superfund site. In order to be implemented within the timeframe of the EPA remedial action, this alternative would require that DEQ enter into an agreement with the Gould Superfund Site Respondents (GSSR), with EPA's concurrence, enabling joint use of a single remedial contractor. DEQ would be responsible for payment of additional remedial contractor costs associated with site investigation, sediment removal, dewatering, on-site stockpiling and on-site containment of unconsolidated sediment not contaminated with lead above the EPA cleanup criteria.

6.3.3 Alternative 3 - Sediment Removal, Dewatering, Stockpiling and Off-Site Disposal

This alternative includes the removal, dewatering and stockpiling of EDL sediments as described in Alternative 2 above. However, this alternative includes off-site disposal of EDL sediments rather than disposal in the OCF. Under this alternative, DEQ assumes that the dewatered sediment would be considered a listed hazardous waste (K099). In order for material with this classification to be disposed off-site, the material must be treated to reduce certain specified constituents to concentrations less than that required in the Universal Treatment Standards. For this hazardous waste classification, the material placed into a landfill must contain less than 1 ug/kg (1 ppb) of PCDDs and PCDFs each. DEQ assumes that incineration would be used to treat the sediment to this concentration and the resulting ash would be placed in a RCRA Subtitle C landfill facility.

7.0 EVALUATION OF REMEDIAL ACTION ALTERNATIVES

7.1 Alternative 1 - No Action

Effectiveness - This alternative would not attain any of the RAOs and is therefore deemed ineffective.

Reliability - This alternative is not considered reliable.

Implementation - This alternative does not require any implementation activities. This alternative will not affect the EPA remedial action at the Gould Superfund site or on-going RI/FS activities at the Rhone-Poulenc facility.

Cost - Cost for this alternative is zero.

SCOEPA00003479

7.2 Alternative 2 -Sediment Removal, Dewatering, On-site Stockpile, On-site Disposal

Effectiveness - The effectiveness of Alternative 2 is primarily achieved through source removal and long-term monitoring. This alternative 2 does not address groundwater directly, the removal of EDL sediments is expected to be an effective means of reducing human exposure to contaminated groundwater and reducing the migration of contaminants from EDL sediments to the Willamette River. This alternative 2 would be consistent with and contribute to the efficient performance of long-term remedial actions addressing groundwater contamination.

Reliability - Removal of EDL is expected to achieve a high degree of reliability. Placement in the Gould OCF is also expected to be a reliable disposal option.

Implementation - Given the current status of the GSSR remedial actions, a window of opportunity exists to conduct sediment removal. Once the EDL is backfilled, future sediment removal would likely be impossible. Implementation difficulties associated with this option include coordinating joint contracting with the GSSR in a short timeframe. It is assumed that the on-site disposal activity will be the same for the lead and PCDD/PCDF contaminated sediment. This alternative will not affect the EPA remedial action at the Gould Superfund site or on-going RI/FS activities at the Rhone-Poulenc facility.

Implementation Risk - The implementation risk associated with the excavation of EDL sediments is relatively high due to the increased potential for exposure to contaminated sediments. Additional risk will also be incurred while the EDL sediments are stockpiled for approximately 1 year prior to placement in the OCF.

Cost - For costing purposes, it is assumed that 6000 cubic yards of sediment (in-place) is associated with the lead contamination and 7800 cubic yards of sediment (in-place) is associated with PCDD/PCDF contaminated sediment. It is assumed that the volume increase associated handling is offset by the volume decrease associated with dewatering for no net volume change for disposal purposes.

The current cost estimate for the removal of 6000 cubic yards of EDL sediments is approximately $3.5 million. The construction of the OCF, placement of the Gould sediments and long-term monitoring is estimated at an additional $6 million for a total cost estimate of $9.5 million. The costs associated with the excavation of an additional volume of 7800 cubic yards is estimated to be between $1 million and $1.5 million. The costs associated with placing an additional volume of sediments into the OCF are estimated at 10 - 15% of the total volume going into the OCF or $0.6 million to $0.9 million. Long term monitoring is estimated at $27,500 on a semi-annual basis for a net present worth of $675,000.

PCDD/PCDF Sediment Activities:	$1 million to $1.5 million
PCDD/PCDF On-site Disposal:	$600,000 to $900,000

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Total Capital/Engineering Costs:	$1.6 million to $2.4 million
Annual Monitoring Cost:	$50,000 (25,000 per event)
Net Present Worth Monitoring Cost:	$675,000
Total Net Present Worth Cost:	$2.3 million to $3.1 million

7.3 Alternative 3 - Alternative 2 with Off-site Disposal

Effectiveness - See Alternative 2

Reliability - Removal of EDL sediments is expected to achieve a high degree of reliability. Off-site disposal is also expected to be a reliable disposal option.

Implementation - See Alternative 2. Off-site disposal would involve an additional task to procure a transportation and disposal contractor for DEQ.

Implementation Risk - The implementation risk during excavation of EDL sediments is expected to be similar to that of Alternative 2. Under this alternative, stockpiling of the sediments will not be required (reducing the implementation risk), however, transportation of the sediment material (increasing the implementation risk). Overall the implementation risks associated with Alternatives 2 and 3 are similar.

Cost - For comparison purposes, potential off-site disposal costs for the PCDD/PCDF contaminated sediment (approximately 7800 cubic yards or 12,000 tons) have been estimated. The disposal costs assume the sediment is a K099 listed hazardous waste and are based on transportation and incineration cost of $600 per ton.

PCDD/PCDF Sediment Activities:	$1 million to $1.5 million
PCDD/PCDF Off-site Disposal:	$7.2 million
Total Capital/Engineering Costs:	$8.2 to $9.7 million
Annual Monitoring Cost:	$50,000 (25,000 per event)
Net Present Worth Monitoring Cost:	$675,000
Total Net Present Worth Cost:	$8.9 to $10.4 million

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8.0 PEER REVIEW SUMMARY

A project team consisting of a Project Manager, a Hydrogeologist, a Registered Professional engineer and a Toxicologist have been involved throughout the course of this project. Team members have reviewed all relevant project plans and reports and have submitted written comments to the Project Manager. Written comments from the project team to the Project Manager are maintained in the project file and are a part of the Administrative Record for the project. The project team unanimously supports the recommended removal action described in Section 9.

9.0 THE RECOMMENDED REMOVAL ACTION

DEQ recommends Alternative 2, the excavation, dewatering, stockpiling and on-site disposal of EDL sediments. DEQ believes that Alternative 2 will best meet the removal action objectives of protecting human health and the environment by removing a source of groundwater contamination. Furthermore, DEQ believes that a limited window of opportunity exits to remove EDL sediments and that following completion of the OCF as mandated by the EPA remedy, source removal will no longer be a viable option for addressing groundwater contamination that may be migrating to the Willamette River or presenting a risk to human health.

DEQ has determined that Alternative 2 is the most cost effective approach to effectively address the source of groundwater contamination. DEQ believes that removing EDL sediments and disposing of them off-site is too costly and that taking no action will not effectively achieve the removal action objectives. Although further evaluation of groundwater contamination in the vicinity of EDL could be achieved during the site-wide RI/FS for the Rhone-Poulenc facility, construction of the OCF will significantly limit cleanup options in the vicinity of EDL.

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TABLE 1
EDL SEDIMENT DATA SUMMARY

Contaminant	Maximum Sediment Concentration	Sample Location
Total Lead (mg/kg)	117,000	DLF
EP-Toxicity Lead (mg/l)	57.4	DLF
Xylenes	260	DLJ
Toluene	5.3	DLJ
Ethylbenzene	16	DLJ
Chlorobenzene	590	DLI
1,2-dichlorobenzene	3300	DLH
1,4-dichlorobenzene	1000	DLH
4,4'-DDE	2000	DLD
4,4'-DDD	28000	DLD
4,4'-DDT	120	DLB
Hexachlorobenzene	5600	DLD
Dichlorofluoromethane	51	DLC
Phenol	19,000	DLC
2-chlorophenol	1700	DLF
4-chlorophenol	1300	DLE
Cresols (total)	1300	DLF
2,4-dichlrophenol	9800	DLC
2,6-dichlorophnol	1500	DLF
2,4,6-trichlorophenol	270	DLA
4-nitrophenol	530	DLC
2,4-dimethylphenol	3900	DLB
Aldrin	140	DLJ
2,4-D	4000	DLH
2,4,5-T	1600	DLH
Dieldrin	130	DLH
Endrin	98	DLB
PCBs (total)	7300	DLJ
2,3,7,8-TCDD (pg/g)	880	T-24
2,3,7,8-TCDF (pg/g)	270	T-13
PCDD/PCDF (total) (pg/g)	84,000	T-24
PCDD/PCDF (TEC) (pg/g)	1070	T-24

Units in ug/kg unless otherwise noted.

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Dioxin and Furan Results
East Doane Lake
Portland, Oregon

Analyte	T11UCDX (pg/g)	T12UCDX (pg/g)	T13UCDX (pg/g)	T14UCDX (pg/g)	T21UCDX (pg/g)	T22UCDX (pg/g)	T23UCDX (pg/g)	T24UCDX (pg/g)
1,2,3,4,6,7,8-HpCDD	5.3	ND	990	830	14	ND	140	1200
1,2,3,4,6,7,8-HpCDF	5.3	4.4	250	230	25	ND	210	390
1,2,3,4,7,8,9-HpCDF	ND	ND	17	19	ND	ND	7.4	33
1,2,3,4,7,8-HxCDD	ND	ND	24	21	ND	ND	ND	30
1,2,3,4,7,8-HxCDF	ND	ND	56	74	ND	ND	23	82
1,2,3,6,7,8-HxCDD	ND	ND	130	76	ND	ND	13	100
1,2,3,6,7,8-HxCDF	ND	ND	38	43	ND	ND	12	65
1,2,3,7,8,9-HxCDD	ND	ND	70	49	ND	ND	7	60
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDD	ND	ND	47	41	ND	ND	6.8	59
1,2,3,7,8-PeCDF	ND	ND	60	62	ND	ND	18	ND
2,3,4,6,7,8-HxCDF	ND	ND	39	38	ND	ND	8.6	52
2,3,4,7,8-PeCDF	ND	ND	110	110	4	ND	20	130
2,3,7,8-TCDD	31	23	490	570	180	4	340	880
2,3,7,8-TCDF	3.4	2	260	270	16	ND	27	260
HpCDDs (total)	11	ND	2500	1800	27	3.9	330	2600
HpCDFs (total)	8.7	4.4	480	510	42	ND	460	1100
HxCDDs (total)	ND	ND	1500	980	13	ND	120	2200
HxCDFs (total)	7.5	4.4	750	850	62	ND	290	1200
OCDD	42	23	5100	5800	130	21	1700	14000
OCDF	11	10	250	310	49	ND	160	650
PeCDDs (total)	ND	ND	1300	630	14	ND	88	2200
PeCDFs (total)	450	260	9500	12000	2400	47	3800	14000
TCDDs (total)	110	59	5900	6700	540	14	1100	7600
TCDFs (total)	1500	900	24000	33000	8400	190	13000	35000
TEQ Concentration	31.11	23.05	652.34	718.67	182.85	3.97	369.48	1,068.60

TABLE 2
DIOXIN AND FURAN RESULTS

Table 3

Rhone-Poulenc East Doane Lake Sediments. Assessment of Risk

Sand (Area 1)

Case A - Standard Method- Congeners that were detected at least once were subject to the risk assessment.

Non-detects = 1/2 reported detection limit

	DLA	DLB	DLD	DLE	T11	T12	T21	T22	N	Ave	STD DEV	T statistic	90th Conf	TEFs	Risk Maintainence	Risk Construction	Risk Well Worker
Dioxins																	
2,3,7,8 TCDD	1.03E-10	7.69E-10	1.08E-09	1.13E-09	1.58E-09	1.18E-09	9.19E-09	2.04E-10	8	1.90E-09	3E-09	1.41492	3.4E-09	1	5.656E-07	9.3848E-08	2.9E-09
1,2,3,7,8 PeCDD	8.97E-12	3.65E-10	3.59E-10	3.01E-10	7.04E-12	4.94E-12	1.21E-11	3.07E-12	8	1.33E-10	1.7E-10	1.41492	2.2E-10	0.5	1.8288E-08	3.0344E-09	9.5E-11
1,2,3,4,7,8-HxCDD	3.85E-12	9.23E-11	1.59E-10	1.10E-10	4.10E-12	4.10E-12	3.07E-12	2.35E-12	8	4.73E-11	8.3E-11	1.41492	7.9E-11	0.1	1.3149E-09	2.1818E-10	6.8E-12
1,2,3,6,7,8-HxCDD	3.59E-12	9.23E-11	1.59E-10	1.10E-10	3.85E-12	4.10E-12	4.82E-12	2.25E-12	8	4.75E-11	8.3E-11	1.41492	7.9E-11	0.1	1.3161E-09	2.1837E-10	6.8E-12
1,2,3,7,8,9-HxCDD	4.10E-12	9.23E-11	1.59E-10	1.10E-10	3.59E-12	3.84E-12	2.57E-12	2.05E-12	8	4.72E-11	8.3E-11	1.41492	7.9E-11	0.1	1.3132E-09	2.179E-10	6.8E-12
1,2,3,4,6,7,8-HpCDD	4.03E-12	3.66E-11	5.13E-11	5.31E-11	1.94E-11	5.49E-12	5.12E-11	4.94E-12	8	2.83E-11	2.2E-11	1.41492	3.9E-11	0.01	6.5573E-11	1.088E-11	3.4E-13
OCDD	3.08E-11	2.44E-11	1.22E-10	1.10E-10	1.08E-10	5.91E-11	3.34E-10	5.39E-11	8	1.05E-10	1E-10	1.41492	1.6E-10	0.001	2.5817E-11	4.2838E-12	1.3E-13
Furans																	
2,3,7,8-TCDF	4.10E-08	1.23E-08	3.97E-09	1.54E-08	8.74E-10	5.14E-10	4.11E-09	9.10E-09	8	1.09E-08	1.3E-08	1.41492	1.8E-08	0.1	2.9211E-07	4.8468E-08	1.5E-09
1,2,3,7,8-PeCDF	3.15E-10	2.56E-09	8.97E-09	4.55E-09	4.48E-11	2.69E-11	1.86E-10	6.15E-11	8	2.09E-09	3.2E-09	1.41492	3.7E-09	0.05	3.0811E-08	5.1124E-09	1.6E-10
2,3,4,7,8-PeCDF	2.88E-10	2.56E-09	8.97E-09	4.55E-09	8.40E-11	4.68E-11	5.12E-10	7.05E-11	8	2.13E-09	3.2E-09	1.41492	3.7E-09	0.5	3.1069E-07	5.1551E-08	1.6E-09
1,2,3,4,7,8-HxCDF	8.28E-11	3.59E-10	4.62E-10	3.46E-10	1.13E-11	8.43E-12	2.95E-11	4.10E-12	8	1.60E-10	1.9E-10	1.41492	2.6E-10	0.1	4.2758E-09	7.0947E-10	2.2E-11
1,2,3,6,7,8-HxCDF	3.08E-11	3.59E-10	4.62E-10	3.46E-10	1.29E-11	8.94E-12	2.31E-11	4.62E-12	8	1.56E-10	2E-10	1.41492	2.5E-10	0.1	4.2258E-09	7.0118E-10	2.2E-11
2,3,4,6,7,8-HxCDF	1.41E-11	3.59E-10	4.62E-10	3.46E-10	1.29E-11	8.94E-12	2.31E-11	7.18E-12	8	1.54E-10	2E-10	1.41492	2.5E-10	0.1	4.2075E-09	6.9813E-10	2.2E-11
1,2,3,7,8,9-HxCDF														0.1			
1,2,3,4,6,7,8-HpCDF	4.38E-12	1.60E-10	1.73E-10	1.15E-10	6.78E-11	5.63E-11	3.20E-10	4.38E-12	8	1.13E-10	1.1E-10	1.41492	1.7E-10	0.01	2.7504E-10	4.5635E-11	1.4E-12
1,2,3,4,7,8,9-HpCDF	1.44E-11	1.60E-10	1.73E-10	1.15E-10	2.89E-12	3.14E-12	1.09E-11	1.28E-12	8	8.01E-11	7.6E-11	1.41492	9.8E-11	0.01	1.6308E-10	2.708E-11	8.5E-13
OCDF	1.48E-11	8.24E-11	1.10E-10	1.14E-10	4.02E-11	3.85E-11	1.79E-10	2.20E-12	8	7.24E-11	6E-11	1.41492	1E-10	0.001	1.7042E-11	2.8277E-12	8.8E-14
														Total	1.2347E-06	2.0487E-07	6.4E-09

Case B - Standard Method- Congeners that were detected at least once were subject to the risk assessment.

Non-detects = 1/2 reported detection limit for the high resolution method , 1/2 composite detection limit for the low resolution method

	SLA	DLB	DLD	DLE	T11	T12	T21	T22	N	Ave	STD DEV	T statistic	90th Conf	TEF	Risk Maintainence	Risk Construction	Risk Well worker
Dioxins																	
2,3,7,8 TCDD	1.03E-10	1.44E-10	1.44E-10	1.44E-10	1.58E-09	1.18E-09	9.19E-09	2.04E-10	8	1.59E-09	3.1E-09	1.41492	3.1E-09	1	5.2413E-07	8.6967E-08	2.7E-09
1,2,3,7,8 PeCDD	8.97E-12	1.78E-11	1.78E-11	1.78E-11	7.04E-12	9.88E-12	1.21E-11	3.07E-12	8	1.18E-11	5.8E-12	1.41492	1.5E-11	0.5	1.2151E-09	2.0162E-10	6.3E-12
1,2,3,4,7,8-HxCDD	3.85E-12	8.10E-12	8.05E-12	8.10E-12	4.10E-12	4.10E-12	3.07E-12	2.35E-12	8	5.22E-12	2.4E-12	1.41492	6.4E-12	0.1	1.0715E-10	1.778E-11	5.6E-13
1,2,3,6,7,8-HxCDD	3.59E-12	9.44E-12	9.44E-12	9.44E-12	3.85E-12	4.10E-12	4.82E-12	2.25E-12	8	5.84E-12	3.1E-12	1.41492	7.4E-12	0.1	1.2205E-10	2.0351E-11	6.4E-13
1,2,3,7,8,9-HxCDD	4.10E-12	1.05E-11	1.05E-11	1.05E-11	3.59E-12	3.84E-12	2.57E-12	2.05E-12	8	5.96E-12	3.8E-12	1.41492	7.9E-12	0.1	1.3095E-10	2.1727E-11	6.8E-13
1,2,3,4,6,7,8-HpCDD	4.03E-12	3.14E-11	3.14E-11	3.14E-11	1.94E-11	5.49E-12	5.12E-11	4.94E-12	8	2.24E-11	1.7E-11	1.41492	3.1E-11	0.01	5.1402E-11	8.529E-12	2.7E-13
OCDD	3.08E-11	6.69E-11	6.69E-11	6.69E-11	1.08E-10	5.91E-11	3.34E-10	5.39E-11	8	9.83E-11	9.8E-11	1.41492	1.5E-10	0.001	2.4489E-11	4.0633E-12	1.3E-13
Furans																	
2,3,7,8-TCDF	4.10E-08	8.33E-10	8.33E-10	8.33E-10	8.74E-10	5.14E-10	6.81E-08	4.11E-09	8	1.46E-08	2.8E-08	1.41492	2.7E-08	0.1	4.5763E-07	7.5932E-08	2.4E-09
1,2,3,7,8-PeCDF	3.15E-10	3.15E-10	3.15E-10	3.15E-10	4.48E-11	2.69E-11	7.81E-09	1.86E-10	8	1.16E-09	2.7E-09	1.41492	2.5E-09	0.05	2.0874E-08	3.4636E-09	1.1E-10
2,3,4,7,8-PeCDF	2.88E-10	2.86E-10	2.86E-10	2.86E-10	8.40E-11	4.61E-11	1.41E-08	5.12E-10	8	1.98E-09	4.9E-09	1.41492	4.4E-09	0.5	3.6896E-07	6.1219E-08	1.9E-09
1,2,3,4,7,8-HxCDF	8.28E-11	8.26E-11	8.26E-11	8.26E-11	1.13E-11	8.43E-12	1.87E-09	3.34E-11	8	2.46E-10	5.8E-10	1.41492	5.3E-10	0.1	8.8954E-09	1.476E-09	4.6E-11
1,2,3,6,7,8-HxCDF	3.08E-11	3.08E-11	3.08E-11	3.08E-11	1.29E-11	8.94E-12	1.05E-09	2.31E-11	8	1.52E-10	3.8E-10	1.41492	3.3E-10	0.1	5.5522E-09	9.2125E-10	2.9E-11
2,3,4,6,7,8-HxCDF	1.41E-11	3.44E-11	3.44E-11	3.44E-11	1.29E-11	8.94E-12	1.00E-09	2.31E-11	8	1.45E-10	3.5E-10	1.41492	3.2E-10	0.1	5.2916E-09	8.7802E-10	2.7E-11
1,2,3,7,8,9-HxCDF														0.1			
1,2,3,4,6,7,8-HpCDF	4.38E-12	4.88E-11	4.88E-11	4.88E-11	6.78E-11	5.63E-11	3.07E-09	3.20E-10	8	4.58E-10	1.1E-09	1.41492	9.9E-10	0.01	1.6449E-09	2.7294E-10	8.5E-12
1,2,3,4,7,8,9-HpCDF	1.44E-11	1.44E-11	1.44E-11	1.44E-11	2.89E-12	3.20E-12	2.30E-10	1.09E-11	8	3.80E-11	7.8E-11	1.41492	7.7E-11	0.01	1.2804E-10	2.1245E-11	6.6E-13
OCDF	1.48E-11	3.30E-11	3.30E-11	3.30E-11	4.02E-11	3.85E-11	1.02E-09	1.79E-10	8	1.74E-10	3.5E-10	1.41492	3.5E-10	0.001	5.7708E-11	9.5753E-12	3E-13
														Total	1.3948E-06	2.3144E-07	7.2E-09

TABLE 3
RISK ASSESSMENT RESULTS - SAND UNIT

TABLE 4
RISK ASSESSMENT RESULTS - SILT UNIT

Table 4

Rhone-Poulenc East Doane Lake Sediments, Assessment of Risk

Silt (Area2)

Case A - Standard Method- Congeners that were detected at least once were subject to the risk assessment.

Non-detects = 1/2 reported detection limit

	DLC	DLF	DLG	DLH	DLI	T13	T23	T24	N	Ave	STD DEV	T statistic	90th Conf	TEF	Risk Maintainence	Risk Construction	Risk Well worker
Dioxins																	
2,3,7,8-TCDD	3.08E-10	7.18E-09	5.38E-09	9.23E-09	4.77E-10	2.71E-08	1.74E-08	4.50E-08	8	1.40E-08	1.54E-08	1.41492	2.2E-08	1	*3.6131E-06*	5.9951E-07	3.6E-10
1,2,3,7,8-PeCDD	1.80E-11	4.68E-11	7.05E-10	2.69E-11	1.99E-12	5.63E-10	8.70E-11	7.55E-10	8	2.75E-10	3.36E-10	1.41492	4.4E-10	0.5	3.6878E-08	6.119E-09	3.8E-14
1,2,3,4,7,8-HxCDD	1.49E-11	7.95E-12	1.69E-10	1.10E-11	9.74E-13	1.18E-10	7.70E-12	1.54E-10	8	8.04E-11	7.31E-11	1.41492	9.7E-11	0.1	1.6149E-09	2.6795E-10	7.2E-17
1,2,3,6,7,8-HxCDD	1.38E-11	2.44E-11	1.69E-10	1.36E-11	1.56E-12	5.28E-10	8.67E-11	5.13E-10	8	1.66E-10	2.25E-10	1.41492	2.8E-10	0.1	4.6417E-09	7.7017E-10	5.9E-18
1,2,3,7,8,9-HxCDD	1.56E-11	2.56E-11	1.69E-10	1.31E-11	2.10E-12	3.82E-10	3.58E-11	3.08E-10	8	1.19E-10	1.51E-10	1.41492	1.9E-10	0.1	3.2323E-09	5.3631E-10	2.9E-18
1,2,3,4,6,7,8-HpCDD	2.01E-11	1.45E-10	8.97E-11	3.11E-11	1.30E-11	3.33E-09	5.12E-10	4.39E-09	8	1.07E-09	1.75E-09	1.41492	1.9E-09	0.01	3.2359E-09	5.3693E-10	2.9E-18
OCDD	1.41E-10	2.31E-09	1.54E-10	3.08E-10	2.51E-10	1.40E-08	4.37E-09	3.80E-08	8	7.19E-09	1.26E-08	1.41492	1.3E-08	0.001	2.2421E-09	3.7202E-10	1.4E-18
Furans																	
2,3,7,8-TCDF	2.56E-08	3.08E-07	1.04E-08	4.82E-09	7.95E-10	6.79E-08	6.94E-09	6.88E-08	8	8.14E-08	1.03E-07	1.41492	1.1E-07	0.1	*1.8813E-06*	3.1216E-07	9.8E-11
1,2,3,7,8-PeCDF	4.55E-10	1.15E-09	1.67E-09	3.97E-10	1.92E-10	7.82E-09	2.30E-09	4.99E-09	8	2.37E-09	2.70E-09	1.41492	3.7E-09	0.05	3.0958E-08	5.1368E-09	2.6E-14
2,3,4,7,8-PeCDF	2.12E-10	1.28E-09	1.87E-09	1.79E-10	1.92E-10	1.41E-08	2.56E-09	1.66E-08	8	4.60E-09	6.72E-09	1.41492	8E-09	0.5	6.6255E-07	1.0993E-07	1.2E-11
1,2,3,4,7,8-HxCDF	3.46E-11	3.72E-10	1.28E-09	3.59E-11	2.69E-11	1.87E-09	5.91E-10	2.11E-09	8	7.85E-10	8.18E-10	1.41492	1.2E-09	0.1	1.9547E-08	3.2434E-09	1.1E-14
1,2,3,6,7,8-HxCDF	4.23E-11	1.01E-10	1.20E-09	2.69E-11	7.95E-12	1.04E-09	3.08E-10	1.87E-09	8	5.60E-10	6.67E-10	1.41492	8.9E-10	0.1	1.4884E-08	2.4663E-09	6.1E-15
2,3,4,6,7,8-HxCDF	3.97E-11	1.41E-10	1.20E-09	2.56E-11	1.28E-11	9.90E-10	2.21E-10	1.34E-09	8	5.08E-10	5.90E-10	1.41492	8E-10	0.1	1.3337E-08	2.2129E-09	4.9E-15
1,2,3,7,8,9-HxCDF														0.1			
1,2,3,4,6,7,8-HpCDF	7.05E-11	2.18E-10	7.69E-10	4.42E-11	1.92E-11	3.08E-09	2.69E-09	4.99E-09	8	1.49E-09	1.88E-09	1.41492	2.4E-09	0.01	4.0334E-09	6.6925E-10	4.5E-18
1,2,3,4,7,8,9-HpCDF	9.62E-12	3.46E-11	7.69E-10	9.62E-12	8.33E-12	2.31E-10	9.47E-11	4.22E-10	8	1.49E-09	1.88E-09	1.41492	2.4E-09	0.01	4.0334E-09	6.6925E-10	4.5E-18
OCDF	3.11E-11	1.54E-10	1.39E-10	8.59E-11	7.51E-12	1.03E-09	5.84E-10	2.37E-09	8	1.07E-10	2.73E-10	1.41492	3.3E-10	0.001	5.5577E-11	9.2218E-12	8.5E-20
														Total	6.2957E-06	1.0446E-06	4.7E-10

Case B - Standard Method- Congeners that were detected at least once were subject to the risk assessment.

Non-detects = 1/2 reported detection limit for the high resolution method , 1/2 composite detection limit for the low resolution method

	DLC	DLF	DLG	DLH	DLI	T13	T23	T24	N	Ave	STD DEV	T statistic	90th Conf	TEF	Risk Maintainence	Risk Construction	Risk Well worker
Dioxins																	
2,3,7,8-TCDD	3.08E-10	7.18E-09	1.44E-10	9.23E-09	4.77E-10	2.71E-08	1.74E-08	4.50E-08	8	1.34E-08	1.59E-08	1.41492	2.1E-08	1	*3.5476E-06*	5.8865E-07	1.8E-08
1,2,3,7,8-PeCDD	1.60E-11	4.68E-11	1.78E-11	2.69E-11	1.99E-12	5.83E-10	8.70E-11	7.55E-10	8	1.89E-10	2.96E-10	1.41492	3.4E-10	0.5	2.8057E-08	4.8554E-09	1.5E-10
1,2,3,4,7,8-HxCDD	1.49E-11	7.95E-12	8.10E-12	1.10E-11	9.74E-13	1.18E-10	7.70E-12	1.54E-10	8	4.03E-11	8.00E-11	1.41492	7E-11	0.1	1.1704E-09	1.942E-10	8.1E-12
1,2,3,6,7,8-HxCDD	1.38E-11	2.44E-11	9.44E-12	1.36E-11	1.56E-12	5.28E-10	8.67E-11	5.13E-10	8	1.46E-10	2.32E-10	1.41492	2.6E-10	0.1	4.3054E-09	7.2434E-10	2.3E-11
1,2,3,7,8,9-HxCDD	1.56E-11	2.56E-11	1.05E-11	1.31E-11	2.10E-12	3.82E-10	3.58E-11	3.08E-10	8	8.91E-11	1.53E-10	1.41492	1.8E-10	0.1	2.9264E-09	4.8556E-10	1.5E-11
1,2,3,4,6,7,8-HpCDD	2.01E-11	1.45E-10	3.14E-11	3.11E-11	1.30E-11	3.33E-09	5.12E-10	4.39E-09	8	1.06E-09	1.76E-09	1.41492	1.9E-09	0.01	3.2278E-09	5.3557E-10	1.7E-11
OCDD	1.41E-10	2.31E-09	8.69E-11	3.08E-10	2.51E-10	1.40E-08	4.37E-09	3.80E-08	8	7.18E-09	1.26E-08	1.41492	1.3E-08	0.001	2.2408E-09	3.7181E-10	1.2E-11
Furans																	
2,3,7,8-TCDF	2.56E-08	3.08E-07	8.33E-10	4.82E-09	7.95E-10	6.79E-08	6.94E-09	6.88E-08	8	8.02E-08	1.04E-07	1.41492	1.1E-07	0.1	*1.8675E-06*	3.0986E-07	9.7E-09
1,2,3,7,8-PeCDF	4.55E-10	1.15E-09	3.15E-10	3.97E-10	1.92E-10	7.82E-09	2.30E-09	4.99E-09	8	2.20E-09	2.79E-09	1.41492	3.6E-09	0.05	2.9929E-08	4.9661E-09	1.6E-10
2,3,4,7,8-PeCDF	2.12E-10	1.28E-09	2.86E-10	1.79E-10	1.92E-10	1.41E-08	2.56E-09	1.66E-08	8	4.43E-09	6.82E-09	1.41492	7.8E-09	0.5	6.5245E-07	1.0826E-07	3.4E-09
1,2,3,4,7,8-HxCDF	3.46E-11	3.72E-10	6.20E-11	3.59E-11	2.69E-11	1.87E-09	5.91E-10	2.11E-09	8	6.13E-10	8.22E-10	1.41492	1E-09	0.1	1.7045E-08	2.8283E-09	8.8E-11
1,2,3,6,7,8-HxCDF	4.23E-11	1.01E-10	3.06E-11	2.69E-11	7.95E-12	1.04E-09	3.08E-10	1.87E-09	8	4.03E-10	6.18E-10	1.41492	7.1E-10	0.1	1.1863E-08	1.9684E-09	6.2E-11
2,3,4,6,7,8-HxCDF	3.97E-11	1.41E-10	3.44E-11	2.56E-11	1.28E-11	9.90E-10	2.21E-10	1.34E-09	8	3.51E-10	5.18E-10	1.41492	6.1E-10	0.1	1.0132E-08	1.6812E-09	5.3E-11
1,2,3,7,8,9-HxCDF														0.1			
1,2,3,4,6,7,8-HpCDF	7.05E-11	2.18E-10	4.88E-11	4.42E-11	1.92E-11	3.08E-09	2.69E-09	4.99E-09	8	1.40E-09	1.93E-09	1.41492	2.4E-09	0.01	3.93E-09	6.5209E-10	2E-11
1,2,3,4,7,8,9-HpCDF	9.62E-12	3.46E-11	1.44E-11	9.62E-12	8.33E-12	2.31E-10	9.47E-11	4.22E-10	8	1.03E-10	1.50E-10	1.41492	1.8E-10	0.01	2.9624E-10	4.9154E-11	1.5E-12
OCDF	3.11E-11	1.54E-10	3.30E-11	8.59E-11	7.51E-12	1.03E-09	5.84E-10	2.37E-09	8	5.34E-10	8.25E-10	1.41492	9.5E-10	0.001	1.5764E-10	2.6156E-11	8.2E-13
														Total	6.1829E-06	1.0259E-06	3.2E-08

Table 6

Rhone-Poulenc East Doane Lake Sediments. Assessment of Risk

Lime (Area3)

Case A - Standard Method- Congeners that were detected at least once were subject to the risk assessment.

Non-detects = 1/2 reported detection limit

	DLJ	DLK	DLL	DLM	DLN	DLO	DLP	DLV	DLW	DLX	N	Ave	STD DEV	T statistic	90th Conf	TEF	Risk Maintainence	Risk Construction	Risk Well worker
Dioxins																			
2,3,7,8 TCDD	1.28E-09	6.41E-11	1.21E-10	7.44E-10	1.13E-09	8.46E-11	7.18E-09	1.54E-09	1.38E-09	1.44E-09	10	1.50E-09	2.08E-09	1.383029	2.41E-09	1	4.00593E-07	6.6469E-08	2.08E-09
1,2,3,7,8 PeCDD	1.28E-11	7.69E-12	1.28E-11	4.17E-10	3.14E-10	1.22E-11	3.14E-10	4.29E-11	1.79E-10	7.69E-12	10	1.32E-10	1.6E-10	1.383029	2.02E-10	0.5	1.66203E-08	2.7909E-09	8.72E-11
1,2,3,4,7,8-HxCDD	9.74E-12	9.23E-12	6.92E-12	1.74E-10	1.67E-10	9.49E-12	1.44E-10	1.28E-11	1.08E-10	1.49E-12	10	6.43E-11	7.43E-11	1.383029	9.68E-11	0.1	1.61083E-09	2.6728E-10	8.35E-12
1,2,3,6,7,8-HxCDD	9.23E-12	8.46E-12	6.15E-12	1.74E-10	1.67E-10	8.46E-12	1.44E-10	1.74E-10	4.87E-10	5.38E-12	10	1.18E-10	1.51E-10	1.383029	1.85E-10	0.1	3.07279E-09	5.0986E-10	1.59E-11
1,2,3,7,8,9-HxCDD	1.05E-11	9.74E-12	7.18E-12	1.74E-10	1.67E-10	1.00E-11	1.44E-10	1.44E-10	4.82E-10	6.92E-12	10	1.16E-10	1.49E-10	1.383029	1.81E-10	0.1	3.00502E-09	4.9861E-10	1.56E-11
1,2,3,4,6,7,8-HpCDD	3.85E-11	6.59E-12	6.96E-12	8.42E-11	8.24E-11	1.70E-11	7.51E-11	6.59E-10	8.42E-09	1.58E-10	10	9.55E-10	2.63E-09	1.383029	2.11E-09	0.01	3.60368E-09	5.8135E-10	1.82E-11
OCDD	6.41E-10	2.05E-11	5.26E-11	1.67E-10	1.18E-08	8.97E-11	1.21E-10	1.95E-09	4.87E-08	1.13E-09	10	6.47E-09	1.53E-08	1.383029	1.31E-08	0.001	2.18784E-09	3.6302E-10	1.13E-11
																		0	
																		0	
Furans																			
2,3,7,8-TCDF	1.54E-08	4.23E-10	9.23E-09	5.26E-09	2.56E-08	8.33E-10	2.18E-08	2.82E-09	1.10E-09	7.95E-09	10	9.04E-09	9.05E-09	1.383029	1.3E-08	0.1	2.16329E-07	3.5895E-08	1.12E-09
1,2,3,7,8-PeCDF	5.13E-10	2.50E-10	1.92E-10	6.22E-09	8.33E-09	1.73E-10	1.73E-09	2.50E-10	1.03E-10	1.60E-10	10	1.79E-09	2.97E-09	1.383029	3.09E-09	0.05	2.57272E-08	4.2688E-09	1.33E-10
2,3,4,7,8-PeCDF	4.23E-10	2.12E-10	1.92E-10	6.22E-09	8.33E-09	1.41E-10	1.73E-09	3.72E-10	1.47E-10	1.41E-10	10	1.79E-09	2.97E-09	1.383029	3.09E-09	0.5	2.57175E-07	4.2672E-08	1.33E-09
1,2,3,4,7,8-HxCDF	2.82E-11	1.09E-11	2.69E-11	6.15E-10	5.13E-10	1.92E-11	4.62E-10	8.85E-11	5.26E-11	5.77E-11	10	1.87E-10	2.4E-10	1.383029	2.92E-10	0.1	4.86806E-09	8.0774E-10	2.52E-11
1,2,3,6,7,8-HxCDF	2.31E-11	9.62E-12	7.95E-12	6.15E-10	5.13E-10	1.54E-11	4.62E-10	8.08E-11	2.82E-11	2.18E-11	10	1.78E-10	2.47E-10	1.383029	2.86E-10	0.1	4.75332E-09	7.887E-10	2.46E-11
2,3,4,6,7,8-HxCDF	2.44E-11	1.09E-11	1.54E-11	6.15E-10	5.13E-10	1.67E-11	4.62E-10	3.33E-10	5.26E-11	2.44E-11	10	2.07E-10	2.46E-10	1.383029	3.14E-10	0.1	5.22677E-09	8.6759E-10	2.71E-11
1,2,3,7,8,9-HxCDF																0.1			
1,2,3,4,6,7,8-HpCDF	3.14E-11	2.63E-11	7.69E-12	2.56E-10	1.86E-10	1.79E-11	2.56E-10	1.06E-09	6.67E-10	1.01E-10	10	2.61E-10	3.44E-10	1.383029	4.11E-10	0.01	6.84756E-10	1.1362E-10	3.65E-12
1,2,3,4,7,8,9-HpCDF	8.33E-12	4.29E-11	8.33E-12	2.56E-10	1.86E-10	1.41E-11	2.56E-10	6.22E-12	2.12E-11	6.41E-12	10	8.05E-11	1.07E-10	1.383029	1.27E-10	0.01	2.12123E-10	3.6197E-11	1.1E-12
OCDF	3.48E-11	2.01E-11	2.75E-11	2.01E-10	1.30E-10	2.38E-11	1.36E-10	9.16E-12	4.40E-10	6.96E-12	10	1.03E-10	1.36E-10	1.383029	1.62E-10	0.001	2.70331E-11	4.4855E-12	1.4E-13
																Total	9.45799E-07	1.5693E-07	4.9E-09

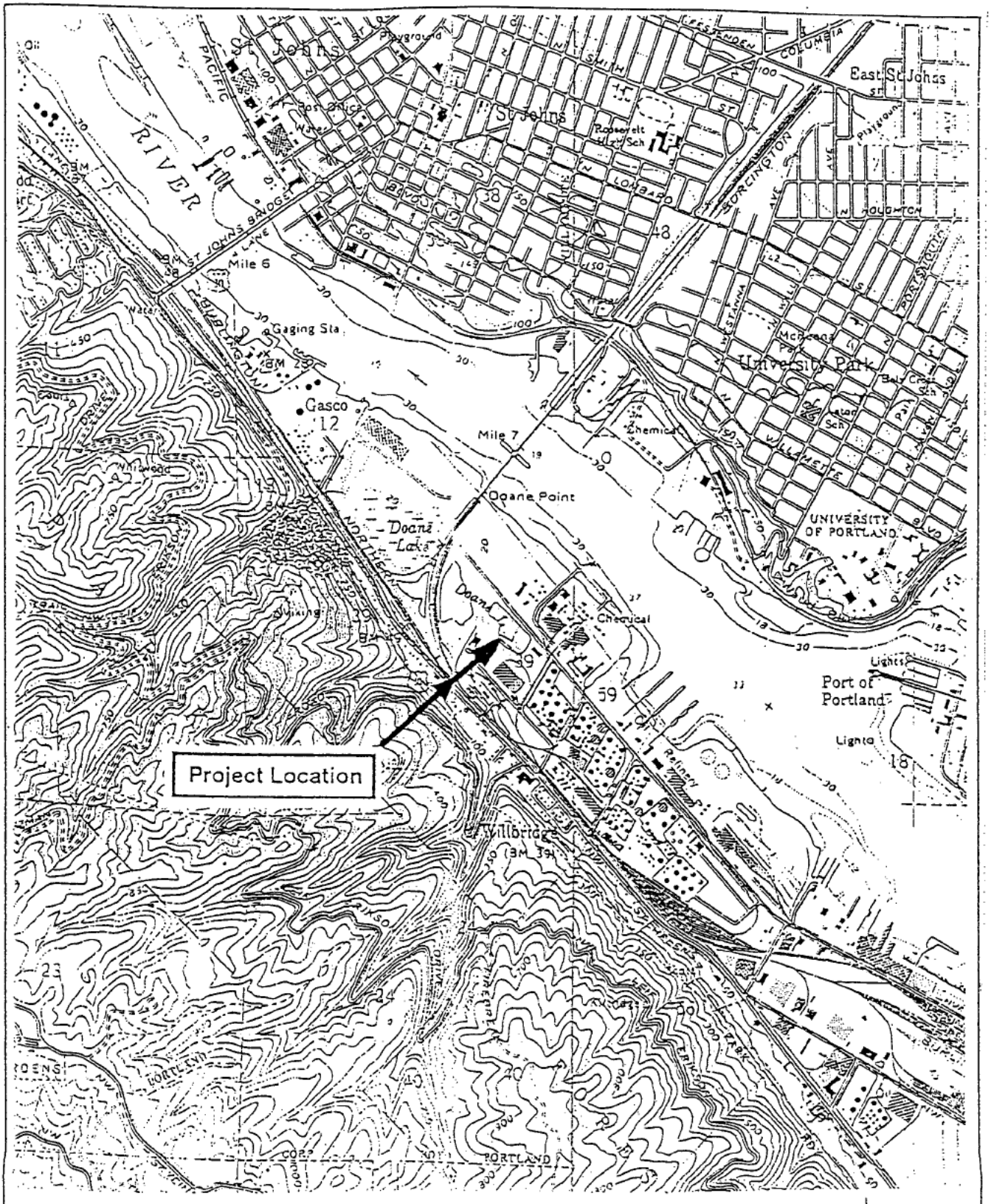
Case B - Standard Method- Congeners that were detected at least once were subject to the risk assessment.

Non-detects = 1/2 reported detection limit for the high resolution method , 1/2 composite detection limit for the low resolution method

	DLJ	DLK	DLL	DLM	DLN	DLO	DLP	DLV	DLW	DLX	N	Ave	STD DEV	T statistic	90th Conf	TEF	Risk Maintainence	Risk Construction	Risk Well worker
Dioxins																			
2,3,7,8 TCDD	1.28E-09	6.41E-11	1.21E-10	1.44E-10	1.44E-10	8.46E-11	1.44E-10	1.54E-09	1.38E-09	1.44E-09	10	6.34E-10	6.71E-10	1.383029	9.28E-10	1	1.54407E-07	2.562E-08	8.01E-10
1,2,3,7,8 PeCDD	1.28E-11	7.69E-12	1.28E-11	1.78E-11	1.78E-11	1.22E-11	1.78E-11	4.29E-11	1.79E-10	7.69E-12	10	3.28E-11	5.23E-11	1.383029	5.57E-11	0.5	4.63784E-09	7.6954E-10	2.4E-11
1,2,3,4,7,8-HxCDD	9.74E-12	9.23E-12	6.92E-12	8.10E-12	8.10E-12	9.49E-12	8.10E-12	1.28E-11	1.08E-10	1.49E-12	10	1.82E-11	3.17E-11	1.383029	3.21E-11	0.1	5.33466E-10	8.8519E-11	2.77E-12
1,2,3,6,7,8-HxCDD	9.23E-12	8.46E-12	6.15E-12	9.44E-12	9.44E-12	8.46E-12	9.44E-12	1.74E-10	4.87E-10	5.38E-12	10	7.27E-11	1.55E-10	1.383029	1.4E-10	0.1	2.33549E-09	3.8752E-10	1.21E-11
1,2,3,7,8,9-HxCDD	1.05E-11	9.74E-12	7.18E-12	1.05E-11	1.05E-11	1.00E-11	1.05E-11	1.44E-10	4.82E-10	6.92E-12	10	7.02E-11	1.51E-10	1.383029	1.36E-10	0.1	2.26549E-09	3.759E-10	1.17E-11
1,2,3,4,6,7,8-HpCDD	3.85E-11	6.59E-12	6.96E-12	3.14E-11	3.14E-11	1.70E-11	3.14E-11	6.59E-10	8.42E-09	1.58E-10	10	9.40E-10	2.64E-09	1.383029	2.09E-09	0.01	3.48317E-09	5.7795E-10	1.81E-11
OCDD	6.41E-10	2.05E-11	5.26E-11	6.69E-11	6.69E-11	8.97E-11	6.69E-11	1.95E-09	4.87E-08	1.13E-09	10	5.28E-09	1.53E-08	1.383029	1.2E-08	0.001	1.99008E-09	3.3021E-10	1.03E-11
Furans																			
2,3,7,8-TCDF	1.54E-08	4.23E-10	9.23E-09	8.33E-10	8.33E-10	8.33E-10	8.33E-10	2.82E-09	1.10E-09	7.95E-09	10	4.03E-09	5.12E-09	1.383029	6.26E-09	0.1	1.04245E-07	1.735E-06	3.01E-11
1,2,3,7,8-PeCDF	5.13E-10	2.50E-10	1.92E-10	3.15E-10	3.15E-10	1.73E-10	3.15E-10	2.50E-10	1.03E-10	1.60E-10	10	2.59E-10	1.16E-10	1.383029	3.09E-10	0.05	2.5725E-09	2.1408E-08	9.17E-15
2,3,4,7,8-PeCDF	4.23E-10	2.12E-10	1.92E-10	2.86E-10	2.86E-10	1.41E-10	2.86E-10	3.72E-10	1.47E-10	1.41E-10	10	2.49E-10	9.88E-11	1.383029	2.92E-10	0.5	2.42844E-08	2.0209E-06	8.17E-12
1,2,3,4,7,8-HxCDF	2.82E-11	1.09E-11	2.69E-11	6.26E-11	6.26E-11	1.92E-11	6.26E-11	8.85E-11	5.26E-11	5.77E-11	10	4.72E-11	2.46E-11	1.383029	5.79E-11	0.1	9.84077E-10	1.6046E-08	2.57E-15
1,2,3,6,7,8-HxCDF	2.31E-11	9.62E-12	7.95E-12	3.08E-11	3.08E-11	1.64E-11	3.08E-11	8.08E-11	2.82E-11	2.18E-11	10	2.79E-11	2.05E-11	1.383029	3.69E-11	0.1	6.13842E-10	1.0217E-08	1.04E-15
2,3,4,6,7,8-HxCDF	2.44E-11	1.09E-11	1.54E-11	3.44E-11	3.44E-11	1.67E-11	3.44E-11	3.33E-10	5.26E-11	2.44E-11	10	5.81E-11	9.74E-11	1.383029	1.01E-10	0.1	1.67509E-09	2.788E-08	7.77E-15
1,2,3,7,8,9-HxCDF																			
1,2,3,4,6,7,8-HpCDF	3.14E-11	2.63E-11	7.69E-12	4.88E-11	4.88E-11	1.79E-11	4.88E-11	1.06E-09	6.67E-10	1.01E-10	10	2.06E-10	3.6E-10	1.383029	3.63E-10	0.01	6.04315E-10	1.0058E-09	1.01E-16
1,2,3,4,7,8,9-HpCDF	8.33E-12	4.29E-11	8.33E-12	1.44E-11	1.44E-11	1.41E-11	1.44E-11	6.22E-12	2.12E-11	6.41E-12	10	1.51E-11	1.06E-11	1.383029	1.98E-11	0.01	3.2975E-11	5.4863E-11	3.01E-19
OCDF	3.48E-11	2.01E-11	2.75E-11	3.30E-11	3.30E-11	2.38E-11	3.30E-11	9.16E-12	4.40E-10	6.96E-12	10	6.61E-11	1.32E-10	1.383029	1.24E-10	0.001	2.05967E-11	3.4281E-12	1.18E-20
																Total	3.04686E-07	3.8607E-06	9.18E-10

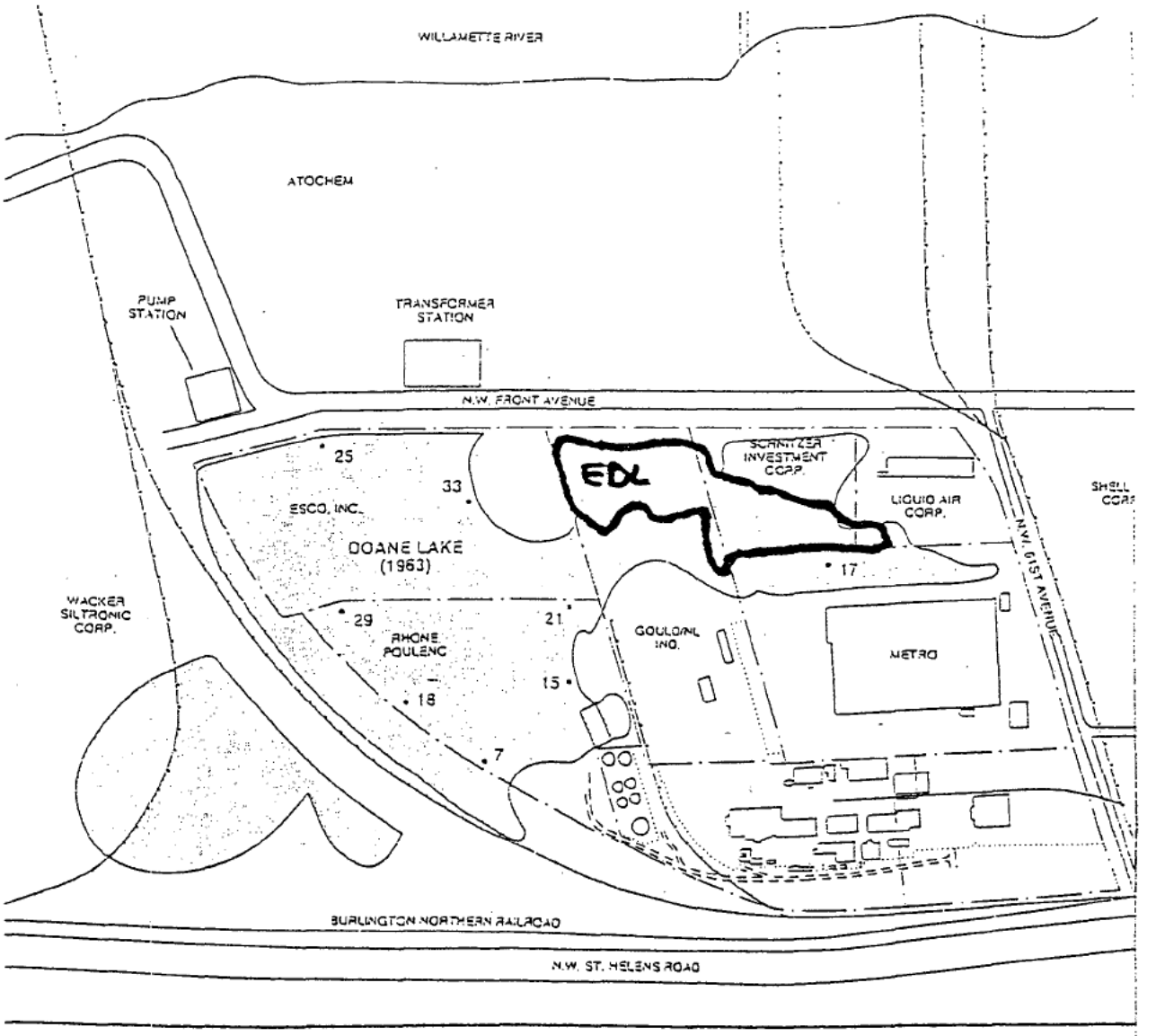
TABLE 5
RISK ASSESSMENT RESULTS- LIMEY SILT UNIT

FIGURE 1
SITE LOCATION MAP



Source: U.S.G.S. Linnton, Oreg. Quadrangle. Photorevised 1984
U.S.G.S. Portland, Oreg.-Wash. Quadrangle. Photorevised 1970 and 1977

FIGURE 2
SITE LAYOUT MAP



Explanation

25 Well location with fill thickness (ft)

Approximate boundary of Doane Lake, 1963

0 250 500 1000
Scale feet

SCOEPA00003489

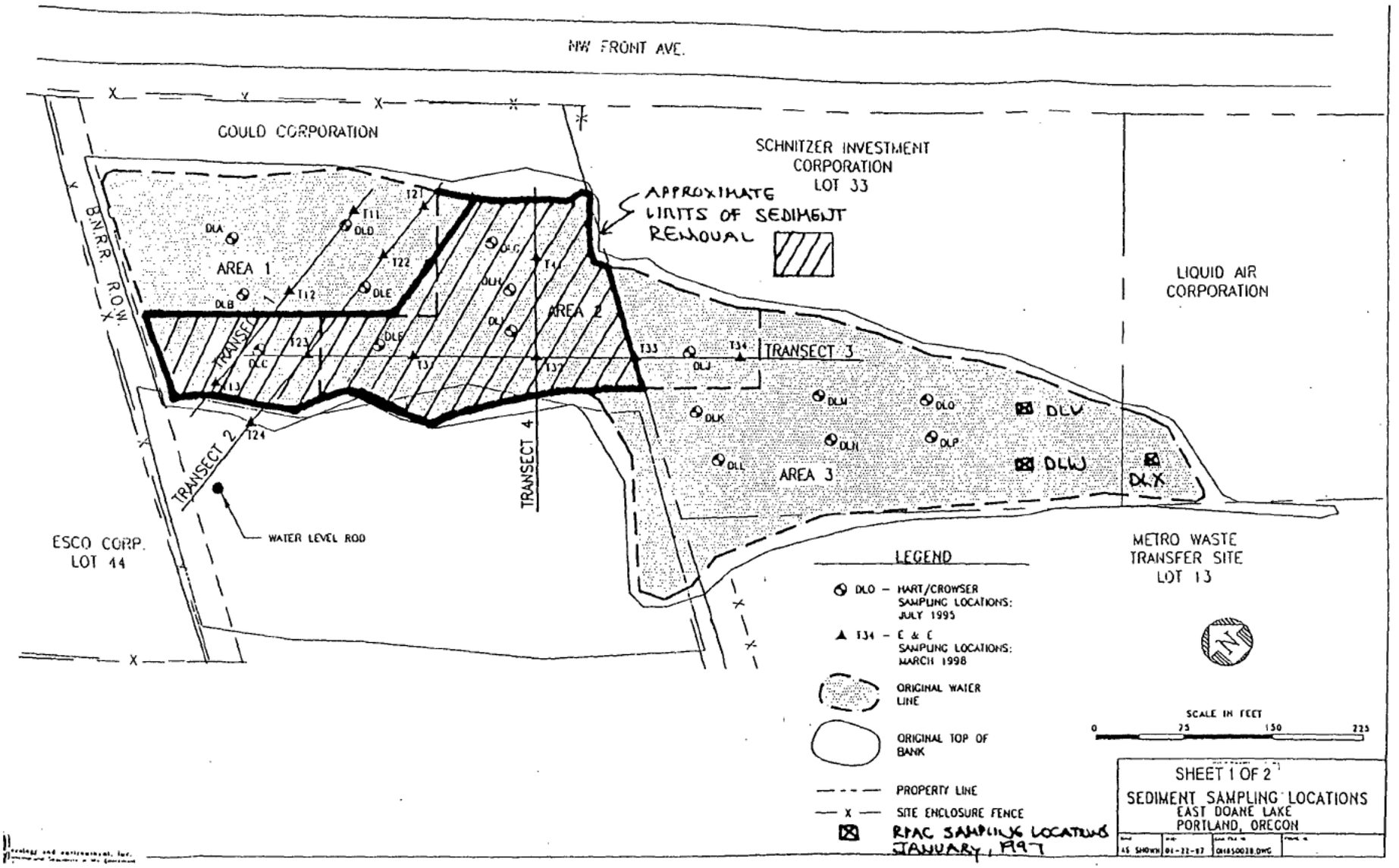


FIGURE 3
SAMPLE LOCATION MAP

APPENDIX A
ADMINISTRATIVE RECORD

Rhone-Poulenc File:

1. East Doane Lake Interim Removal Measure Final Workplan, Woodward Clyde Consultants, August, 6, 1997.
2. East Doane Lake Interim Removal Measure Report, Woodward Clyde Consultants, October 24, 1997.
3. Letter to Robert L. Ferguson, Rhone-Poulenc AG Company, Request for submittal of Land and Water Use document, DEQ, November 12, 1997.
4. Letter to Robert L. Ferguson, Rhone-Poulenc AG Company, Notice of removal requirements, DEQ, December 26, 1997.
5. Letter to Robert L. Ferguson, Rhone-Poulenc AG Company, DEQ comments on East Doane Lake Interim Removal Report with attachments, DEQ, January 20, 1998.
6. Memo to File, East Doane Lake Sediment Removal Volume Estimate, DEQ, February 4, 1998.
7. Memo to File, Rationale for Refined Volume Estimate, East Doane Lake Sediment Removal, DEQ, April 14, 1998.

NL/Gould File:

1. Stage I Field Activities Report, Gould Superfund Site, Portland, Oregon, ENVIRON International Corporation, October 31, 1995.
2. Amended Remedy Document for the Gould Superfund Site, Portland, Oregon, ENVIRON International Corporation, January 26, 1996.
3. Amended Record of Decision, Decision Summary, and Responsiveness Summary for Gould Superfund Site, Soils Operable Unit, Portland, Oregon, Environmental Protection Agency, Region 10, June 3, 1997.
4. First Amendment to Administrative Order, Gould Superfund Site, Portland, Oregon, Environmental Protection Agency, Region 10, July 8, 1997.
5. Consent Decree, United States of America, Plaintiff, vs. NL Industries, Inc., Gould, Inc., Johnson Controls, Inc., Exide Inc., AT&T Technologies, Inc., Rhone-Poulenc, Burlington Northern Railroad Co., ESCO Corp., and Schnitzer Investment Co., Defendants.

SCOEPA00003491

FIRST ADDENDUM
TO
VOLUNTARY AGREEMENT
FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DEQ NO. WMCVC-NWR-94-13

The Oregon Department of Environmental Quality (DEQ) and NW Natural (NWN) agree to amend Voluntary Agreement No. WMCVC-NWR-94-13 dated August 8, 1994 (Agreement), as follows. All other terms of the Agreement remain in effect and apply to this First Addendum.

1. Recital I.B is amended, to read:

   "The NWN Site is a "facility" within the meaning of ORS 465.200(13). The NWN Site includes property located at 7540 N.W. St. Helens Road, Portland, Oregon, currently owned by NWN (NWN Property), as well as adjacent property located at 7200 N.W. Front Avenue, Portland, Oregon, currently owned by Siltronic Corporation (Siltronic Property), to the extent the Siltronic Property is the location of or otherwise affected by wastes associated with manufactured gas process (MGP) operations on the NWN Site. This facility is generally referred to in this First Addendum as the "NWN Site". The general location of the NWN Site is shown on Attachment AA to the First Addendum."

2. Recital I.C is amended, to add:

   "Waste management areas extended onto the northern portion of what is now the Siltronic Property, in areas of low elevation prone to flooding. The tar ponds at the NWN Property were periodically excavated and redeposited onto what is now the Siltronic Property. MGP operations ceased in 1956. NWN's predecessor sold the Siltronic Property to Victor Rosenfeld and H.A. Anderson in 1962. Thereafter, wastes associated with the MGP operations within the northern Siltronic Property area may have been redistributed across portions of the Siltronic Property when that property was filled between 1966 and 1975. Wastes within tar ponds on the NWN Property were used as fill or redistributed on the NWN Property when the eastern corner of the NWN Property was filled during the 1972/1973 time-frame."

3. Recital I.D is amended, to add:

   "Investigations conducted to date on the Siltronic Property indicate that MGP waste (e.g., tar and oil, lampblack, and spent oxide) are present in subsurface soil and groundwater across the Siltronic Property, with the primary accumulation located on the northern portion of the property in the area of the former Gasco waste effluent ponds and the adjacent lowland. Dense nonaqueous phase liquid (DNAPL) in the vicinity of the former waste effluent ponds has been observed in four groundwater

monitoring wells on the Siltronic Property. Observed thicknesses ranged from two feet in monitoring well WS-10-27 to 12.5 feet in monitoring well WS-15-85. Approximately three to four feet of DNAPL is present in monitoring wells located adjacent to the Willamette River (WS-11-125 and WS-14-125). The location of the referenced monitoring wells is identified on Attachment BB to the First Addendum. Up to 25,000 ug/L benzene, 495,000 ug/L naphthalene, and 4,441 ug/L cyanide have been detected in groundwater at the Siltronic Property. Concentrations in soil have been detected up to: 35,432 mg/kg total PAH; 230 mg/kg dibenzofuran; 218 mg/kg benzene; and 15,000 mg/kg cyanide.

Investigations at the Siltronic Property have further identified elevated concentrations of chlorinated solvents in soil and groundwater. The chlorinated solvent contamination is being addressed by Siltronic Corporation and is outside the scope of this Agreement."

4. A new Recital I.G is added, reading:

"The NWN Site is located within or adjacent to the Portland Harbor Superfund Site, which site was placed on the federal National Priorities List by the U.S. Environmental Protection Agency (EPA) in December 2000. By memorandum of understanding, EPA is the lead agency for implementing investigation and cleanup of in-water sediments contamination in the Willamette River in the Portland Harbor Superfund Site, and DEQ is the lead agency for implementing investigations and source control at upland facilities. This Agreement as amended is consistent with DEQ's responsibilities at the Portland Harbor Superfund Site. Evaluation of the portions of the NWN Site located on the Siltronic Property as a potential source of contaminants to the Portland Harbor Superfund Site is also the subject of DEQ Order No. ECVC-NWR-00-27 issued by DEQ to NWN and Wacker Siltronic Corporation on October 4, 2000. DEQ separately issued Order No. VC-NWR-03-16 to Wacker Siltronic Corporation on February 5, 2004. This Agreement as amended does not supersede or affect obligations imposed under DEQ Orders No. ECVC-NWR-00-27 and VC-NWR-03-16."

5. A new Recital I. H is added, reading:

"By entering into this First Addendum, NWN does not admit liability or responsibility for conditions that may be present at the NWN Site, including hazardous substance releases at or to the Siltronic Property resulting from or exacerbated by the acts or omissions of parties other than NWN."

6. Section II.A.2 is deleted, and replaced with:

"2. <u>DEQ Review and Approval</u>

(a) Where DEQ review and approval is required for any plan or activity under the Agreement as amended, NWN may not proceed to implement the plan or activity until

DEQ approval is received. Any DEQ delay in granting or denying approval correspondingly extends the time for completion by NWN. For purposes of the Agreement as amended, "day" means calendar day unless otherwise specified.

(b) After review of any plan, report, or other item required to be submitted for DEQ approval under the Agreement as amended, DEQ shall in writing: (1) approve the deliverable in whole or in part; or (2) disapprove the deliverable in whole or in part and notify NWN of deficiencies and/or request modifications to cure the deficiencies.

(c) DEQ approvals, rejections, modifications, or identification of deficiencies shall be given as soon as practicable and state DEQ's reasons with reasonable specificity.

(d) In the event of DEQ disapproval or request for modification, NWN shall correct the deficiencies and resubmit the revised report or other item for approval within 30 days of receipt of the DEQ notice or within such other time as specified in the DEQ notice.

(e) In the event a deficiency identified by DEQ is not addressed by NWN in the revised deliverable, DEQ may modify the deliverable to cure the deficiency.

(f) In the event of approval or modification of the deliverable by DEQ, NWN shall implement the action required by the plan, report, or other item, as so approved or modified, or, as to any DEQ modifications, invoke dispute resolution under Section II.M of the Agreement."

7. Section II.A.3 is deleted, and replaced with:

"3. Additional Measures

(a) NWN may elect at any time during the term of the Agreement as amended to undertake measures, beyond those required under the Agreement and the SOW, necessary to address the release or threatened release of hazardous substances at the facility. Such additional measures (including but not limited to engineering or institutional controls and other removal or remedial measures) are subject to prior approval by DEQ, which approval shall be granted if DEQ determines that the additional measures will not compromise the validity of the RI/FS, will not threaten human health or the environment, and will comply with applicable laws.

(b) DEQ may determine that, in addition to work specified in the SOW or an approved work plan, additional work is necessary to complete the RI/FS in satisfaction of the SOW and OAR Chapter 340 Division 122, or is necessary to address unanticipated threats to human health or the environment. DEQ may require that such additional work be incorporated into the applicable work plan by modification or be performed in accordance with a DEQ-specified schedule. NWN shall modify the work plan or implement the additional work in accordance with DEQ's directions and schedule, or invoke dispute resolution under Section II.M of the Agreement within 14 days of receipt of DEQ's directions."

8. A new Section II.A.4 is added, reading:

"4. Source Control Measures

For any unpermitted discharge or release of hazardous substances at the NWN Property to the Willamette River or river sediments identified in the remedial investigation, NWN shall identify and evaluate source control measures in accordance with the SOW and the terms and schedule of a DEQ-approved work plan. DEQ will review and approve source control measures pursuant to OAR 340-122-0070 and in consultation with EPA. Upon DEQ approval of a source control measure, NWN shall develop a source control work plan in accordance with DEQ's directions and, upon DEQ approval, implement the work plan."

9. Section II. D is amended to update the current DEQ and NWN project managers:

DEQ Project Manager	NW Natural Project Manager
[To Be Determined]	Robert J. Wyatt
Department of Environmental Quality	NW Natural
Northwest Region	220 N.W. Second Avenue
2020 SW Fourth Avenue, Suite 400	Portland, Oregon 97209
Portland, Oregon 97201	(503) 226-4211 Ext. 5425

10. Section II.N.3. is amended, to add:

"Except as expressly provided in this Agreement, NWN reserves all rights, claims, and defenses relating to the NWN Site."

11. A new Section II.S is added, reading:

"S. Stipulated Penalties

1. Subject to Sections II.K and M, upon any violation by NWN of any requirement of this Agreement as amended, and upon NWN's receipt from DEQ of written notice of violation, NWN shall pay the stipulated penalties set forth in the following schedule:

(a) Up to $5,000 for the first week of violation or delay and up to $ 2,500 per day of violation or delay thereafter, for failure to provide access or records in accordance with Section II.C or G.

(b) Up to $ 2,500 for the first week of violation or delay and up to $ 1,000 per day of violation or delay thereafter, for:

(i) failure to submit a final work plan, addressing DEQ's comments on the draft work plan or incorporating DEQ modifications to the work plan, in accordance with the SOW's schedule and terms;

(ii) failure to perform work in accordance with an approved work plan's schedule and terms;

(iii) failure to perform additional work required by DEQ under Section II.A.3; or

(iv) failure to submit a final report, addressing DEQ's comments on the draft report or incorporating DEQ modifications to the report, in accordance with an approved work plan's schedule and terms.

(c) Up to $500 for the first week of violation or delay and up to $500 per day of violation or delay thereafter, for:

(i) failure to submit a draft work plan in accordance with the SOW's schedule and terms;

(ii) failure to submit progress reports in accordance with Section II.H; or

(iii) any other violation of the Agreement as amended, SOW, or an approved work plan.

2. Within 30 days of receipt of DEQ's written notice of violation, NWN either shall pay the amount of such stipulated penalty assessed, by check made payable to the "State of Oregon, Hazardous Substance Remedial Action Fund", or request a contested case regarding the penalty assessment in accordance with Section II.T.3. NWN shall pay simple interest of 9% per annum on the unpaid balance of any stipulated penalties, which interest shall begin to accrue at the end of the 30-day payment period. Any unpaid amounts that are not the subject of a pending contested case, or that have been determined owing after a contested case, are a liquidated debt collectible under ORS 293.250 and other applicable law.

3. In assessing a penalty under this subsection, the Director may consider the factors set forth in OAR 340-12-045. NWN may request a contested case hearing regarding the penalty assessment in accordance with OAR Chapter 340 Division 11. The scope of any such hearing must be consistent with the stipulations set forth in Section 2 of the Agreement, must be limited to the occurrence or non-occurrence of the alleged violation, and may not review the amount of the penalty assessed. Penalties may not accrue pending any contested case regarding the alleged violation. Violations arising out of the same facts or circumstances or based on the same deadline are considered as one violation per day."

12. The Scope of Work (Attachment B to the Agreement) is amended in Section I.A.1.i., by revising the first sentence to read:

"Determine the magnitude, nature, and extent of apparent MGP waste-related contamination at the NW Natural (NWN) Site."

13. The Scope of Work is amended in Section I.A.2, by adding the following objective:

    "viii. Identify hot spots of contamination, if any, at the facility."

14. The Scope of Work is amended in Section I.B, by adding:

    "This schedule is applicable to the RI/FS for the portion of the NWN Site on the Siltronic Property. NWN shall compile and evaluate existing data on MGP-related constituents and provide to DEQ an outline of data needs to complete the remedial investigation for the portion of the NWN Site on the Siltronic Property including an RI proposal and schedule for the RI, within 120 days of execution of the First Addendum."

15. The Scope of Work is amended in Section I.B, by adding:

    "NWN shall provide DEQ with a work plan to identify and evaluate source control measures at the NWN Property. The work described in the work plan shall be consistent with the source control approach described in the December 2005 Portland Harbor Joint Source Control Strategy".

16. For deliverables submitted after the date of execution of this First Addendum, the Scope of Work is amended in Section III.F, by deleting the entire section and replacing it with:

    "F. Endangerment Assessment Work Plan

    1. HUMAN HEALTH RISK ASSESSMENT PLAN

    Objective: To evaluate the collective demographic, geographic, physical, chemical, and biological factors at the site, for the purposes of characterizing current and reasonably likely future risks to human health as a result of a threatened or actual release(s) of a hazardous substance. To document the magnitude of the potential risk at the site; support risk management decisions; and establish remedial action goals, if necessary.

    Scope: The Human Health Risk Assessment shall evaluate risk in the context of current and reasonably likely future land and water uses, and in the absence of any actions to control or mitigate these risks (i.e., under an assumption of no action). The human health risk assessment portion of the work plan shall be developed based on the requirements specified in OAR 340-122-0084; DEQ guidance; and, as appropriate, the Risk Assessment Guidance for Superfund - Human Health Evaluation Manual Part A, United States Environmental Protection Agency (EPA), Interim Final, July 1989, (RAGS-HHEM); Human Health Evaluation Manual, Supplemental Guidance:

"Standard Default Exposure Factors", EPA, March 1991,(HHE-SG); and the Exposure Factors Handbook, EPA, 1996. A suggested outline for the human health evaluation is given in Exhibit 9-1 of the RAGS-HHEM. The work plan shall use this outline as a framework for discussing the methodologies and assumptions to be used in assessing the potential human health risks at the site.

Procedure: The work plan shall describe the different tasks involved in preparing the Human Health Risk Assessment. The Human Health Risk Assessment can be completed using either deterministic or probabilistic methodologies. If probabilistic methodologies are to be used, NWN shall discuss risk protocol with DEQ before the commencement of a probabilistic risk assessment. If deterministic methodologies will be used, then the Human Health Risk Assessment shall include an estimate of both the central tendency exposure (CTE) and the reasonable maximum exposure (RME) expected to occur under both current and future land use conditions. In general, RME exposures shall be based on the 90th percentile exposure case. Additional guidance on quantifying the RME is given in Chapter 6 of the RAGS-HHEM, SRAGS, and HHE-SG. Quantifying the potential risks associated with the RME shall be the overall goal of the risk assessment.

2. ECOLOGICAL RISK ASSESSMENT PLAN

Objective: To evaluate the collective demographic, geographic, physical, chemical, and biological factors at the site, for the purposes of characterizing current and reasonably likely future risks to the environment as a result of a threatened or actual release(s) of a hazardous substance; document the magnitude of the potential risk at a site; support risk management decisions; and establish remedial action goals, if necessary.

Scope: The Ecological Risk Assessment shall evaluate risk in the context of current and reasonably likely future land and water uses in the absence of any actions to control or mitigate these risks (i.e., under an assumption of no action). The Ecological Risk Assessment shall use a tiered approach (with four levels) to produce a focused and cost-effective assessment of risk. The Ecological Risk Assessment Work Plan shall be developed based on the requirements specified in OAR 340-122-0084; DEQ guidance; and, as appropriate, Proposed Guidelines for Ecological Risk Assessment, EPA, September 1996; Framework for Ecological Risk Assessment, EPA, February 1992; and Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, Interim Final, EPA, March 1989 (RAGS-EEM).

Procedure: The plan shall describe the different tasks involved in preparing the ecological risk assessment. Ecological risk assessments may include a Level I Scoping plan; a Level II Screening plan; and a Level III Baseline plan or Level IV Field Baseline plan. The Level III and Level IV baseline plans shall include an exposure analysis, an ecological response analysis, a risk characterization and an uncertainty analysis as required by OAR 340-122-0084(3). The ecological risk assessment can be completed using either deterministic or probabilistic methodologies. If probabilistic methodologies are to be used, NWN shall discuss risk protocol with DEQ before the

commencement of a probabilistic risk assessment. If deterministic methodologies are to be used, then the ecological risk assessment shall include an estimate of both the central tendency exposure (CTE) and the reasonable maximum exposure (RME) expected to occur. Estimating the potential risks associated with the RME shall be the overall goal of the risk assessment."

STIPULATED, AGREED, AND APPROVED FOR ISSUANCE:

NW Natural

By: _____ Date: _____
(Signature)

_____
(Name)

_____
(Title)

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

By: _____ Date: _____
(Signature)

_____
(Name)

_____
(Title)

COPY

amec

September 22, 2005

0-61M-107030/Phase 69

Tom Roick
Project Manager, Cleanup & Portland Harbor
Oregon Department of Environmental Quality
2020 SW 4th Ave, Suite 400
Portland, Oregon 97201-4987

Dear Mr. Roick:

Re: Stage 1 Source Control Evaluation – Modification to Scope, Siltronic Property RP - Portland Site

On behalf of SLLI, AMEC Earth & Environmental, Inc. is submitting this proposed modification to the scope of work presented in the Draft Stage 1 Source Control Evaluation Work Plan (Stage 1 SCE WP) dated July 1, 2005. SLLI respectfully requests the Oregon Department of Environmental Quality's (DEQ's) timely response, as this proposed modification affects field work scheduled to be completed at the Siltronic property in October and November 2005.

The Stage 1 SCE is being conducted to investigate the extent and magnitude of constituents that may be related to operations at the former Rhône-Poulenc (RP) facility that were potentially discharged to the Willamette River and differentiate these constituents from those of other parties in the area. This work scope was requested by the DEQ in a letter dated February 22, 2005. The scope of work for the Stage 1 SCE was presented by SLLI in a Stage 1 SCE scope of work letter dated May 20, 2005. DEQ provided comments on the scope of work in a letter dated June 9, 2005. Based on the scope letter and DEQ's comments, a Stage 1 SCE WP was submitted to DEQ on July 1, 2005. DEQ approved the scope of work presented in the Stage 1 SCE WP in a letter dated August 1, 2005.

Stage 1 SCE Task 1 reconnaissance borings have been completed on Arkema Lots 1 and 2. The remainder of Task 1 reconnaissance borings to be advanced on the Beach Area and Siltronic Riverbank (as defined in the Stage 1 SCE WP) are tentatively scheduled to begin in late October 2005 pending final Division of State Lands, Army Corp of Engineers, and City of Portland Greenway Permit approvals, as well as completion of property access agreements.

The purpose of this letter is to propose a modification to the scope of work presented in the Stage 1 SCE WP based on drilling conditions observed during Task 1 reconnaissance borings located at Arkema Lots 1 and 2 (Figure 1A). The modification will affect the scope of Task 1 reconnaissance borings at the Siltronic Riverbank. No modifications are planned for the Beach Area.

AMEC Earth & Environmental, Inc.
7376 SW Durham Road
Portland, Oregon
USA 97224
Tel +1 (503) 639-3400
Fax +1 (503) 620-7892

Task 1 - Reconnaissance Borings

Prior to the Task 1 reconnaissance borings at Arkema Lots 1 and 2, direct-push borings at the RP Site had been advanced to approximately 60 feet below ground surface (bgs). Five of the nine direct-push borings advanced at Arkema Lots 1 and 2 during August 2005 were deeper than 60 feet bgs. During advancement of these borings, subsurface conditions at Arkema Lots 1 and 2 were not favorable to direct-push methods deeper than approximately 80 feet bgs. Due to heaving sands, drill rods were damaged at one boring (ARK-09, advanced 84 feet bgs), and drilling had to be halted before reaching refusal at four other borings (ARK-02, advanced to 80 feet bgs; ARK-03, advanced to 80 feet bgs; ARK-05, advanced to 62 feet bgs; and ARK-06, advanced to 80 feet bgs). Based on these drilling difficulties encountered on the Arkema property during August 2005, it is AMEC's opinion that direct-push drilling methods will not allow completion of the scope of work proposed in the Stage 1 SCE WP for the Siltronic Riverbank (Stage 1 SCE WP, Figure 1). In order to collect groundwater samples at depths outlined in the Stage 1 SCE WP, SLLI proposes, and requests DEQ's approval, to modify the scope of the Stage 1 SCE WP, as described below.

In the Stage 1 SCE WP, SLLI proposed to advance six direct-push borings on the Siltronic Riverbank, and to collect groundwater samples at first-encountered groundwater, 100 feet bgs, 130 feet bgs, 160 feet bgs, 190 feet bgs, and refusal depth, respectively.

The Stage 1 SCE WP also specified two sonic borings for lithologic characterization and collection basalt groundwater samples, and installation of one monitoring well cluster (with no reconnaissance groundwater sampling).

SLLI proposes to modify the Stage 1 SCE WP to consist of the following Siltronic Riverbank program (approximate depths only), as shown on the enclosed Figure 1A, using sonic drilling methods only:

- Complete four sonic borings 10 feet into basalt, with reconnaissance groundwater samples collected at first-encountered groundwater, 100 feet bgs, 130 feet bgs, 160 feet bgs, 190 feet bgs, within the gravel (if present), and 10 feet into the basalt; and
- Install one monitoring well cluster, including a well completed within each lithologic unit and the basalt; reconnaissance groundwater samples will also be collected from the deepest boring at the same frequency and depths specified above.

This proposed scope of work modification will allow data quality objectives for the Siltronic Riverbank, including evaluation of discrete water quality and geology to be achieved. This scope also provides additional characterization of the basalt groundwater. The proposed scope of work should minimize the possibility of delays and duplication of effort during the Stage 1 SCE field work. Note that the locations on Figure 1A are approximate and subject to property owner approval.

The remainder of the DEQ-approved Stage 1 SCE scope of work will remain the same.

SCOEPA00003501

If you have any questions or concerns, please do not hesitate to contact Roger Gresh or Teresa Wilson at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

Roger T. Gresh, P.G.
Project Manager

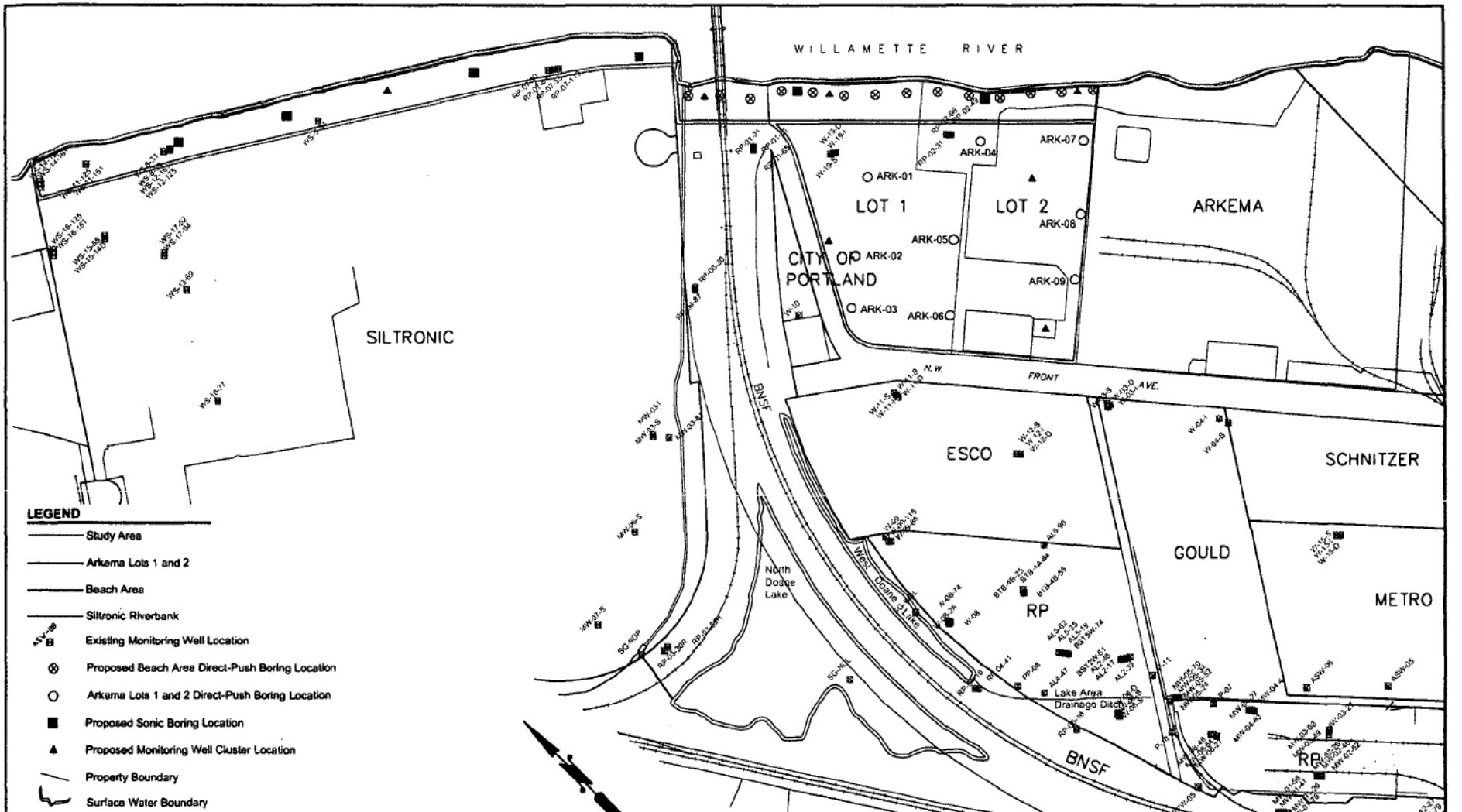
Teresa A.R. Wilson
Task Manager

Attachment: Figure 1A - Proposed Investigation Locations

CLJ/lp

c: R. Ferguson, SLLI
S. Dearden, Sanofi-Aventis
J. Benedict, CHBH&L

SCOEPA00003502



SCOEPA00003503

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
811 SW Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
TDD (503) 229-6993

July 23, 1999

Mr. David Bristol
Miller, Nash, Wiener, Hager & Carlsen
3500 U.S. Bancorp Tower
111 SW Fifth Avenue
Portland, Oregon 97204

RECEIVED
July 27 1999
TRONIC
engineering

RE: Proposed Rhone Poulenc Remedial Investigation Activities on Wacker Siltronic Corporation's Property

Dear Mr. Bristol:

As you are aware, the Oregon Department of Environmental Quality (DEQ) is in the process of completing the remedial investigation at the Rhone Poulenc facility located at 6200 NW St. Helens Road. A key element of the remedial investigation is to establish the downgradient extent of groundwater contamination. Access to the Wacker Siltronic Corporation (Wacker Siltronic) property located at 7200 NW Front Avenue is critical to the successful completion of this task. In addition, continued progress at all DEQ cleanup sites located within the Portland Harbor Study Area is critical to the successful implementation of the Portland Harbor Sediment Management plan.

The purpose of the investigative activities described in the CPT, GeoProbe and Well Installation Field Sampling Plan dated July 7, 1999 is to identify and collect groundwater samples from more permeable groundwater zones to select appropriate monitoring well locations and depths. Specifically, the purpose of the investigative activities proposed for the Wacker Siltronic property is to delineate the extent of Rhone Poulenc contamination downgradient of known source areas at the site. Based on groundwater data collected from existing wells, Rhone Poulenc contaminants are most likely to be present as dissolved phase contaminants at intermediate and deeper depths.

DEQ wishes to assure you that every effort will be taken to minimize the impacts on the Wacker Siltronic facility. For example, the investigation relies on the use of low impact direct push sampling techniques (CPT and GeoProbe) to determine monitoring well locations. In addition, all investigation derived wastes (IDW) generated at your facility will be brought back to the Rhone Poulenc facility for storage and management.

DEQ requests that Rhone-Poulenc be granted access to Wacker Siltronic property as soon as practicable to complete the groundwater investigation. The data generated may assist Wacker Siltronics with any future investigations and will contribute to our overall understanding of contaminant distribution with the Portland Harbor Study Area.

If I can be of any assistance in this matter or you have any questions, please feel free to contact me at (503) 229-5648.

Sincerely,

Eric L. Blischke
Project Manager
Waste Management and Cleanup Division

CC: Paul Slyman, DEQ/WMCD
Dave St. Louis, DEQ/NWR
Mavis Kent, DEQ/NWR
Kurt Burkholder, DOJ
Thomas McCue, Wacker Siltronic Corporation
Robert Ferguson, Rhone Poulenc
Roger Gresh, URS Greiner Woodward Clyde
Jim Benedict, Cable, Huston, Benedict and Haagensen

amec

January 31, 2006

Mr. Tom McCue
Siltronic Corporation
7200 NW Front Avenue, MS-20
Portland, Oregon 97210-3676

Dear Tom:

Re: Response to Maul Foster & Alongi, Inc. Letters Dated November 18 and 21, 2005
Source Control Evaluation Work
RP - Portland Site

AMEC Earth & Environmental, Inc. (AMEC), on behalf of SLLI, is sending this letter in response to two letters sent on your behalf by Maul Foster & Alongi, Inc. (MFA) dated November 18 and 21, 2005, regarding work being conducted by AMEC on Siltronic Corporation (Siltronic) property. MFA's letters document events that occurred during AMEC's direct-push sampling at locations SIL-01 and SIL-04. The sampling was conducted as part of SLLI's Stage 1 Source Control Evaluation (SCE) scope of work, as presented in the Final Stage 1 SCE Work Plan dated October 31, 2005. We note that, contrary to the statement in the November 18 letter, the broken direct-push rod was located at SLLI boring location SIL-01, not SIL-02 as stated by MFA.

It should be noted that, in the case of both incidents, AMEC consulted with MFA field staff who confirmed with Mr. James Peale that the AMEC proposed method of abandonment for the broken direct-push rod by grouting in place was satisfactory to MFA. AMEC was told verbally by Ms. Scout Mauldin of MFA that Mr. Peale approved the abandonment procedure.

Although the measures taken at the locations of the broken rods are generally considered sufficient to avoid creation of a vertical migration pathway, SLLI chose to attempt to overdrill and remove the rods as a very conservative measure that could eliminate the subsurface metal rods from Siltronic's property. AMEC proposed a scope of work to Siltronic and MFA by e-mail on December 21, 2005, to overdrill at these locations using a sonic rig. The proposed scope of work and schedule were accepted by Siltronic by e-mail on December 22, 2005.

On January 11 through January 16, 2006, Boart Longyear (Boart), at the direction of AMEC, attempted to retrieve the broken rods from both boring locations SIL-01 and SIL-04 using sonic drilling methods. MFA representatives were onsite observing the overdrilling activities. Despite extensive efforts, the overdrilling activities at both locations were unsuccessful in removing the broken direct-push rods. Both borings were abandoned in accordance with State of Oregon requirements. Following is a summary of those overdrilling activities.

SIL-01

At location SIL-01, 8-inch casing was advanced by Sonic drilling to a depth of 45 feet below ground surface (bgs) and a bentonite seal was installed from approximately 42 to 45 feet bgs. After allowing the bentonite seal to hydrate for one hour, Boart continued drilling and casing the hole with 6-inch casing while advancing with a 4-inch core barrel. Boart cored from 70 to 90 feet bgs several times with the 4-inch core barrel in an attempt to trap the broken direct-push

rods in the core barrel. After three hours of unsuccessful attempts, the boring was abandoned with 280 gallons of bentonite grout and six 50-pound bags of bentonite chips.

SIL-04

At location SIL-04, 9-inch casing was advanced to 48 feet bgs and a bentonite seal was installed from 45 to 48 feet bgs. After the seal was allowed to hydrate for one hour, 8-inch casing was advanced to 58 feet bgs, while using a 6-inch core barrel to drill ahead of the casing. Again, Boart worked for over three hours attempting to trap the direct-push rods within the core barrel and was unsuccessful. The boring was abandoned with 260 gallons of bentonite grout and seven 50-pound bags of bentonite chips.

As discussed, and agreed to at the time of the incident, AMEC felt that grouting the rods in place is protective of the groundwater, and does not anticipate any issues related to preferential pathways along or within the pipe. We welcome any guidance that MFA, based on their site experience, can give us regarding future field-related issues that may be encountered at the Siltronic property, and appreciate the cooperation and interaction provided to date.

If you have any questions, please contact Roger Gresh or Teresa Wilson at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

Teresa A.R. Wilson
Task Manager

Roger Gresh, R.G.
Project Manager

TARW/lp

c: S. Dearden, Sanofi-Aventis
R. Ferguson, SLLI
J. Benedict, CHBH&L
J. Peale, MFA
C. Reive, Jordan Schrader
A. Gladstone, Davis Rothwell Earle & Xochihua
T. Roick, DEQ
D. Bayuk, DEQ

SCOEPA00003507

May 20, 2005

0-61M-107030/Phase 69

Tom Roick
Project Manager, Cleanup & Portland Harbor
Oregon Department of Environmental Quality
2020 SW 4th Ave, Suite 400
Portland, Oregon 97201-4987

Dear Mr. Roick;

Re: Stage 1 Source Control Evaluation
RP - Portland Site

On March 31, 2005, the Oregon Department of Environmental Quality (DEQ) advised SLLI that the Rhône-Poulenc (RP) Portland Site (Site) has been identified as a "high priority site" for a source control evaluation (SCE), based on groundwater concentrations that exceed screening values in monitoring wells near the Willamette River (River), and an alleged body of evidence that RP-related constituents have a complete groundwater pathway by which they can reach the River. This interpretation is based largely on an incomplete understanding of the sources of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (dioxins) in the River, a limited data set for dioxin congeners that does not allow proper evaluation of potential dioxin sources near river mile 7 (RM 7), and a consequent assumption that the former RP facility is responsible for all dioxins in that stretch of the River. DEQ requested from SLLI a proposal to conduct additional investigation to assess this assumption that a pathway exists for RP-related constituents to enter the River. SLLI agreed to do so in an April 18, 2005 letter to DEQ.

SLLI rejects the supposition that the former RP facility is the sole or major source of dioxins detected in the sediment at or near RM 7 and contends that there are other probable sources. One potential source of particular interest to SLLI is the Arkema site immediately upriver from the RP National Pollutant Discharge Elimination System (NPDES) outfall area. Substantial literature exists linking chloralkali manufacturing to dioxin generation. In addition, the highest concentrations of dioxin in this stretch of the River have been detected near the docks at Arkema, and the congener fingerprint of the dioxins in these samples is a nearly perfect example of the pattern that is referred to in the scientific literature as the "chlorine pattern", "chloralkali pattern", or "dioxin chloralkali pattern". A report presenting an evaluation of dioxin source congener fingerprint signatures in the River near RM 7 is currently being prepared, and will be forward to DEQ as soon as it is complete. In order to accurately assess the RP contribution to the River, if any, it is necessary, in addition to assessing groundwater conditions at the edge of the River as we have discussed, to identify other point sources of dioxins in the vicinity of the Site as well as other sources of industrial- and urban-generated dioxin. A comprehensive assessment of dioxin congener fingerprint distribution in both sediment and upland groundwater will be required to help identify sources.

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In order to achieve the goal of a fair and accurate assessment of historical and potential ongoing sources of dioxin and other constituents to the River near RM 7, SLLI has developed a scope of work for the Stage 1 SCE that includes two major components, as described below:

- **Stage 1 SCE Groundwater Investigation**
  This component of the Stage 1 SCE investigation involves the installation of a series of reconnaissance borings and monitoring wells along the riverfront for sampling groundwater, measuring groundwater elevations, and conducting transducer studies. The scope of work is described below in detail. The purpose of this component is to determine if constituents of potential concern are present in groundwater adjacent to the River at levels of regulatory concern. At issue is whether any particular constituents found in these borings or wells are related to former RP operations or derived from some other source(s). To help determine sources of dioxins, the line of newly constructed wells is to extend south beyond the existing wells historically used in the RP groundwater monitoring program. The analytical plan will include all dioxin and furan congeners in addition to volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and other constituents. The complete list of chemical analyses to be conducted is discussed below and summarized in Table 1. It is anticipated that the results of the Stage 1 SCE Groundwater Investigation may identify an area or areas for additional and more comprehensive investigation.
- **Sediment Investigation**
  Although much sediment analytical data have been collected in the River by others, further investigation is clearly needed to accurately characterize the nature and distribution of dioxin congeners in sediment along the Arkema waterfront. This additional sediment data will be used to supplement the data derived from the Stage 1 SCE Groundwater Investigation and the Outfall 22B investigation (conducted earlier this year), which indicate that constituents related to the Arkema site have likely migrated downstream along the River toward the Burlington Northern Santa Fe (BNSF) railroad bridge. SLLI anticipates that this data gap will be filled by ongoing investigations being conducted by the Lower Willamette Group. If necessary, SLLI will provide to DEQ at a later date additional information regarding this component of the SCE

The proposed activities represent an ambitious scope of work but one that SLLI feels is necessary to accurately answer the questions posed by the DEQ regarding continuing discharge to the River. As discussed by Roger Gresh and Tom Roick on May 16, 2005, SLLI also is requesting a meeting with DEQ on the 1st or 2nd of June 2005 to discuss this scope of work for the Stage 1 SCE as well as the West Doane Lake (WDL) Treatability Study (TS), for which a draft work plan was submitted to DEQ on May 19, 2005.

In addition to the work summarized above, SLLI understands that Arkema has one ongoing remedial action and two planned remedial actions to address dissolved-phase constituents beneath its former plant area. According to information in DEQ's files, Arkema is currently conducting air sparging in its source area and is planning to perform calcium polysulfide and sodium persulfate injection to address dissolved-phase hexavalent chromium and DDT/chlorobenzene, respectively. Although these actions are taking place on Lots 3 and 4 of Arkema's property, an analysis of chemical distribution and hydrology throughout the area

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indicates that these actions could impact groundwater quality beneath Lots 1 and 2. Because the former RP facility has been considered by Arkema and DEQ to be a source of groundwater contamination beneath Lots 1 and 2, and because SLLI has conducted and is planning to conduct investigations at Lots 1 and 2 as part of the Stage 1 SCE Groundwater Investigation, there is a concern that the actions planned by Arkema will interfere with DEQ's ability to differentiate Arkema and RP-related constituents beneath Lots 1 and 2. Further, the Arkema Interim Remedial Measures (IRM) are scheduled to be conducted beginning spring/summer 2005, prior to our Stage 1 SCE Groundwater Investigation.

To allow documentation of changes in groundwater chemistry beneath Lots 1 and 2, SLLI proposes conducting a limited direct-push groundwater investigation at Lots 1 and 2, and sampling of selected existing Arkema groundwater monitoring wells, prior to the implementation of Arkema's proposed actions. This work would be conducted as an early expedited phase of the Stage 1 SCE Groundwater Investigation. An abbreviated work plan for this "baseline" investigation, including sampling locations and analytical program, will be provided for DEQ review and approval.

Throughout the planning process for the "baseline" investigation and the remainder of the Stage 1 SCE, SLLI wants to work with DEQ to expedite document review and approval to allow permits to be obtained, property access agreements to be executed, and field investigations to be completed according to the proposed schedules.

Please advise Roger Gresh of the availability of DEQ staff for a June 1st or 2nd meeting with SLLI. Our expectation is that by meeting to discuss the Stage 1 SCE scope, SLLI will be able to submit a Stage 1 SCE Work Plan that can be quickly approved by DEQ with minor, if any, modifications.

The sections below provide scope details for the Stage 1 SCE Groundwater Investigation, and discussion regarding the Stage 1 SCE schedule and the WDL TS schedule.

STAGE 1 SCE GROUNDWATER INVESTIGATION SCOPE OF WORK

As suggested above, SLLI anticipates that more than one phase of investigation may be required to complete the SCE at the River. This scope of work is for a proposed Stage 1 SCE. The objectives of Stage 1 are related to a subset of data gaps presented to DEQ in a letter from SLLI dated April 18, 2005, including an evaluation of: 1) whether constituents are present in near-river groundwater at regulatory levels of concern; 2) whether the constituents are from a RP source or other sources; 3) the extent and the chemical makeup of the dioxin and chlorinated solvent plumes originating at the Arkema site flowing to the north/northwest toward RP's historical drainage ditch; 4) the connection, if any, between Siltronic's trichloroethylene (TCE) plume and deep TCE detected below their property; and 5) whether there are possible additional sources of TCE in deep water-bearing zones beneath Siltronic.

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Field Work

The scope of work to evaluate the above-listed data gaps has been divided into four tasks.

- **Task 1** - Drilling of reconnaissance borings near the River and Arkema Lots 1 and 2 by using both direct-push and sonic drilling technologies for lithologic logging and the collection of soil and groundwater analytical samples. Analytical results will be used to evaluate whether constituents at or above regulatory levels of concern are present near the River, and to help differentiate using chemical forensic tools between constituents derived from the former RP facility and constituents from other sources;
- **Task 2** - Installation of up to four monitoring well clusters adjacent to the River and three monitoring well clusters located on Arkema Lots 1 and 2;
- **Task 3** - Groundwater sampling and water elevation monitoring of newly installed monitoring wells and selected existing monitoring well clusters to evaluate groundwater quality and vertical and lateral hydraulic gradients; and
- **Task 4** - Transducer study to be conducted within selected newly installed monitoring well clusters and selected existing monitoring well clusters to evaluate hydraulic gradients and tidal influence on the water-bearing zones near the River.

Described below are the activities that will be conducted under each task. Table 1 summarizes the proposed activities.

Task 1 - Reconnaissance Borings

- Direct-push borings along the beach from near the BNSF railroad bridge to the southern boundary of Arkema Lots 1 and 2 (beach area), as shown on Figure 1, will be advanced for lithologic logging and soil and groundwater characterization. Borings will be advanced to refusal depth, estimated at 50 feet (ft) below ground surface (bgs). Soil sampling will be conducted continuously for lithologic logging, documentation of visually impacted soils, screening for potential laboratory analysis, and archiving for potential future analysis from targeted zones including but not limited to: 0 to 0.5 ft bgs, 5 to 5.5 ft bgs, capillary fringe, and 20 to 20.5 ft bgs. Soil samples will be submitted for chemical constituent analysis only if visual and/or photoionization detector (PID) evidence during sample collection indicates potential soil impact. However, soil samples may be collected and analyzed for hydrogeologic parameters. Three reconnaissance groundwater samples will be collected per boring for laboratory analysis. Water samples will be collected from the first water-bearing zone, approximately 30 ft bgs, and drill refusal depth. Planned chemical analyses for the beach area boring samples are summarized on Table 1.
- Direct-push borings at Arkema Lots 1 and 2, in the uplands area above the beach, will be advanced for lithologic logging and soil and groundwater characterization. Borings will be advanced to refusal depth, estimated at 60 ft bgs. Soil sampling will be conducted continuously for lithologic logging, documentation of visually impacted soils, screening for potential laboratory analysis, and archiving of soil samples for potential future analysis from

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targeted zones including but not limited to: 0 to 0.5 ft bgs, 5 to 5.5 ft bgs, capillary fringe, and 20 to 20.5 ft bgs. Soil samples will be submitted for chemical analysis only if visual and/or PID evidence during sample collection indicates potential soil impact. However, soil samples may be collected and analyzed for hydrogeologic parameters. Three reconnaissance groundwater samples will be collected per boring for laboratory analysis. Water samples will be collected from the first water-bearing zone, approximately 40 ft bgs, and drill refusal depth. Planned chemical analyses for the Arkema Lots 1 and 2 boring samples are summarized in Table 1.

- Direct-push borings along the Siltronic riverbank, as shown on Figure 1, will be advanced to characterize soil lithology and groundwater quality. Borings will be advanced to refusal depth, estimated at 100 ft bgs near the BNSF railroad bridge to 200 ft bgs near Siltronic's plant area. Soil sampling will be conducted continuously for lithologic logging and documentation of visually impacted soils. Soil samples for laboratory analysis of chemical constituents will not be collected at these boring locations because historical RP activities have not been documented in these areas, and Gasco-related soil impact at the Siltronic property has been fairly well documented by Northwest Natural and Siltronic. However, soil samples may be collected and analyzed for hydrogeologic parameters. Three reconnaissance groundwater samples will be collected per boring for laboratory analysis. Water samples will be collected from the first water-bearing zone, approximately 100 ft bgs, and drill refusal depth. Planned chemical analyses for the riverbank boring samples are summarized on Table 1.
- Sonic borings along the beach area and Siltronic riverbank, as shown on Figure 1, will be advanced to confirm lithologic logging from the direct-push borings, to document the basalt surface elevation and surface condition (e.g., fracturing and weathering) and gravel thickness (if observed), and groundwater quality in the basalt water-bearing zone. Borings will be drilled approximately 10 ft into the basalt. Soil sampling will be conducted continuously for lithologic logging and documentation of visually impacted soils. Soil samples for laboratory analysis of chemical constituents will not be collected at these boring locations. However, soil samples may be collected and analyzed for hydrogeologic parameters. One reconnaissance groundwater sample will be collected from the basalt water-bearing zone for laboratory analysis. An additional groundwater sample will be collected if the gravel water-bearing zone is encountered during drilling and if a sample was not obtained from a nearby direct-push boring from this water-bearing zone. Planned analyses for the sonic boring samples are summarized on Table 1.

Task 2 - Monitoring Well Installation

- Up to four monitoring well clusters will be installed near the River. Currently, it is anticipated that three well clusters will be installed in the beach area and one cluster will be installed on the Siltronic riverbank, as shown on Figure 1. In addition, up to three monitoring well clusters will be installed in the Arkema Lots 1 and 2 area, as shown on Figure 1. Final monitoring well locations will be determined from the analytical results collected from the Task 1 reconnaissance borings. Borings for the well installation will include soil sampling to confirm lithologic logging from the reconnaissance borings, to document the basalt surface

elevation and gravel thickness (if observed). Soil samples for laboratory analysis of chemical constituents will not be collected at these boring locations. Monitoring well clusters will be screened in the first water-bearing zone, alluvium water-bearing zone, and basalt water-bearing zones. Monitoring wells will be constructed in a manner similar to monitoring well cluster RP-07.

Task 3 - Groundwater Monitoring Event

- Following the installation of the new monitoring wells from Task 2, a groundwater sampling event will be conducted from each of the newly installed monitoring well clusters and from existing monitoring well cluster locations W-19, RP-01, RP-02, RP-07, WS-11, and WS-12. Groundwater sampling will be conducted in general accordance with applicable portions of AMEC's Final Post-Characterization Groundwater Monitoring Plan dated February 17, 2004. Analyses for the monitoring well groundwater samples are provided in Table 1.

Task 4 - Transducer Study

- Immediately following the groundwater sampling event, a pressure transducer will be installed in each monitoring well in well clusters W-19, RP-02, and in each well of two of the newly installed beach and/or Arkema area monitoring well clusters to evaluate hydraulic gradients and tidal influence on the water-bearing zones near the River for a period of one month.

STAGE 1 SCE SCHEDULE

SLLI requests that DEQ expedite their review of this Stage 1 SCE scope of work in advance of the June 1st or 2nd meeting to facilitate SLLI's submittal and DEQ's approval of the Stage 1 SCE Work Plan and subsequent implementation of the Stage 1 field work in the 2005 in-river work window. If any additional SCE work is proposed after SLLI's June meeting with DEQ, this work, if warranted, could be conducted in a subsequent stage of the SCE.

The attached Figure 2 illustrates the proposed schedule for the Stage 1 SCE based on a June 1, 2005 DEQ meeting date, and highlights some of the schedule constraints for implementation of this scope of work. SLLI currently anticipates that if the proposed Stage 1 SCE scope of work generally can be agreed upon at the June 1 meeting, then a Stage 1 SCE Work Plan will be submitted to DEQ within a few weeks of the meeting, and quickly approved by DEQ. The proposed schedule on Figure 2 includes an expedited review period of 16 weekdays for DEQ review and approval of the Work Plan. Because a DEQ-approved Work Plan is required to define the scope for permits and property access, DEQ's expedited approval of the Work Plan is critical.

Results from the Stage 1 SCE field investigation will be evaluated and summarized in a report to DEQ that will include boring logs from the reconnaissance and monitoring well drilling activities, validated laboratory analytical results, groundwater sample collection forms, and recommendations for further investigation, if warranted.

WDL TS SCHEDULE

As already discussed with Tom Roick, SLLI recommends that the WDL TS also be discussed at the June DEQ meeting with SLLI. The criteria on which basis the TS will be conducted need to be agreed upon in advance between SLLI and DEQ. This topic was discussed briefly at the March 31, 2005 DEQ meeting with SLLI, but needs to be addressed further in order to reach agreement in a timely manner. Similar to the Stage 1 SCE schedule, timely implementation of the WDL TS also is dependent upon expedited document submittal and DEQ approval. Figure 3 shows a proposed schedule for the WDL TS Work Plan finalization, approval by DEQ, and implementation of the WDL TS. As mentioned above, DEQ should have received the WDL TS Work Plan under separate cover on May 19, 2005.

Please contact Roger Gresh if you have any questions regarding the Stage 1 SCE scope of work and to confirm arrangements for the June meeting.

Sincerely,

AMEC Earth & Environmental, Inc.

Roger Gresh, P.G.
Project Manager

Teresa A.R. Wilson, R.G.
Task Manager

Attachments: Table 1 - Investigation Locations and Analytical Methods Stage 1 Source Control Evaluation
Figure 1 - Stage 1 Source Control Evaluation Proposed Locations
Figure 2 - Stage 1 Source Control Evaluation Proposed Schedule
Figure 3 - West Doane Lake Treatability Study Proposed Schedule

CLJ\lp

c: R. Ferguson, SLLI
S. Dearden, Sanofi-Aventis
J. Benedict, CHBH&L

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TABLE 1
Investigation Locations and Analytical Methods
Stage 1 Source Control Evaluation
RP - Portland Site

Location	Sampling Media	Analytical Requirements											
		Proposed Sampling Depth [A]	VOCs by EPA Method 8260B	SVOCs by EPA Method 8270C	Herbicides by EPA Method 8151A	Pesticides by EPA Method 8081A	Dioxins/ Furans by EPA Method 8290	TPH Diesel Range by NWTPH-Dx	Metals by EPA Method 6010A/6020/7470A [B]	Compound Specific Isotope	Chloride by EPA Method 300.0	Ammonia by EPA Method 350.3	Natural Attenuation Parameters [C]
Beach Area Borings	Soil	0-0.5 ft bgs	A	A	A	A	A	A	A	A			
		5-5.5 ft bgs	A	A	A	A	A	A	A	A			
		Capillary Fringe	A	A	A	A	A	A	A	A			
		20-20.5 ft bgs	A	A	A	A	A	A	A	A			
	Groundwater	First WBZ	X	X	X	X	X	X	X	X	X	X	
		30 ft bgs	X	X	X	X	X	X	X	X	X	X	
		Refusal Depth	X	X	X	X	X	X	X	X	X	X	
Arkema Lots 1 and 2 Borings	Soil	0-0.5 ft bgs	A	A	A	A	A	A	A	A			
		5-5.5 ft bgs	A	A	A	A	A	A	A	A			
		Capillary Fringe	A	A	A	A	A	A	A	A			
		20-20.5 ft bgs	A	A	A	A	A	A	A	A			
	Groundwater	First WBZ	X	X	X	X	X	X	X	X	X	X	
		40 ft bgs	X	X	X	X	X	X	X	X	X	X	
		Refusal Depth	X	X	X	X	X	X	X	X	X	X	
Siltronic Riverbank Borings	Soil	No Samples Planned											
	Groundwater	First WBZ	X	X	X	X	X	X	X	X			
		100 ft bgs	X	X	X	X	X	X	X	X			
		Refusal Depth	X	X	X	X	X	X	X	X			
Sonic Borings	Soil	No Samples Planned											
	Groundwater	Gravel WBZ	X	X	X	X	X	X	X	X	X	X	
		Basalt WBZ	X	X	X	X	X	X	X	X	X	X	
Monitoring Well Installation	Soil	No Samples Planned											
	Groundwater	No Samples Planned											
Groundwater Sampling Event	Groundwater	Various	X	X	X	X	X	X	X	X	X	X	X

Notes:
(A) Sampling depths may be adjusted based on field observations.
(B) Total and dissolved metals analysis for groundwater samples.

(C) Natural attenuation parameters include: ferrous iron, microbial enumerations, nuterients, total organic carbon, chemical oxygen demand, sulfate, sulfide, total alkalinity, major cations, and methane.

A	Archive, analyze only if evidence of contamination
bgs	below ground surface
EPA	Environmental Protection Agency
ft	feet
NA	Not applicable
SVOC	Semivolatile organic compounds
TPH	Total Petroleum Hydrocarbons
VOCs	Volatile organic compounds
WBZ	Water-bearing zone

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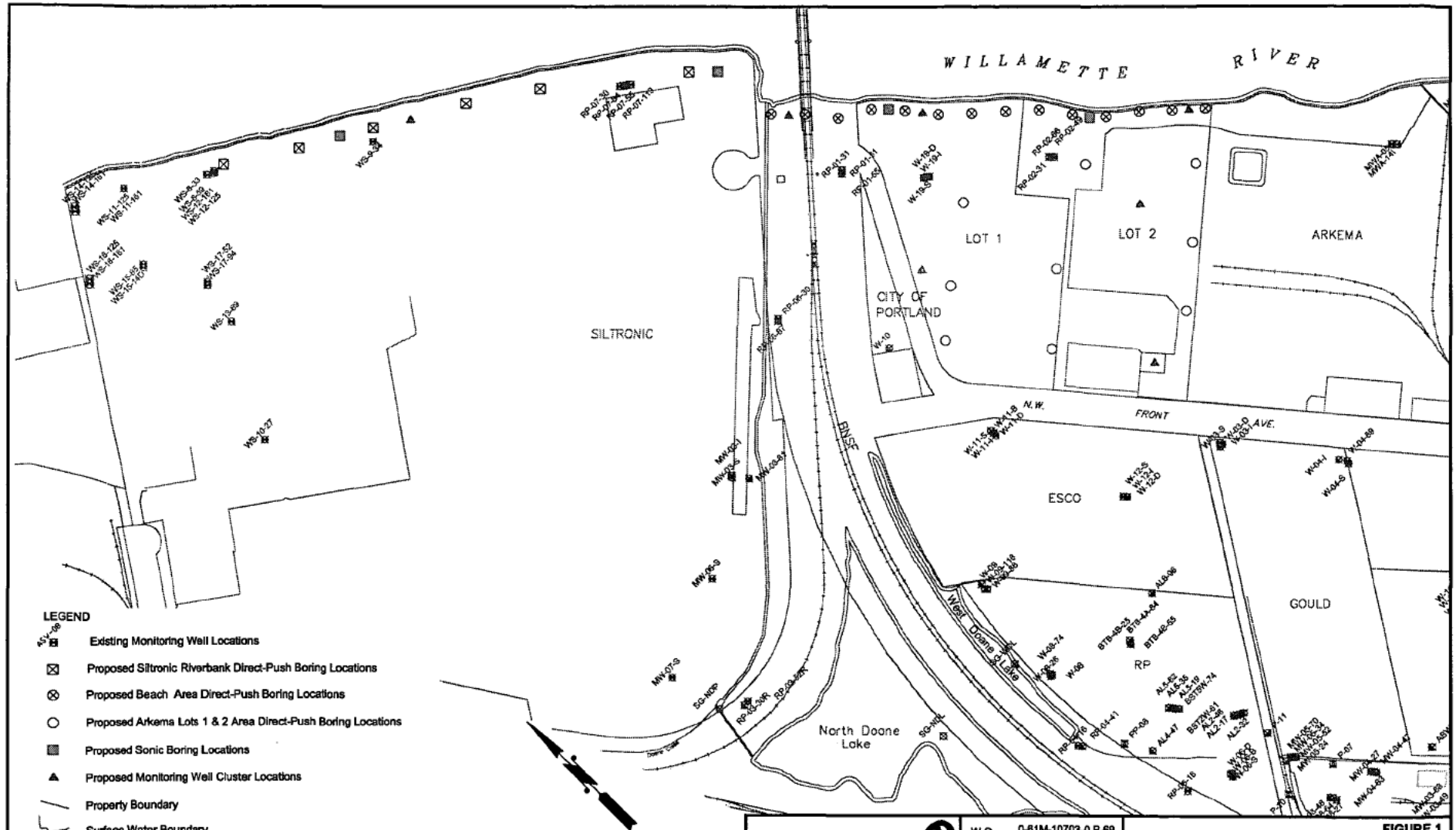

NOTE:
1. Boring locations are approximated. Final boring locations will depend upon drill rig site access.
2. Final monitoring well locations will be based on results from the reconnaissance borings.

amec
7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 P-69
DESIGN	CJ
DRAWN	DD
DATE	MAY 2005
SCALE	1"=280'

FIGURE 1
STAGE I SOURCE CONTROL EVALUATION
PROPOSED LOCATIONS

RP - PORTLAND SITE

AMEC DRAWING NO. K:\10000\10700\10703\PHASE 69 SOURCE CONTROL EVALUATION\DEQ SCE SOW\0505 FIG-1.dwg

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FIGURE 2
Stage 1 Source Control Evaluation
Proposed Schedule
RP - Portland Site

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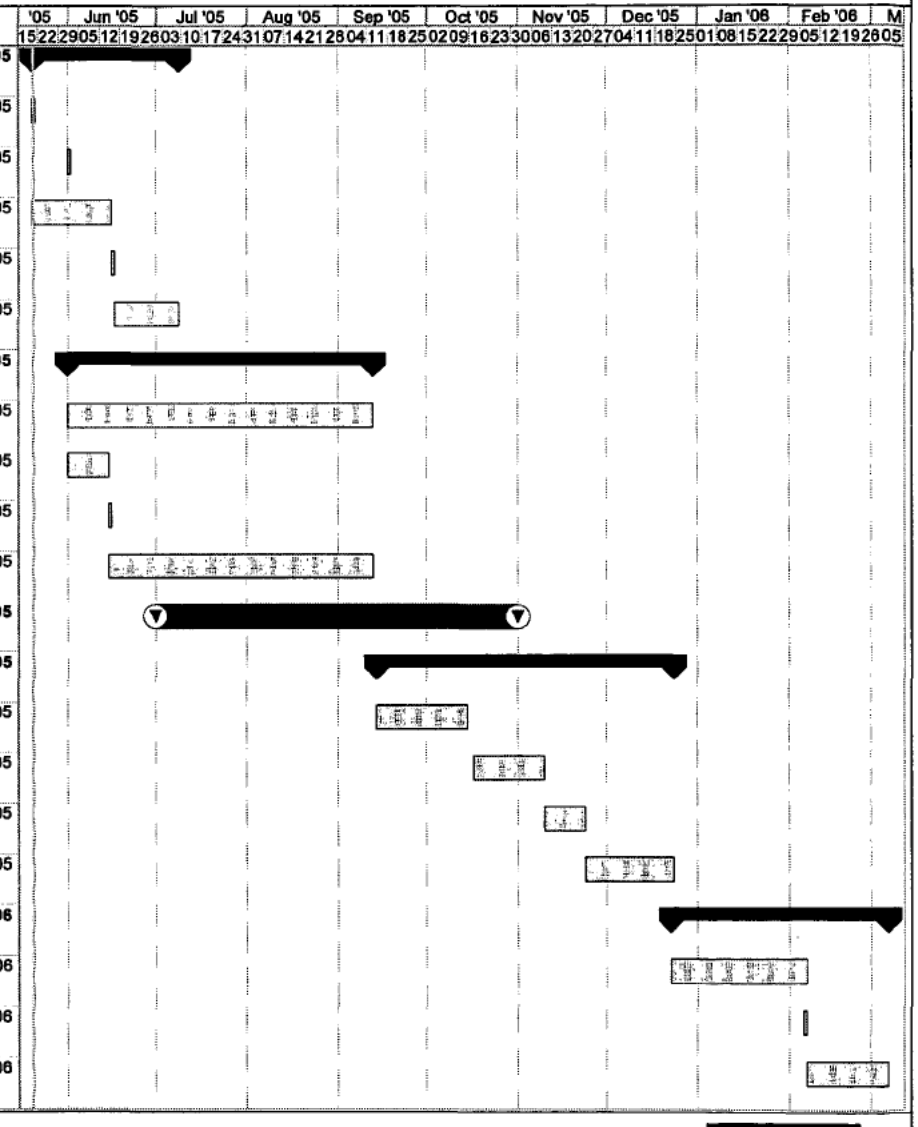
ID	Task Name	Duration (business days)	Start	Finish
1	**Work Plan**	**36 days**	**Fri 05/20/05**	**Fri 07/08/05**
2	Submittal of Scope of Work Letter to DEQ	1 day	Fri 05/20/05	Fri 05/20/05
3	Meeting with DEQ, SLLI and AMEC	1 day	Wed 06/01/05	Wed 06/01/05
4	Work Plan Preparation	19 days	Fri 05/20/05	Wed 06/15/05
5	Work Plan - Submit to DEQ	1 day	Thu 06/16/05	Thu 06/16/05
6	Work Plan - DEQ Review Period	16 days	Fri 06/17/05	Fri 07/08/05
7	**Site Access/Permit Processing**	**74 days**	**Wed 06/01/05**	**Mon 09/12/05**
8	Site Access Negotiations	74 days	Wed 06/01/05	Mon 09/12/05
9	DSL-USACOE Permit Application	10 days	Wed 06/01/05	Tue 06/14/05
10	Submit DSL-USACOE Permit	1 day	Wed 06/15/05	Wed 06/15/05
11	DSL-USACOE Review Period (90 calendar days)	64 days	Wed 06/15/05	Mon 09/12/05
12	**DSL-USACOE Work Window Fall 2005**	**87 days**	**Fri 07/01/05**	**Mon 10/31/05**
13	**Field Activities**	**73 days**	**Wed 09/14/05**	**Fri 12/23/05**
14	Task 1-Reconnassaince Borings	23 days	Wed 09/14/05	Fri 10/14/05
15	Task 2-Monitoring Well Installation	18 days	Mon 10/17/05	Wed 11/09/05
16	Task 3-Groundwater Monitoring Event	10 days	Thu 11/10/05	Wed 11/23/05
17	Task 4-Transducer Study	22 days	Thu 11/24/05	Fri 12/23/05
18	**Stage 1 SCE Report**	**52 days**	**Fri 12/23/05**	**Mon 03/06/06**
19	Preparation of Technical Report	32 days	Fri 12/23/05	Mon 02/06/06
20	Technical Report - Submit to DEQ	1 day	Mon 02/06/06	Mon 02/06/06
21	Technical Report - DEQ Review Period	20 days	Tue 02/07/06	Mon 03/06/06



Project: Stage 1 SCE Proposed Schedule.mpp
Date: Fri 05/20/05

Task | Progress | Summary
Split | Milestone | Time Constraints for Field Activities

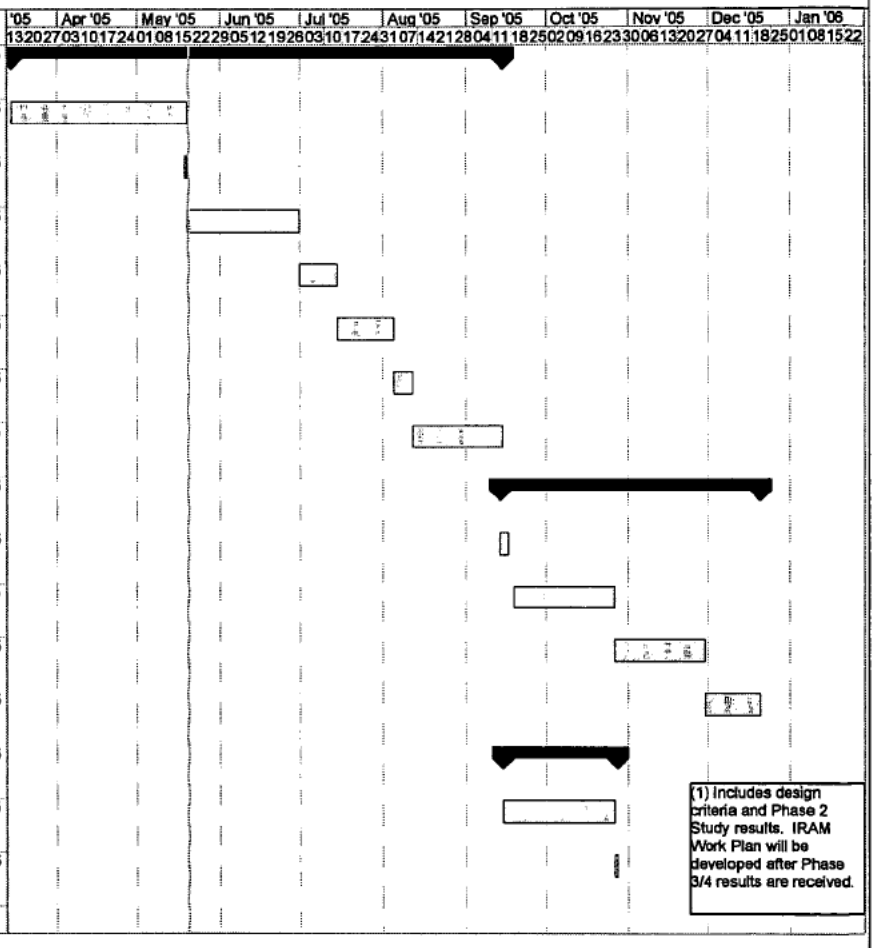
\\por-fs1\clientdata\10000\10700\10703\Phase 69 Source Control Evaluation\DEQ SCE SOW\Stage 1 SCE Proposed Schedule.mpp

SCOEPA00003517

FIGURE 3
West Doane Lake Treatability Study
Proposed Schedule
RP - Portland Site

amec

ID	Task Name	Duration (business days)	Start	Finish
1	**West Doane Lake Treatability Study**	**132 days**	**Tue 03/15/05**	**Wed 09/14/05**
2	Prepare WDL Treatability Study Work Plan	48 days	Tue 03/15/05	Thu 05/19/05
3	Submit WDL Treatability Study Work Plan to DEQ	1 day	Thu 05/19/05	Thu 05/19/05
4	Receive DEQ Comments for Work Plan	30 days	Fri 05/20/05	Thu 06/30/05
5	Finalize WDL Treatability Study Work Plan	10 days	Fri 07/01/05	Thu 07/14/05
6	Field Preparation and Mobilization	15 days	Fri 07/15/05	Thu 08/04/05
7	Conduct WDL Phase I Characterization Sediment Sampling	5 days	Fri 08/05/05	Thu 08/11/05
8	Obtain Laboratory Analytical Report	24 days	Fri 08/12/05	Wed 09/14/05
9	**Conduct WDL Treatability Study**	**70 days**	**Wed 09/14/05**	**Tue 12/20/05**
10	Conduct WDL Sediment Phase 2 Stabilization Study Sampling	3 days	Wed 09/14/05	Fri 09/16/05
11	Conduct Phase 3 and 4 Stabilization Mix Ratio Optimization Study	28 days	Mon 09/19/05	Wed 10/26/05
12	Validate Laboratory Data	24 days	Thu 10/27/05	Tue 11/29/05
13	Input Analytical Data into Database	15 days	Wed 11/30/05	Tue 12/20/05
14	**Prepare WDL Treatability Study EE/CA Report (1)**	**31 days**	**Thu 09/15/05**	**Thu 10/27/05**
15	Prepare EE/CA Report	30 days	Thu 09/15/05	Wed 10/26/05
16	Submit EE/CA Report to DEQ	1 day	Thu 10/27/05	Thu 10/27/05



(1) Includes design criteria and Phase 2 Study results. IRAM Work Plan will be developed after Phase 3/4 results are received.

Project: WDL TS Proposed Schedule.mpp
Date: Fri 05/20/05

Task | Progress | Milestone | Summary

SCOEPA00003518

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FAX TRANSMITTAL

TO: Tom McCue

DATE: 6/2/05

FAX #:

RE: DEQ Memo

PAGES: 17 INCLUDING COVER SHEET

FROM: Peter

Maul Foster & Alongi, Inc.—Portland

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CO [redacted]

- James

cc Allan Gladstone
Chris Rave

Maul Foster & Alongi, Inc. provides private and public sector clients with high-quality, practical, solution-oriented environmental consulting and engineering services that are recognized by our clients for their quality, value, and merit.

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- Corrective Action Plans
- Cost Analyses
- Data Management
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- Geotechnical Engineering
- Groundwater Modeling and Monitoring
- Hydraulic, Geologic, and Hydrogeologic Assessments
- Permitting
- Prospective Purchaser Agreements
- Property Transaction Assessments
- Regulatory Agency Liaison
- Regulatory Support/Negotiation
- Regional Aquifer Protection and Planning
- Remedial Investigation
- Remediation System Design and Installation
- Remediation System Operation and Maintenance
- Risk Assessment
- Risk Communication
- Site Grading and Paving
- Stormwater Detention and Treatment System Design
- Water Quality Assessment

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_{10} 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 Siltronic 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:

<u>Columbia River Basalt:</u> 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

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

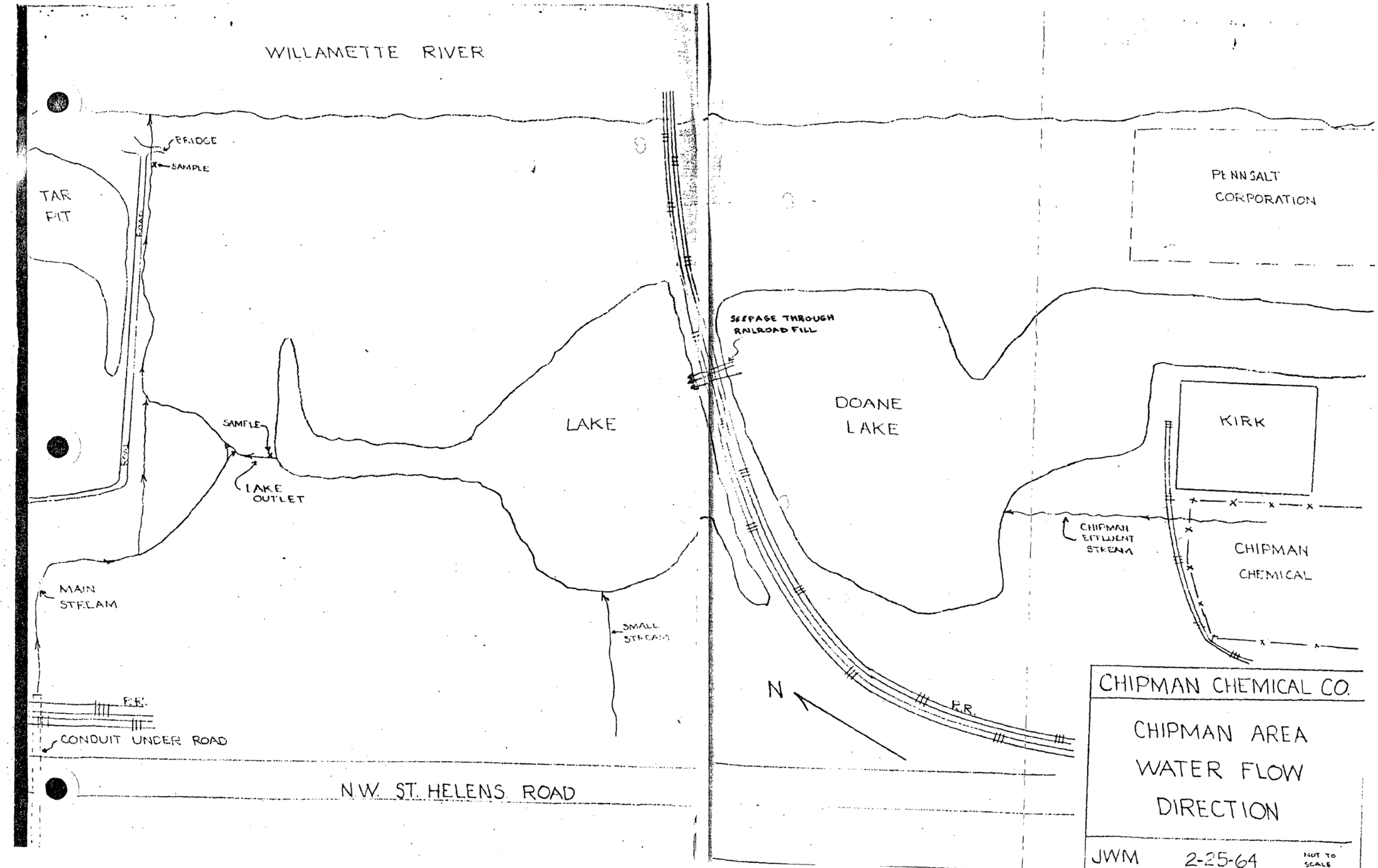
aromatic hydrocarbons, petroleum hydrocarbons and PAHs. In addition, due to the presence of lead in groundwater above the MCL and the potential for cyanide and hydrogen sulfide formation during sulfur removal, the investigation should also focus on inorganic contaminants such as metals, cyanide and hydrogen 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.



SCOEPA00003536

Tom McCue

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

April 15, 2002

Mr. Eric Blischke
Oregon Department of Environmental Quality
Voluntary Cleanup and Site Assessment Section
2020 SW Fourth Avenue, Suite 400
Portland OR 97201-4987

HAI Project No. 5237

SUBJECT: March 2002 Progress Report for Remedial Investigation (RI) Activities, Wacker Siltronic Corporation Property, 7200 NW Front Avenue, Portland, Oregon

Dear Mr. Blischke:

Hahn and Associates, Inc. (HAI) has prepared this Progress Report summarizing RI work activities that have occurred relating to the Wacker Siltronic Corporation (Wacker) property during the month of March 2002. RI field activities for the site are being conducted as per both the approved *Final Focused Remedial Investigation (RI) Work Plan*[1] (RI Work Plan), as well as the approved *Supplemental RI Work Plan* [2]. This Progress Report has been prepared as per an Order (DEQ No. ECVC-NWR-00-27) issued jointly to both NW Natural and Wacker by the Oregon Department of Environmental Quality (ODEQ), dated October 4, 2000. As per the referenced Order, monthly progress reports are to be prepared by the 15th day of each month, with the reporting to continue for the duration of the project.

Summary of Activities in March 2002

In correspondence dated January 7, 2002, the ODEQ provided comments resulting from review of HAI's November 20, 2001 *Data Package for Focused Remedial Investigation*. These comments identified a termination point for Phase I RI activities (completion of the off-site drainage ditch survey). The ODEQ also requested the submittal of a Work Plan addendum to address Phase II investigatory activities at the site, with a submittal date of March 8, 2002, as extended by the ODEQ in correspondence dated February 6, 2002 (Blischke to Wyatt).

Representatives of NW Natural, Wacker, and ODEQ met on March 1, 2002 to discuss the Phase II RI activities requested by the ODEQ. As agreed during the meeting, Wacker prepared a Work Plan to further investigate the migration of trichloroethene (TCE)-related impacts identified during the Phase I RI, while NW Natural prepared a Work Plan to further investigate the migration of impacts potentially attributable to former Pacific Gas & Coke operations (PG&C). Wacker's Work Plan, as well as responses to

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[1] Hahn and Associates, Inc. (2001). *Final Focused Remedial Investigation Work Plan, Wacker Siltronic Corporation Property, 7200 NW Front Avenue, Portland, Oregon.* June 1, 2001.

[2] Hahn and Associates, Inc. (2002). *Supplemental Remedial Investigation Work Plan, Wacker Siltronic Corporation,, 7200 NW Front Avenue, Portland, Oregon.* March 7, 2002.

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ODEQ's comment letter, were provided to the ODEQ in correspondence dated March 6, 2002 (Futornick to Blischke). NW Natural's Work Plan, as well as responses to ODEQ's January 7, 2002 comment letter, were provided to the ODEQ in correspondence dated March 7, 2002 (Ede to Blischke).

Both the NW Natural and the Wacker Work Plan Addendums were approved for implementation by the ODEQ in correspondence dated March 15, 2002 (Eric Blischke to Bob Wyatt and Cathryn Young). Field activities associated with the Work Plan Addendums were conducted by HAI (PG&C-related) on March 18, 2002 and by Limno-Tech, Inc. (TCE-related) on March 19 through March 22, 2002.

As included within the HAI-prepared March 7, 2002 Work Plan Addendum, field activities relating to investigation of potential PG&C impacts involved the installation of one push probe boring (P-1A) for the purpose of collecting groundwater samples adjacent to the location of the formerly installed P-1 boring (Figure 1). The ODEQ had requested the collection of groundwater samples at this location to more thoroughly evaluate potential groundwater discharges to the Willamette River since a thin layer of weathered tar and associated naphthalene were identified immediately above the historical ground surface (i.e., silt unit) at this location.

As described in NW Natural's responses to ODEQ's January 7, 2002 correspondence, the semi-solid tar identified at the P-1 boring location is likely the result of historical discharges associated with the former tar ponds, and therefore is not indicative of on-going product migration to the river, nor does it alter the conceptual contaminant migration model for the site. However, groundwater sampling at the P-1 location was proposed in the Work Plan Addendum to confirm that no localized contaminant transport is occurring.

Analytical results of the groundwater samples collected from temporary well points installed in boring P-1A during the supplemental investigation are summarized on Tables 1 through 4. As indicated on these tables, one groundwater sample was collected across a depth interval of 24 to 28 feet below ground surface (bgs) within the Surficial Fill water-bearing zone (immediately above the weathered tar zone), while two groundwater samples were collected across a depth interval of 54 to 58 feet bgs within the Alluvial Sand WBZ. A boring log that describes hydrogeological conditions encountered at the P-1A location, as well as results of contaminant field screening, is attached.

As summarized on Tables 1 and 2, and as depicted on the cross-section presented in Figure 2, analyses of groundwater samples from both the Surficial Fill and the Alluvial Sand water-bearing zones (WBZs) at the P-1A location did not identify the presence of benzene (or carcinogenic PAHs) at concentrations greater than analytical method detection limits. Further, with the exception of cyanide and zinc, all other analyzed constituents were either non-detect or were reported at concentrations below levels established for the protection of surface water-related aquatic life and human health through the Ambient Water Quality Criteria (AWQC). Cyanide and zinc detections at P-1A, although greater than the AWQC, were consistent with detections at other locations, and as such, the detection of cyanide in groundwater at P-1A is not indicative of a preferential zone of migration. Although not relevant to groundwater, we have used the AWQC as a very conservative screen with

regard to the potential for groundwater discharge to impact surface water, assuming zero dilution in the receiving surface water body.

Based on results of the P-1A investigatory activities described above, further supplemental investigation associated with potential PG&C-related impacts is not warranted at this time. A full reporting and evaluation of the results of NW Natural's investigatory activities will be included within the Phase I Site Characterization Summary Report and the Technical Memorandum on Source Control Measures, both of which are due to the ODEQ within 90 days after completion of the Phase I RI activities. NW Natural understands that results of Wacker's TCE-related investigation activities will be documented by Wacker to be submitted independently by them to the ODEQ.

Additional activities completed during March 2002 included submittal of NW Natural's responses (Ede to Blischke, 3/21/02) to ODEQ comments provided within their March 15, 2002 approval of the RI Work Plan Addendums. Finally, in correspondence dated March 28, 2002 (Blischke to Wyatt and Young), the ODEQ requested that water level monitoring activities be conducted by either NW Natural (assuming access is provided) or by Wacker at Wacker-owned monitoring wells WS-1 through WS-5, and WS-10 during the planned April 2, 2002 area-wide sampling event.

Anticipated / Completed Activities in April and May 2002

The third quarterly groundwater monitoring event associated with the three monitoring wells installed in September 2001 at the Wacker property (WS-8-33, WS-8-59, and WS-9-34) was initiated by HAI on April 2, 2002. These sampling activities were conducted synchronously with sampling activities conducted at the adjacent NW Natural property, and were coordinated with area-wide water level monitoring activities conducted by others at nearby Rhone-Poulenc / Aventis and Atofina wells and within Wacker wells that pre-date initiation of source control investigation activities (i.e., wells WS-1 through WS-5, and WS-10). Further, as requested by the ODEQ in correspondence dated March 28, 2002 (Blischke to Wyatt and Young), to assist Wacker in their TCE investigation, groundwater samples collected from select wells at the adjacent NW Natural – Gasco site during April 2002 will include analysis for TCE and it's primary degradation products.

Remaining Phase I RI data collection tasks to be completed at the site include: 1) completion of a continuous short-term (48 hours) groundwater elevation monitoring event; 2) an inspection and survey of the base of the drainage ditch located immediately west and south of the Wacker property; and 3) the final groundwater sampling event in late June 2002. Task 1, which still needs DEQ approval, will be scheduled for completion prior to the final (June 2002) groundwater sampling event, while Task 2 will require receipt of access approval from the Burlington Northern Santa Fe Railroad Company (BNSF), the owner of the right-of-way through which the ditch runs.

Access to the BNSF property was officially requested in correspondence dated November 16, 2001. In early April 2002, the request was modified to reduce the area requiring access (i.e., no access to Rhone-Poulenc / Aventis wells) in an effort to simplify BNSF's access approval process. At this time, no Access Agreement has yet been proposed by BNSF's

representatives (The Staubach Company, Inc.). Due to continued difficulties in gaining off-site access for completion of the remaining Phase I RI task (off-site ditch survey), a second 45-day extension to the February 22, 2002 field work completion deadline is requested, with a new completion date to be established as May 23, 2002. Task 2 will be scheduled for completion as soon as possible after receipt of approved access from BNSF.

Should you have any questions, please contact the undersigned.

Sincerely,

Robert Ede, R.G.
Associate

c: Mr. Bob Wyatt, NW Natural
Ms. Patty Dost, Schwabe, Williamson & Wyatt
Mr. Carl Stivers, Anchor Environmental, L.L.C.
Ms. Cathryn Young, Wacker Siltronic Corporation

LE 1
mary of Analytical Results for Groundwater Samples: Temporary Well Points
cted Volatile Organic Compounds by EPA Method 8260

d Remedial Investigation
r Siltronic Corporation
IW Front Avenue
d, Oregon

Project No. 5237

ell Point ocation	HAI Sample Number	Sample Date	Screen Interval (feet bgs)	Analytical Results – ug/l (ppb) VOCs by EPA Method 8260																	
				Aromatic VOCs (AVOCs)									Halogenated VOCs (HVOCs)								
				Benzene	Ethylbenzene	Toluene	Xylene	Naphthalene	Chlorobenzene	1,2-DCB	1,3-DCB	1,4-DCB	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	TCE	Vinyl Chloride	Other VOCs	Total AVOCs	Total HVOCs
P-1A	5237-020318-331	18-Mar-02	24-28	ND> 1.	ND> 1.	ND> 1.	ND> 2.	89.6	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	89.6	ND
	5237-020318-333	18-Mar-02	54-58	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	3.99	ND> 1.	ND> 1.	ND> 1.2	ND	ND	4.
uplicate)	5237-020318-334	18-Mar-02	54-58	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	4.19	ND> 1.	ND> 1.	ND> 1.2	ND	ND	4.2
P-2	5237-010816-316	16-Aug-01	28-32	61.2	ND> 1.	ND> 1.	2.3	2.6	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	66.1	ND
	5237-010816-317	16-Aug-01	54-58	2.1	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1	6.4	ND> 1.	ND> 1.	ND> 1.2	ND	2.1	6.4
	5237-010816-318	16-Aug-01	96-100	117.	41.	4.1	ND> 2.	3.8	ND> 1.	ND> 1.	ND> 1.	ND> 1.	12.6	6,780.	21.9	11,200.	720.	isopropylbenzene=1.2	165.9	18,721.9
P-3	5237-010821-321	21-Aug-01	28.5-32.5	104.	29.9	ND> 10.	22.3	933.	ND> 10.	ND> 10.	ND> 10.	ND> 10.	ND> 10.	ND> 10.	ND> 10.	ND> 10.	ND> 12.	1,2,4-TMB = 23.6	1,089.2	ND
	5237-010821-323	21-Aug-01	55-59	23.6	ND> 10.	ND> 10.	ND> 10.	53.7	ND> 10.	ND> 10.	ND> 10.	ND> 10.	ND> 10.	312.	ND> 10.	ND> 10.	712.	ND	77.3	524.
	5237-010821-325	21-Aug-01	96-100	21.5	ND> 1.	ND> 1.	ND> 1.	5.82	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	5.99	ND> 1.	ND> 1.	21.2	ND	27.3	27.2
P-4	5237-010815-309	15-Aug-01	28-32	12.	ND> 1.	ND> 1.	ND> 2.	2.99	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	15.	ND
	5237-010815-310	15-Aug-01	50-54	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	453.	4.32	33.3	29.6	ND	ND	520.2
P-5	5237-010815-311	15-Aug-01	29-33	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
uplicate)	5237-010815-312	15-Aug-01	29-33	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
	5237-010815-313	15-Aug-01	52-56	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	1.33	ND> 1.	ND> 1.	ND> 1.2	ND	ND	1.3
	5237-010815-314	15-Aug-01	96-100	ND> 1.	ND> 1.	ND> 1.	ND> 2.	16.6	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	16.6	ND
P-6	5237-010802-300	2-Aug-01	32-36	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
	5237-010802-301	2-Aug-01	46-50	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
P-7	5237-010809-307	9-Aug-01	56-62	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
P-8	5237-010809-304	9-Aug-01	28-32	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
	5237-010809-305	9-Aug-01	50-54	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
	5237-010809-306	9-Aug-01	80-84	11.1	ND> 10.	ND> 10.	ND> 20.	ND> 20.	199.	425.	15.1	155.	ND> 10.	ND> 10.	ND> 10.	ND> 10.	21.1	ND	805.2	21.1
P-9	5237-010816-320	16-Aug-01	31-35	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
vater Effluent Samples																				
Area Outfall	5237-010822-327	22-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	acetone=34.4 chloroform = 2.69	34.4	2.69
Area Outfall	5237-010822-328	22-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
Area	5237-010822-329	22-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
Control Samples																				
ank	5237-010802-302	2-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
ank	5237-010809-303	9-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
ank	5237-010815-308	15-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
ank	5237-010816-315	16-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
ank	5237-010821-322	21-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
ank	5237-010822-326	22-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
ank	5237-020318-330	18-Mar-02	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
EB	5237-010816-319	16-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
EB	5237-020318-332	18-Mar-02	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
	5237-010821-324	21-Aug-01	NA	ND> 1.	ND> 1.	ND> 1.	ND> 2.	ND> 2.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.	ND> 1.2	ND	ND	ND
t Water Quality Criteria (AWQC) for Surface Water [1]				71. [3]	29,000. [3]	200,000. [3]	#	620. [4]	21,000. [3]	17,000. [3]	2,600. [3]	2,600. [3]	#	11,600. [4]	140,000. [3]	81. [3]	525. [3]	#	#	#

Note:
# = not established
AVOCs = aromatic volatile organic compounds
bgs = below ground surface
DCB = dichlorobenzene
DCE = dichloroethene
EB = equipment blank
EPA = U.S. Environmental Protection Agency
HVOCs = halogenated volatile organic compounds
ND = not detected above detection limit indicated
ppb = parts per billion
TCE = trichloroethene
TMB = trimethylbenzene
ug/l = micrograms/liter
VOCs = volatile organic compounds

1 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA 822-Z-99-001) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
2 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
3 = Reference Level based on Human Fish Consumption Criteria of AWQC
4 = Reference Level based on Lowest Observable Health Effect Level for Freshwater, as provided within NOAA Screening Quick Reference Tables, updated September 1999
Bold = Detected above lowest identified AWQC

Updated:4/11/02 RBE
File:5237 GW Rslts_probes

SCOEPA00003541

TABLE 2
Summary of Analytical Results for Groundwater Samples: Temporary Well Points
Polynuclear Aromatic Hydrocarbons by EPA Method 8270 SIM or 8270C

Focused Remedial Investigation
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon

Project No. 5237

PAHs by EPA Method 8270 (SIM)				Analytical Results ug/l (ppb)																			
				Carcinogenic PAHs							Non-carcinogenic PAHs												
Well Point Location	TAI Sample Number	Sample Date	Screen Interval (feet bgs)	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Chrysene	Dibenzo (a,h) anthracene	Indeno (1,2,3-cd) pyrene	Acenaphthene	Acenaphthylene	Anthracene	Benzo (g,h,i) perylene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total PAHs
P-1A	5237-020318-331	18-Mar-02	24-28	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	4.05	ND> 0.1	0.51	ND> 0.1	0.53	1.21	17.5	2.21	0.76	26.8
	5237-020318-333	18-Mar-02	54-58	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	0.11	ND> 0.1	0.11	ND> 0.1	0.12	ND> 0.1	0.35	0.35	0.14	1.2
(duplicate)	5237-020318-334	18-Mar-02	54-58	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	0.3	0.26	ND> 0.1	0.6
P-2	5237-010816-316	16-Aug-01	28-32	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
	5237-010816-317	16-Aug-01	54-58	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	52.1	ND> 2.	2.9	ND> 2.	4.7	16.4	ND> 2.	12.	5.2	93.3
	5237-010816-318	16-Aug-01	96-100	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	8.1	ND> 2.	2.8	ND> 2.	5.7	3.6	5.8	20.	5.6	51.6
P-3	5237-010821-321	21-Aug-01	28.5-32.5	**4.2**	**2.12**	ND> 2.	**4.23**	**5.34**	ND> 2.	ND> 2.	62.	ND> 2.	19.1	2.51	26.8	43.	214.	88.3	28.	499.6
	5237-010821-323	21-Aug-01	55-59	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	3.41	ND> 2.	ND> 2.	ND> 2.	2.48	ND> 2.	4.72	8.69	2.45	21.8
	5237-010821-325	21-Aug-01	96-100	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	7.56	ND> 2.	2.94	ND> 2.	5.55	3.95	12.	22.8	5.41	60.2
P-4	5237-010815-309	15-Aug-01	28-32	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	40.4	ND> 2.	4.18	ND> 2.	8.16	11.9	2.96	24.6	9.61	101.8
	5237-010815-310	15-Aug-01	50-54	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
P-5	5237-010815-311	15-Aug-01	29-33	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	6.62	ND> 2.	ND> 2.	ND> 2.	3.32	3.55	ND> 2.	8.16	3.29	25.
(duplicate)	5237-010815-312	15-Aug-01	29-33	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	5.76	ND> 2.	ND> 2.	ND> 2.	3.63	2.99	ND> 2.	7.56	3.99	23.9
	5237-010815-313	15-Aug-01	52-56	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
	5237-010815-314	15-Aug-01	96-100	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	4.69	ND> 2.	2.14	ND> 2.	3.04	2.99	19.4	14.5	3.12	49.9
P-6	5237-010802-300	2-Aug-01	32-36	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	ND> 0.1	0.47	ND> 0.1	ND> 0.1	ND> 0.1	0.29	0.18	0.91	0.65	0.27	2.8
	5237-010802-301	2-Aug-01	46-50	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	0.15	0.16	ND> 0.1	0.3
P-7	5237-010809-307	9-Aug-01	56-62	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
P-8	5237-010809-304	9-Aug-01	28-32	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	9.4	ND> 2.	ND> 2.	ND> 2.	2.8	3.1	ND> 2.	8.5	3.3	27.1
	5237-010809-305	9-Aug-01	50-54	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
	5237-010809-306	9-Aug-01	80-84	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	2.1	ND> 2.	2.1
P-9	5237-010816-320	16-Aug-01	31-35	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Stormwater Effluent Samples																				
Fab 1 Area Outfall	5237-010822-327	22-Aug-01	NA	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Fab 2 Area Outfall	5237-010822-328	22-Aug-01	NA	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Admin Area Outfall	5237-010822-329	22-Aug-01	NA	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Quality Control Samples																				
Trip Blank	5237-010821-322	21-Aug-01	NA	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Water EB	5237-010816-319	16-Aug-01	NA	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Water EB	5237-020318-332	18-Mar-02	NA	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Soil EB	5237-010821-324	21-Aug-01	NA	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND> 2.	ND
Ambient Water Quality Criteria (AWQC) for Surface Water [1]				0.049 [2]	0.049 [2]	0.049 [2]	0.049 [2]	0.049 [2]	0.049 [2]	0.049 [2]	2,700. [2]	#	110,000. [3]	#	370. [3]	14,000. [3]	620. [4]	#	11,000. [3]	#

Note:
# = not established
bgs = below ground surface
EB = equipment blank
EPA = U.S. Environmental Protection Agency
ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
ug/l = micrograms per liter

1 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA 822-Z-99-001) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
2 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
3 = Reference Level based on Human Fish Consumption Criteria of AWQC
4 = Reference Level based on Lowest Observable Health Effect Level for Freshwater, as provided within NOAA Screening Quick Reference Tables, updated September 1999
Bold = Detected above lowest identified AWQC

Updated: 4/11/02 RBE

SCOEPA00003542

TABLE 3
Summary of Analytical Results for Groundwater Samples: Temporary Well Points
Detected Semi-Volatile Organic Compounds by EPA Method 8270C

Focused Remedial Investigation
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon

Project No. 5237

SVOCs by EPA Method 8270				Analytical Results ug/l (ppb)																			
Well Point Location	HAI Sample Number	Sample Date	Screen Interval (feet bgs)	Bis (2-ethyl hexyl) phthalate		Butyl benzyl phthalate		Carbazole		Dibenzofuran		1,2-Dichlorobenzene		1,4-dichlorobenzene		Diethyl phthalate		bis (2-chloroisopropyl)ether		2-Methylnaphthalene		PAHs
P-1A	5237-020318-331	18-Mar-02	24-28	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	3.5		See Table 2
	5237-020318-333	18-Mar-02	54-58	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
P-2	5237-010816-316	16-Aug-01	28-32	ND>	2.	2.		ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	8.4	B	ND>	2.	See Table 2
	5237-010816-317	16-Aug-01	54-58	ND>	2.	2.4		ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	10.	B	ND>	2.	See Table 2
	5237-010816-318	16-Aug-01	96-100	ND>	2.	3.4		ND>	4.			ND>	2.	ND>	2.	ND>	2.	11.1	B	5.8		See Table 2
P-3	5237-010821-321	21-Aug-01	28.5-32.5	ND>	2.	ND>	2.	56.5		6.29		ND>	2.	ND>	2.	ND>	2.	ND>	2.	82.8		See Table 2
	5237-010821-323	21-Aug-01	55-59	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
	5237-010821-325	21-Aug-01	96-100	5.57		3.64		ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	3.21		See Table 2
P-4	5237-010815-309	15-Aug-01	28-32	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	17.	B	ND>	2.	See Table 2
	5237-010815-310	15-Aug-01	50-54	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	15.9	B	ND>	2.	See Table 2
P-5	5237-010815-311	15-Aug-01	29-33	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	11.1	B	ND>	2.	See Table 2
(duplicate)	5237-010815-312	15-Aug-01	29-33	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	11.5	B	ND>	2.	See Table 2
	5237-010815-313	15-Aug-01	52-56	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	11.	B	ND>	2.	See Table 2
	5237-010815-314	15-Aug-01	96-100	ND>	2.	3.52		ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	12.1	B	4.55		See Table 2
P-7	5237-010809-307	9-Aug-01	56-62	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	3.9		ND>	2.	ND>		See Table 2
P-8	5237-010809-304	9-Aug-01	28-32	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
	5237-010809-305	9-Aug-01	50-54	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
	5237-010809-306	9-Aug-01	80-84	ND>	2.	ND>	2.	ND>	4.	ND>	2.	31.1		9.3		5.1		ND>	2.	ND>	2.	See Table 2
P-9	5237-010816-320	16-Aug-01	31-35	ND>	2.	22.2			4.	ND>	2.	ND>	2.	ND>	2.	7.1		10.8	B	ND>	2.	See Table 2
Stormwater Effluent Samples																						
Fab 1 Area Outfall	5237-010822-327	22-Aug-01	NA	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
Fab 2 Area Outfall	5237-010822-328	22-Aug-01	NA	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
Admin Area Outfall	5237-010822-329	22-Aug-01	NA	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
Quality Control Samples																						
Trip Blank	5237-010821-322	21-Aug-01	NA	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
Water EB	5237-010816-319	16-Aug-01	NA	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	8.1	B	ND>	2.	See Table 2
Water EB	5237-020318-332	18-Mar-02	NA	6.36		ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
Soil EB	5237-010821-324	21-Aug-01	NA	ND>	2.	ND>	2.	ND>	4.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	ND>	2.	See Table 2
Ambient Water Quality Criteria (AWQC) for Surface Water [1]				5.9	[3]	5,200.	[3]	#		#		17,000.	[3]	2,600.	[3]	120,000.	[3]	170,000.	[3]	#		#

Note:
bgs = below ground surface
EB = equipment blank
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

1 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA 822-Z-99-001) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
2 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
3 = Reference Level based on Human Fish Consumption Criteria of AWQC
B = Analyte detected in the associated Method Blank

Updated: 4/10/02 RBE
File Name: 5237 GW Rslts_probes

HAHN AND ASSOCIATES, INC.

TABLE 4
Summary of Analytical Results for Groundwater Samples: Temporary Well Points
Metals, Cyanide, and Chloride

Focused Remedial Investigation
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon

Well Point Location	HAI Sample Number	Sample Date	Screen Interval (feet bgs)	Analytical Results – mg/l (ppm) Dissolved Metals by EPA Methods 6010, 200.7 and/or 7000 Series								
				Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead
P-1A	5237-020318-331	18-Mar-02	24-28	ND> 0.005	ND> 0.005	0.050	ND> 0.002	ND> 0.005	0.012	ND> 0.005	6.96	ND> 0.005
	5237-020318-333	18-Mar-02	54-58	ND> 0.005	ND> 0.005	0.066	ND> 0.002	ND> 0.005	ND> 0.005	ND> 0.005	32.5	ND> 0.005
P-2	5237-010816-316	16-Aug-01	28-32	ND> 0.003	**0.024**	0.121	ND> 0.001	0.005	0.001	0.002	99.5	ND> 0.005
	5237-010816-317	16-Aug-01	54-58	ND> 0.003	ND> 0.005	0.050	ND> 0.001	ND> 0.002	0.003	ND> 0.005	26.5	ND> 0.005
	5237-010816-318	16-Aug-01	96-100	ND> 0.003	ND> 0.005	0.151	ND> 0.001	**0.022**	0.011	**0.013**	71.5	ND> 0.005
P-3	5237-010821-321	21-Aug-01	28.5-32.5	ND> 0.003	**0.016**	0.172	ND> 0.001	ND> 0.001	ND> 0.001	0.001	100.	ND> 0.005
	5237-010821-323	21-Aug-01	55-59	ND> 0.003	ND> 0.005	0.126	ND> 0.001	0.003	0.007	0.002	40.4	ND> 0.005
	5237-010821-325	21-Aug-01	96-100	ND> 0.003	ND> 0.005	0.101	ND> 0.001	0.002	0.005	0.002	46.5	ND> 0.005
P-4	5237-010815-309	15-Aug-01	28-32	ND> 0.003	**0.008**	0.149	ND> 0.001	ND> 0.002	0.002	ND> 0.005	87.5	ND> 0.005
	5237-010815-310	15-Aug-01	50-54	ND> 0.003	ND> 0.005	0.105	ND> 0.001	ND> 0.002	0.003	ND> 0.005	47.3	ND> 0.005
P-5	5237-010815-311	15-Aug-01	29-33	0.003	**0.008**	0.202	ND> 0.001	ND> 0.002	0.016	ND> 0.005	86.	ND> 0.005
(duplicate)	5237-010815-312	15-Aug-01	29-33	0.005	**0.009**	0.245	ND> 0.001	0.009	0.011	**0.01**	100.	**0.019**
	5237-010815-313	15-Aug-01	52-56	0.004	**0.011**	0.352	ND> 0.001	**0.129**	0.046	**0.089**	92.7	**0.008**
	5237-010815-314	15-Aug-01	96-100	0.022	**0.034**	1.080	ND> 0.001	**0.61**	0.134	**0.327**	457.	**0.036**
P-6	5237-010802-300	2-Aug-01	32-36	ND> 0.003	ND> 0.005	0.056	ND> 0.001	ND> 0.0015	0.012	0.002	3.29	ND> 0.005
	5237-010802-301	2-Aug-01	46-50	ND> 0.003	ND> 0.005	0.101	ND> 0.001	ND> 0.002	0.005	0.002	19.5	ND> 0.005
P-7	5237-010809-307	9-Aug-01	56-62	ND> 0.005	ND> 0.005	0.229	ND> 0.002	ND> 0.005	0.006	ND> 0.005	45.2	ND> 0.005
P-8	5237-010809-304	9-Aug-01	28-32	ND> 0.005	**0.019**	0.138	ND> 0.002	ND> 0.005	ND> 0.005	ND> 0.005	35.2	ND> 0.005
	5237-010809-305	9-Aug-01	50-54	ND> 0.005	ND> 0.005	0.108	ND> 0.002	ND> 0.005	ND> 0.005	ND> 0.005	6.17	ND> 0.005
	5237-010809-306	9-Aug-01	80-84	ND> 0.005	ND> 0.005	0.312	ND> 0.002	ND> 0.005	0.01	0.005	43.5	ND> 0.005
P-9	5237-010816-320	16-Aug-01	31-35	ND> 0.003	**0.03**	0.088	ND> 0.001	ND> 0.002	0.008	ND> 0.005	13.4	ND> 0.005
Stormwater Effluent Samples												
Fab 1 Area Outfall	5237-010822-327	22-Aug-01	NA	ND> 0.003	ND> 0.005	0.006	ND> 0.001	ND> 0.0015	ND> 0.001	**0.0134**	0.0735	ND> 0.005
Fab 2 Area Outfall	5237-010822-328	22-Aug-01	NA	ND> 0.003	ND> 0.005	0.009	ND> 0.001	ND> 0.0015	ND> 0.001	**0.0155**	0.458	ND> 0.005
Admin Area Outfall	5237-010822-329	22-Aug-01	NA	ND> 0.003	ND> 0.005	0.005	ND> 0.001	ND> 0.0015	ND> 0.001	**0.0098**	0.0098	**0.0292**
Quality Control Samples												
Trip Blank	5237-010821-322	21-Aug-01	NA	ND> 0.003	ND> 0.005	ND> 0.002	ND> 0.001	ND> 0.002	ND> 0.001	0.001	0.033	ND> 0.005
Water EB	5237-010816-319	16-Aug-01	NA	ND> 0.005	ND> 0.005	ND> 0.002	ND> 0.002	ND> 0.005	ND> 0.005	ND> 0.005	0.086	ND> 0.005
Soil EB	5237-010821-324	21-Aug-01	NA	ND> 0.003	ND> 0.005	ND> 0.002	ND> 0.002	ND> 0.002	ND> 0.001	ND> 0.001	0.02	ND> 0.005
Ambient Water Quality Criteria (AWQC) for Surface Water [1]				4.3 [3]	0.00014 [3]	#	0.002 [2]	0.011 [2]	#	0.009 [2]	#	0.003 [2]

Note:
# = not established
bgs = below ground surface
EB = equipment blank
EPA = U.S. Environmental Protection Agency
mg/l = milligrams/liter
ND = not detected above detection limit indicated
ppm = parts per million

1 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA 822-Z-99-001) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
2 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
3 = Reference Level based on Human Fish Consumption Criteria of AWQC

Bold = Detected above lowest identified AWQC

Updated: 4/10/02 RRF

SCOEPA00003544

TABLE 4
Summary of Preliminary Analytical Results for Groundwater Samples: Temporary Well Points
Metals, Cyanide, and Chloride

Source Control Evaluation
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon

Project No. 5237

Well Point Location	HAI Sample Number	Sample Date	Screen Interval (feet bgs)	Analytical Results – mg/l (ppm)										
				Dissolved Metals by EPA Methods 6010, 200.7 and/or 7000 Series								EPA Method 9010	EPA Method 9010	EPA Method 300
				Magnesium	Manganese	Nickel	Selenium	Silver	Titanium	Vanadium	Zinc	Amenable Cyanide	Cyanide	Chloride
P-1A	5237-020318-331	18-Mar-02	24-28	ND> 0.05	1.33	0.039	ND> 0.005	ND> 0.005	ND> 0.01	ND> 0.005	**0.151**	ND> 0.04	**0.059**	1.75
	5237-020318-333	18-Mar-02	54-58	43.	1.89	0.035	ND> 0.005	ND> 0.005	ND> 0.01	ND> 0.005	0.06	0.064	**0.642**	26.8
P-2	5237-010816-316	16-Aug-01	28-32	11.7	3.63	0.019	ND> 0.005	ND> 0.002	0.078	0.005	0.072	-	**0.723**	2.25
	5237-010816-317	16-Aug-01	54-58	32.1	0.331	0.011	ND> 0.005	ND> 0.002	0.004	0.001	0.02	-	**0.255**	26.
	5237-010816-318	16-Aug-01	96-100	37.7	4.47	0.039	ND> 0.005	ND> 0.002	0.797	0.037	**0.151**	-	**0.549**	24.
P-3	5237-010821-321	21-Aug-01	28.5-32.5	24.6	5.06	0.007	ND> 0.005	ND> 0.002	0.046	0.005	0.017	-	**0.65**	7.
	5237-010821-323	21-Aug-01	55-59	59.6	0.771	0.03	ND> 0.005	ND> 0.002	0.107	0.005	0.078	-	**0.45**	2.
	5237-010821-325	21-Aug-01	96-100	41.7	2.06	0.039	ND> 0.005	ND> 0.002	0.059	0.003	**0.173**	-	**0.498**	9.5
P-4	5237-010815-309	15-Aug-01	28-32	23.1	6.35	0.006	ND> 0.005	ND> 0.002	0.026	0.002	0.024	-	**0.056**	ND> 0.5
	5237-010815-310	15-Aug-01	50-54	55.5	1.28	0.037	ND> 0.005	ND> 0.002	0.01	0.001	0.09	-	**0.071**	ND> 0.5
P-5	5237-010815-311	15-Aug-01	29-33	74.9	6.11	0.047	ND> 0.005	ND> 0.002	0.012	0.002	0.008	-	**0.35**	1.
(duplicate)	5237-010815-312	15-Aug-01	29-33	76.8	5.52	0.019	ND> 0.005	ND> 0.002	0.158	0.009	0.083	-	**0.122**	1.75
	5237-010815-313	15-Aug-01	52-56	82.5	1.57	**0.102**	ND> 0.005	ND> 0.002	3.88	0.204	**0.333**	-	**0.139**	0.5
	5237-010815-314	15-Aug-01	96-100	132.	9.98	**0.351**	ND> 0.005	ND> 0.002	11.7	0.635	**1.69**	-	**0.66**	33.
P-6	5237-010802-300	2-Aug-01	32-36	65.4	1.92	0.012	ND> 0.005	ND> 0.002	0.01	0.003	0.025	-	ND> 0.02	0.75
	5237-010802-301	2-Aug-01	46-50	51.4	0.715	0.031	0.005	ND> 0.002	0.016	ND> 0.001	**0.23**	-	**0.037**	1.75
P-7	5237-010809-307	9-Aug-01	56-62	30.1	6.44	0.03	**0.006**	ND> 0.005	0.04	ND> 0.005	0.092	-	ND>0.02	40.8
P-8	5237-010809-304	9-Aug-01	28-32	39.4	6.54	0.006	**0.006**	ND> 0.005	0.026	ND> 0.005	0.016	-	**0.12**	0.75
	5237-010809-305	9-Aug-01	50-54	70.3	0.542	0.022	ND> 0.005	ND> 0.005	0.012	0.009	**0.136**	-	**0.18**	ND> 0.5
	5237-010809-306	9-Aug-01	80-84	152.	28.9	**0.061**	**0.016**	ND> 0.005	0.101	ND> 0.005	**0.307**	-	ND> 0.02	1,000.
P-9	5237-010816-320	16-Aug-01	31-35	18.9	14.5	0.005	**0.006**	ND> 0.002	0.012	0.001	0.014	-	**0.034**	1.
Stormwater Effluent Samples														
Fab 1 Area Outfall	5237-010822-327	22-Aug-01	NA	0.834	0.0273	ND> 0.003	ND> 0.005	ND> 0.0019	0.0027	0.002	**0.167**	-	ND> 0.02	-
Fab 2 Area Outfall	5237-010822-328	22-Aug-01	NA	0.29	0.0235	ND> 0.003	ND> 0.005	ND> 0.0019	0.0011	0.0033	**0.475**	-	ND> 0.02	-
Admin Area Outfall	5237-010822-329	22-Aug-01	NA	0.239	0.0124	ND> 0.003	ND> 0.005	ND> 0.0019	0.001	0.0015	**0.28**	-	ND> 0.02	-
Quality Control Samples														
Trip Blank	5237-010821-322	21-Aug-01	NA	ND> 0.025	ND> 0.025	ND> 0.003	ND> 0.005	ND> 0.002	ND> 0.001	ND> 0.001	0.009	-	**0.022**	-
Water EB	5237-010816-319	16-Aug-01	NA	ND> 0.05	ND> 0.005	ND> 0.003	ND> 0.005	ND> 0.005	0.002	ND> 0.001	0.003	-	ND> 0.02	23.8
Soil EB	5237-010821-324	21-Aug-01	NA	ND> 0.025	ND> 0.005	ND> 0.003	ND> 0.005	ND> 0.002	ND> 0.001	ND> 0.001	ND> 0.006	-	ND> 0.02	ND> 0.5
Ambient Water Quality Criteria (AWQC) for Surface Water [1]				#	#	0.052 [2]	0.005 [2]	0.003 [2]	#	#	0.12 [2]		0.005 [2]	#

Note:
# = not established
bgs = below ground surface
EB = equipment blank
EPA = U.S. Environmental Protection Agency
mg/l = milligrams/liter
ND = not detected above detection limit indicated
ppm = parts per million

1 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA 822-Z-99-001) based on Fresh Acute, Fresh Chronic (Aquatic Life Protection) and Fish Consumption Only (Human Health Protection)
2 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC
3 = Reference Level based on Human Fish Consumption Criteria of AWQC

Bold = Detected above lowest identified AWQC

Updated: 4/15/02 RBE
File Name: 5237 GW Rslts_probes

SCOEPA00003545

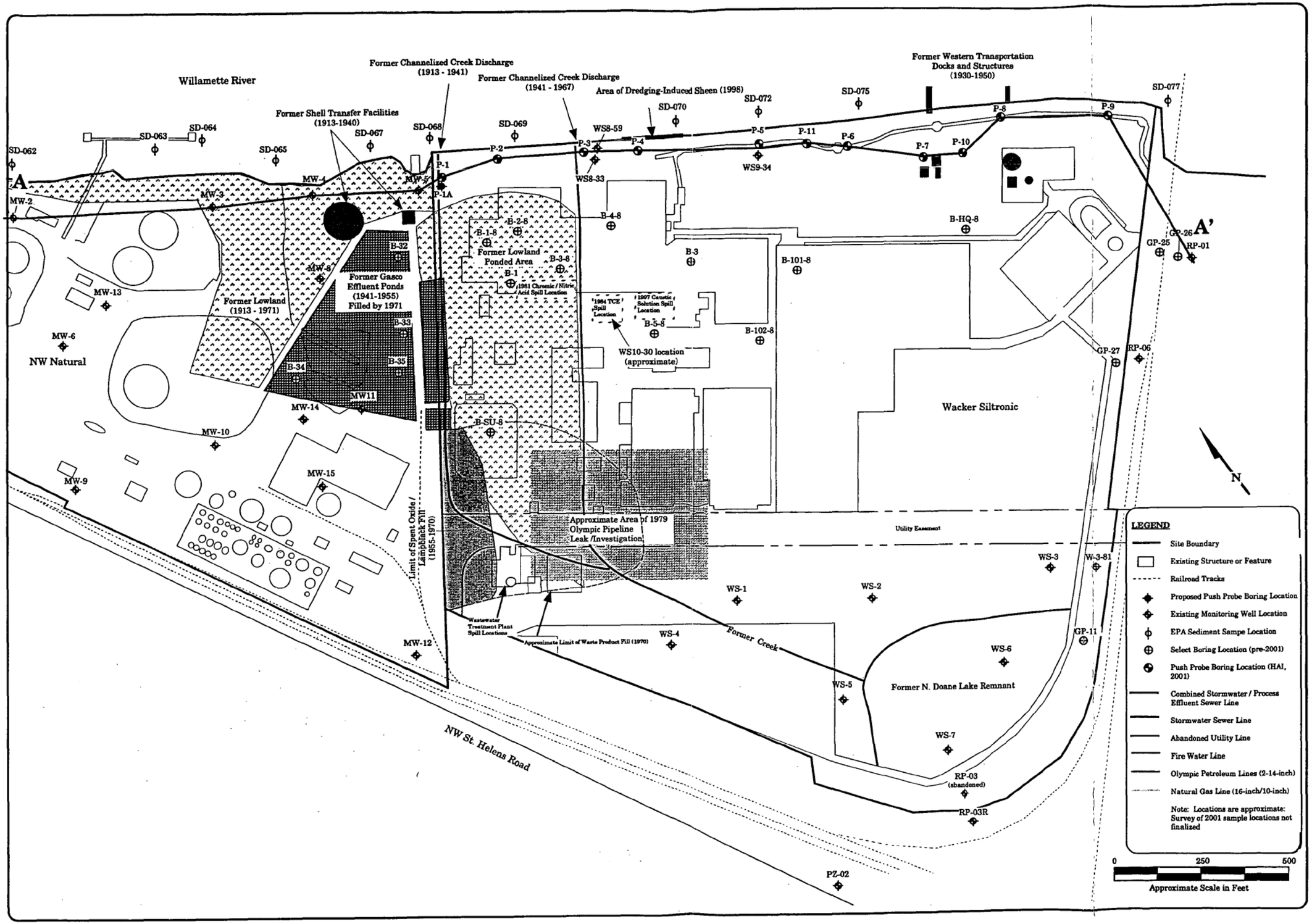


Figure 1

Boring Location and Cross-Section Location Map

Focused Remedial Investigation
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon

HAHN & ASSOCIATES, INC.

ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

March 2002

Project No. 5237

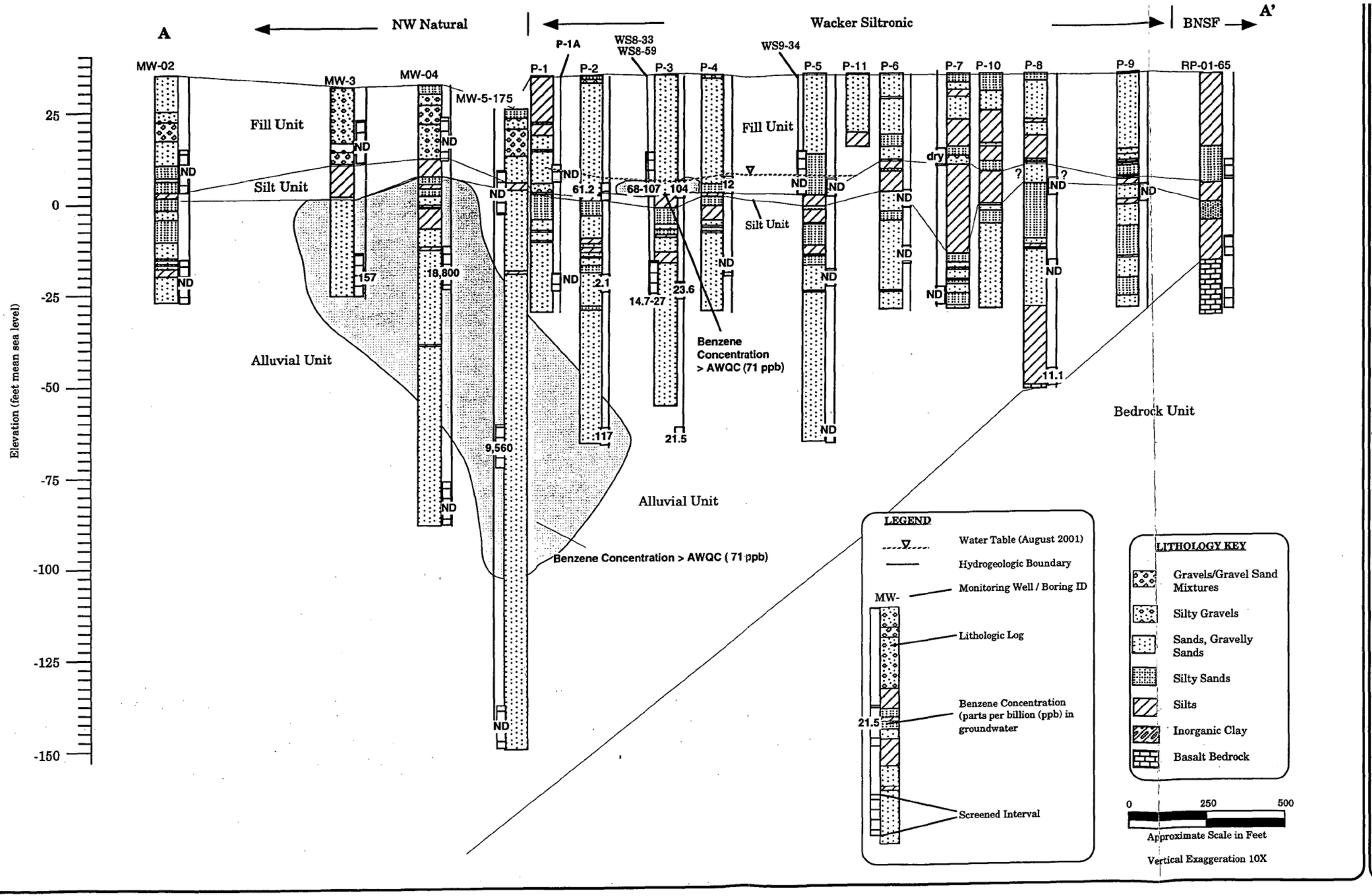


Figure 2

Hydrogeologic Cross Section A - A'

Remedial Investigation
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, Oregon

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
(503) 796-0717

February 2002

Project No. 5237

ATTACHMENT

Boring Log

P-1A

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**		**P-1A**	
PROJECT:	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
RI / Source Control Evaluation	SAMPLING METHOD:	Stainless Steel Soil Sampler with PVC Sleeve	Time:	Time:
Wacker Siltronic Corporation Property	DRILLING METHOD:	Hydraulic Push Probe	8:50	14:00
Portland, Oregon	EQUIPMENT TYPE	Geo-Probe	Date:	Date:
PROJECT #: 5237	DRILLER:	Neil Kranz	03/18/02	03/18/02
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	2.0-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	33.64 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS NW-TPH Dx (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Chips									GP	Surface: Gravel, grey, dry, no petroleum odor, no sheen (0 to 0.5 foot below ground surface (bgs)).
							1			
							2			
							3			Sandy SILT with Gravel - brown becoming orange mottled at 2.5 feet bgs, and grey below 3.0 feet bgs, moist, no petroleum odor, no sheen (0.5 to 5 feet bgs).
	001	8:55	-	-			4			
							5			
							6		ML	Sandy SILT with Gravel - gray, slightly moist, rootlets present, no petroleum odor, no sheen (5 to 12.5 feet bgs).
							7			
							8			
							9			
	002	8:55	-	-			10			
							11			
							12			
							13		SM	Silty SAND - gray, moist, fine grained, no petroleum odor, no sheen (12.5 to 13 feet bgs).
							14		ML	Sandy SILT with Gravel - grey, moist, non-plastic, woody zones, no petroleum odor, no sheen (13 to 15 feet bgs).
	003	9:00	-	-			15			
							16			Silty SAND with Gravel - light brown, increased moisture below 20 feet bgs, fine grained, woody material with large wood fragment at 18 feet bgs, no petroleum odor, no sheen (15 to 20 feet bgs).
							17			
							18		SM	
							19			
	004	9:05	-	-			20			

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**P-1A**		
PROJECT:	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
RI / Source Control Evaluation	SAMPLING METHOD:	Stainless Steel Soil Sampler with PVC Sleeve	Time:	Time:
Wacker Siltronic Corporation Property	DRILLING METHOD:	Hydraulic Push Probe	8:50	14:00
Portland, Oregon	EQUIPMENT TYPE	Geo-Probe	Date:	Date:
PROJECT #: 5237	DRILLER:	Neil Kranz	03/18/02	03/18/02
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

BORING DIAMETER:	2.0-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	33.64 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS NW-TPH Dx (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Chips							21		SP	SAND with Silt and Gravel - brown becoming rusty orange at depth, moist, well graded, loose, no petroleum odor, no sheen (20 to 25 feet bgs).
							22			
							23			
							24			
	005	9:15	-	-			25			SAND with Gravel - brown to gray, wet, no petroleum odor or sheen to 28 feet bgs. Tar with sheen identified at 28 feet bgs. Tar is stiff and plastic,with weathered, grainy texture in places, base of tar is at 30.5 feet bgs, (25 to 30.5 feet bgs).
							26			
							27			**GROUNDWATER SAMPLE** Installed a temporary 1-inch ID stainless steel well point with a 0.010-inch slotted screen at 24 to 28 feet bgs. Following the removal of approximately 1 liter of water, a groundwater sample (#5237-020318-331) was collected with disposable tubing/check valve at 10:20 hours, 3/18/02. Water level was measured at 25 feet bgs prior to sampling. After sampling, the well point was removed from the borehole and the borehole was advanced.
							28			
							29		tar	
	006	9:30	-	-			30			Base of Fill identified at 30.5 feet bgs
Bentonite Grout							31		ML	SILT - olive gray, moist, slightly plastic, several sandy layers, slight sheen, no petroleum odor (30.5 to 31.5 feet bgs).
							32			
							33			
							34			Note: No soil samples collected below 31.5 feet bgs. See boring log for probe P-1 for soil description.
							35			Note: Installed a 3.75-inch OD steel casing to 31.5 feet bgs, sealed base of casing with 3 feet of bentonite chips, then pushed well point directly to target groundwater sample depth of 54 to 58 feet bgs.
							36		SM	
							37			
							38			
							39			
							40		SP	

HAHN & ASSOCIATES, INC. 434 NW Sixth Avenue Portland, Oregon (503) 796-0717	**SOIL BORING NUMBER**	**P-1A**		
PROJECT:	HAI LOGGER:	Rob Ede	DRILL START	DRILL FINISH
RI / Source Control Evaluation	SAMPLING METHOD:	Stainless Steel Soil Sampler with PVC Sleeve	Time:	Time:
Wacker Siltronic Corporation Property	DRILLING METHOD:	Hydraulic Push Probe	8:50	14:00
Portland, Oregon	EQUIPMENT TYPE	Geo-Probe	Date:	Date:
PROJECT #: 5237	DRILLER:	Neil Kranz	03/18/02	03/18/02
	DRILLING CONTRACTOR:	Geo-Tech Explorations, Inc.		

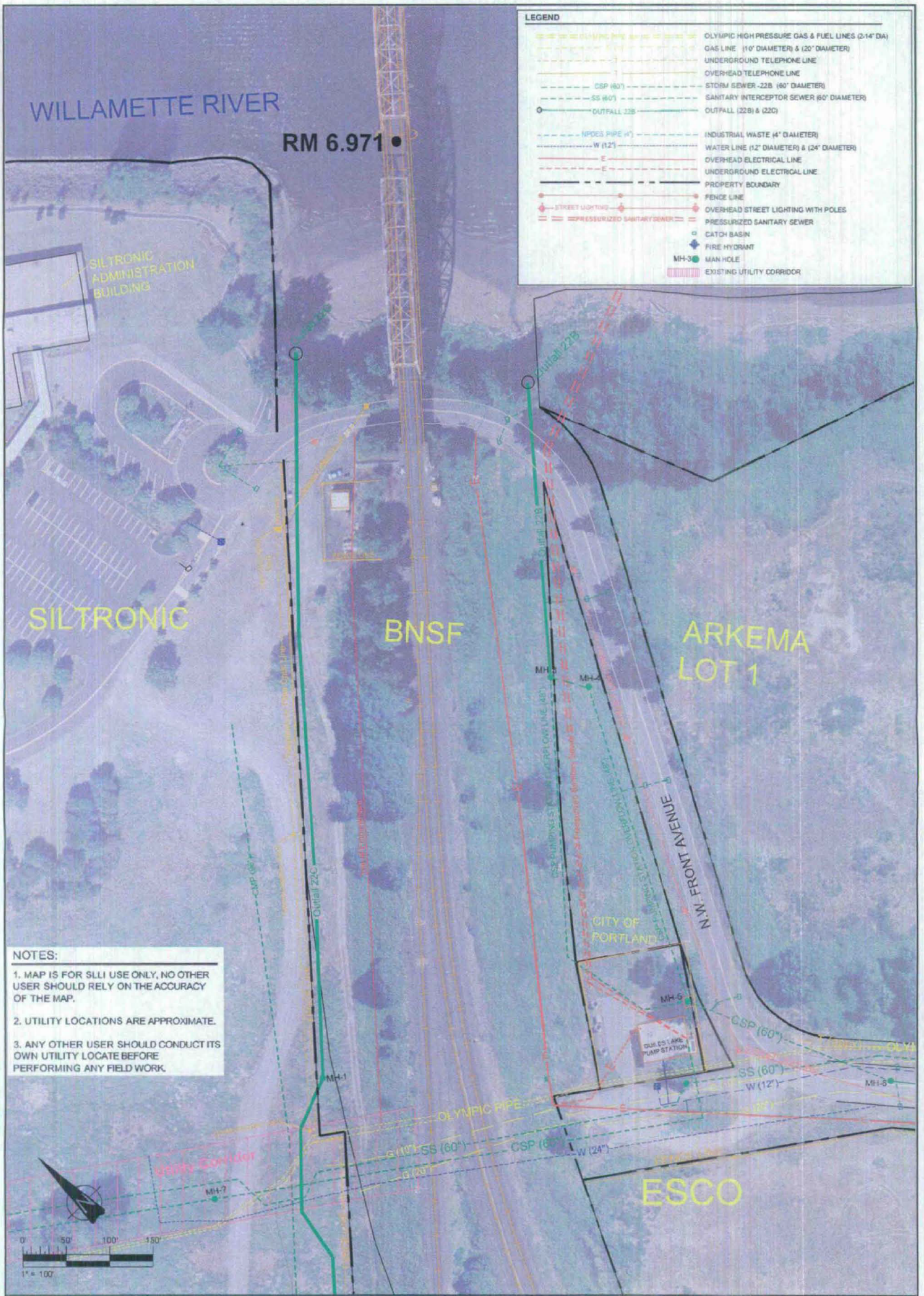
BORING DIAMETER:	2.0-inch
CASING DIAMETER:	Not Applicable
SURFACE ELEVATION:	33.64 feet msl
TOP OF CASING ELEVATION:	Not Applicable

ABANDONMENT DETAILS	SAMPLE NUMBER*	TIME	HEADSPACE (ppm)	LAB RESULTS NW-TPH Dx (ppm)	CORE INTERVAL	RECOVERY INTERVAL	DEPTH (feet)	GROUNDWATER	STRATA (USCS)	SOIL DESCRIPTION
Bentonite Grout							41		SP	
							42			
									ML	
							43		SP	
							44			
							45		ML	
							46			
							47			
							48		SP	
							49			
							50			
							51			
							52			
							53			
							54			
							55			
							56		SP	
							57			
							58			
							59			
							60			

GROUNDWATER SAMPLE
Installed a temporary 1-inch ID stainless steel well point with a 0.010-inch slotted screen at 54 to 58 feet bgs. Following the removal of approximately 1 liter of water, groundwater samples (#5237-020318-333 and duplicate #5237-020318-334) were collected with disposable tubing/check valve at 10:20 hours, 3/18/02. Water level was measured at 50.95 feet bgs prior to sampling. After sampling, the well point was removed from the borehole and the borehole was terminated.

Boring terminated at 58 feet bgs and sealed from base to 30 feet bgs with bentonite grout, and from 30 feet bgs to ground surface with bentonite chips.

* Sample prefix is 5237-020318-



CLIENT: SLLI	DWN BY: BRJ/LM	PROJECT: RP - PORTLAND SITE	DATE: DECEMBER 2006
	CHK'D BY: TJ/JF		PROJECT NO: 061M-107030-P80
AMEC Earth & Environmental, 7376 S.W. Durham Road, Portland, OR, U.S.A. 97224	DATUM: NAD83	TITLE: UTILITY LOCATE MAP	REV. NO.: 1
amec	PROJECTION: OR SP N. Int Ft.		FIGURE No. 1
	SCALE: 1" = 100'		

K:\10000\10700\10703\Phase 80 North Front Ave ISCM\DWG\NFA 30%\FIGURE 1 UTILITY LOCATE MAP.dwg – NFA ISCM – Dec. 07, 2006 1:00pm – doug.davis

CH2M HILL

MEMORANDUM

TO: Wayne, Please review with your records and return by 4/27 am, if possible I will be out of town next week.

FROM: Nick Garcia-Bengochea, (PDX)

DATE: 23 April 1979

RE: Wacker - Oil Spill

PROJECT: P11756.C0

The following is a chronology of the events which have transpired in connection with the oil spill at the Wacker Siltronics Plant, Portland, Oregon. The events and correspondence summarized below are based on recorded field notes, memoranda, and letters compiled by CH2M HILL from January 1979 to April 17, 1979.

Chronology

Jan. 15-16, 1979	Large quantity of oil found in clarifier excavation.
Feb. 5-9, 1979	Olympic Pipeline Company notified of a possible leak in their line crossing the Wacker site. Joe Sharp, Chief Operator for Olympic, believed that oil was not from Olympic lines. Koppers notified that oil on Wacker site may be from an old dump operated by Koppers. Koppers said oil is not from their facilities. Harvey Barragar, Wacker attorney, was notified of problem and that CH2M HILL was going to notify DEQ. DEQ notified of oil on site.
Feb. 12, 1979	Steve Carter, DEQ, visited plant site with Ed Sloan, CH2M HILL. Mr. Carter advised that property owner would be responsible for any problems which arise as a result of the oil. Coast Guard may fine owner if oil finds its way to the river. Mr. Carter suggested that oil be analyzed to determine its source.
Feb. 26, 1979	Telex from Dr. Hermann requesting that DEQ and CH2M HILL hold a formal conference to discuss the present oil situation, preventative measures, and suggested procedures for remedying the situation.
Mar. 1, 1979	Oil samples taken from clarifier excavation and Olympic Pipeline Company diesel oil are submitted to DEQ-PSU lab for testing.
Mar. 2, 1979	Wacker, DEQ, and CH2M HILL meet to review oil problem. Source of oil has not been determined. Possible sources include leakage from pipeline, materials previously disposed of on site, or leakage from neighbors. Oil has remained on site and has not imposed any danger to the Willamette River. Wacker is responsible for preventing the oil from reaching public water systems.

Mar. 6, 1979	DEQ completes analysis of oil samples from clarifier excavation and Olympic diesel oil.
Mar. 7, 1979	Ed Rowan, N.W. Natural Gas Co., informed Mike DiLembo, CH2M HILL, that portions of the Wacker property were used for tar disposal. During the dredge filling of the site, the tar and sand were mixed with a dozer. Mr. Rowan said no other petroleum products were wasted on site. Mr. Rowan also doubted that Koppers was responsible for the leak because they primarily handle heavy oils (creosote).
Mar. 8, 1979	Steve Carter, DEQ, notifies Ed Sloan, CH2M HILL, that based on oil analysis, he believes oil on site is from Olympic Pipeline. DEQ may have the legal right to require that Olympic test its oil line. Steve Carter calls Olympic to inform them of DEQ bit test results.
Mar. 8, 1979	Memorandum from Stu Williams, CH2M HILL, showing suggested design of soil-cement cutoffs. Cutoffs would be installed to prevent oil from migrating along porous storm sewer bedding material leading to the Willamette River. Mr. Williams also noted that bitumen material was encountered throughout the Wacker site during the 1977 soil investigation performed for Wacker by CH2M HILL.
Mar. 8, 1979	Memo from Wayne Hanson, CH2M HILL, to Dr. Hermann, Wacker, reviewing status of oil problem and recommending that Wacker, through its attorney, approach Olympic to get rapid response to clean up spill.
Mar. 9, 1979	Letter from Dr. Hermann, Wacker, to Olympic notifiying that oil on site is from Olympic pipeline leakage. Findings are based on tests performed by DEQ. The condition is interfering with construction progress of the waste treatment facilities, and if not corrected immediately, will cause delays. Olympic is requested to take immediate action to locate and stop the leakage and clean up the spill.

Mar. 10, 1979	Five test holes dug in waste treatment plant area as requested by Wacker. Clean, light oil in large quantities found in all holes. Olympic called out to site. Wayne Rushing, Olympic, viewed oil in test pits and said that oil had been there for years.
Mar. 12, 1979	Two additional test pits dug within easement near pipeline. Steve Carter, DEQ, was at the site observing the excavation. Oil rushed into test holes at about the 7-foot depth. Steve Carter, DEQ, calls Olympic Pipeline. At 4:30 p.m., George Williams, Olympic President, and Wayne Rushing, Olympic, meet Steve Carter at the site. Olympic begins pressure testing their pipeline late that afternoon.
Mar. 13, 1979	Olympic begins digging test pits to determine extent of oil spill and mobilizes vacuum pump trucks to remove oil from site.
Mar. 14, 1979	Olympic pressure test complete, indicating a possible leak. Olympic begins excavating to the pipeline to locate the leak.
Mar. 15, 1979	Olympic finds a leak in its light oil pipeline. According to Olympic sources, corrosion may be reponsible for leak. CH2M HILL staff noted pipe bedding included deposits of sawdust and blocks of concrete with rebar exposed. No sand pipe bedding was evident.
Mar. 15, 1979	Memo from Rick Reid, CH2M HILL, to John Ramage, CH2M HILL, requesting a course of action. Dr. Hermann, Wacker, requests a meeting 19 March 1979 to discuss: 1) How large an area has been affected? 2) Should a subsurface investigation be requested? 3) What should Olympic do to clean up?

Mar. 19, 1979	Letter from Harvey Barragar, Wacker attorney, to George Williams, Olympic President. Olympic Pipeline is requested to contact John Ramage, CH2M HILL, when pumping of oil from site is complete. At that time, a determination of the contaminated area and the quantity of oil remaining in ground would be made. Wacker will advise Olympic Pipeline as soon as the direct costs incurred as a result of the oil spill are determined. From March 15 to April 10, 1979, Olympic replaced approximately 215 feet of 14-inch diameter pipe of their light oil line. From March 13 to April 10, 1979, an oil and water mix was pumped from the ground into a separation tank. Pumping took place on a 24-hour a day basis. The separated oil was pumped into trucks by Crosby and Overton, subcontractors for Olympic, and hauled off the site. The separated water was returned to the ground surface.
Apr. 9, 1979	Meeting with Wacker, Olympic, Hoffman, and CH2M HILL. Items resolved included: 1) Olympic will backfill test pits and trench areas extending under plant facilities to CH2M HILL's satisfaction. 2) Olympic will install 5 well points, 20 feet deep, along the easement to collect additional oil. Other items discussed included: 1) A meeting will be held with Olympic when all direct costs resulting from the oil spill are known. 2) Olympic has removed approximately 1700 barrels (71,400 gallons) of oil from the site.
Apr. 10-13, 1979	Backfilling the pipeline excavation and test pits is underway. Three well points have been installed by Olympic along sections of replaced pipe to continue to remove oil. Test pits and pipeline trench excavations which extend under future plant facilites are backfilled to CH2M HILL's satisfaction.
Apr. 17, 1979	Olympic begins hauling oil-contaminated soil from site.

CH2M HILL

MEMORANDUM:

TO: Dr. Hans Herrmann
Herbert Schmid
Reiner Koschorreck
Dr. Kutzer

Harvey Barragar
G. W. Williams

Ken Durant
Don Daly
Rick Reid
Wayne Hanson
Greg Young

Jerry Olden
Keith Boersma

FROM: I. (Nick) Garcia-Bengochea, (PDX)

DATE: 30 April 1979

RE: Wacker - Oil Spill

PROJECT: P11756.C0

The following is a chronology of the events which have transpired in connection with the oil spill at the Wacker Siltronics Plant, Portland, Oregon. The events and correspondence summarized below are based on recorded field notes, memoranda, and letters compiled by CH2M HILL from January 1979 to April 27, 1979.

Chronology

Jan. 15-16, 1979	Large quantity of oil found in clarifier excavation.
Feb. 5-9, 1979	Olympic Pipeline Company notified of a possible leak in their line crossing the Wacker site. Joe Sharp, Chief Operator for Olympic, believed that oil was not from Olympic lines. Koppers notified that oil on Wacker site may be from an old dump operated by Koppers. Koppers said oil is not from their facilities. Harvey Barragar, Wacker attorney, was notified of problem and that CH2M HILL was going to notify DEQ. DEQ notified of oil on site.
Feb. 12, 1979	Steve Carter, DEQ, visited plant site with Ed Sloan, CH2M HILL. Mr. Carter advised that property owner would be responsible for any problems which arise as a result of the oil. Coast Guard may fine owner if oil finds its way to the river. Mr. Carter suggested that oil be analyzed to determine its source.
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Mar. 12, 1979	Two additional test pits dug within easement near pipeline. Steve Carter, DEQ, was at the site observing the excavation. Oil rushed into test holes at about the 7-foot depth. Steve Carter, DEQ, calls Olympic Pipeline. At 4:30 p.m., George Williams, ~~Manager,~~ and Wayne Rushing, Olympic, meet Steve Carter at the site. Olympic begins pressure testing their pipeline late that afternoon.
Mar. 13, 1979	Olympic begins digging test pits to determine extent of oil spill and mobilizes vacuum pump trucks to remove oil from site. Olympic begins excavating ~~to~~ the pipeline to locate the leak.
Mar. 14, 1979	Letter from Harvey Barragar, Wacker attorney, to Olympic Pipeline. Olympic notified that DEQ tests indicate that oil on Wacker property has probably leaked from Olympic lines. Wacker requests that Olympic locate the leak and pump the oil from the property. Wacker interprets Olympic's action as an indication that Olympic recognizes their responsibility for any damage suffered by Wacker as a result of the oil leaking from Olympic's pipeline. Olympic pressure test complete, indicating a possible leak. Olympic finds a leak in its light oil pipeline. According to Olympic sources, corrosion may be reponsible for leak. CH2M HILL staff noted pipe bedding included deposits of sawdust and blocks of concrete with rebar exposed. No sand pipe bedding was evident.
Mar. 15, 1979	Memo from Rick Reid, CH2M HILL, to John Ramage, CH2M HILL, requesting a course of action. Dr. Hermann, Wacker, requests a meeting 19 March 1979 to discuss: 1) How large an area has been affected? 2) Should a subsurface investigation be requested? 3) What should Olympic do to clean up?

Mar. 19, 1979	Letter from Harvey Barragar, Wacker attorney, to George Williams, Olympic. Olympic Pipeline is requested to contact John Ramage, CH2M HILL, when pumping of oil from site is complete. At that time, a determination of the contaminated area and the quantity of oil remaining in ground would be made. Wacker will advise Olympic Pipeline as soon as the direct costs incurred as a result of the oil spill are determined.
	March 13, 1979, Olympic begins pumping oil and water from the site on a 24-hour a day basis. From March 13 to 28, Olympic uses the clarifier excavation for returning separated water to the ground from oil tank trucks. March 16, Olympic mobilizes a separation tank to site. The oil and water mix is pumped from the ground into the tank. The separated oil is hauled off site by Crosby and Overton, subcontractors for Olympic, in tank trucks. The separated water is returned to the ground.
	CH2M HILL requests that Olympic cease to use the clarifier excavation by March 28, 1979, so Hoffman can continue with the clarifier construction. Olympic complies with request on schedule.
	April 4, 1979, a field order is issued to Hoffman to re-excavate the clarifier excavation because of ground disturbance and sloughing of slopes during oil removal. Work by Hoffman is to be done on a time and materials basis. Hoffman performs clarifier re-excavation between April 4 and 11, 1979.
	From April 4 to April 10, 1979, Olympic replaces 430 feet of pipe in its two 14-inch diameter pipelines.
Apr. 9, 1979	Meeting with Wacker, Olympic, Hoffman, and CH2M HILL. Items resolved included:
	1) Olympic will backfill test pits and trench areas extending under plant facilities to CH2M HILL's satisfaction.

2) Olympic will install 5 well points, 20 feet deep, along the easement to collect additional oil.

Other items discussed included:

1) A meeting will be held with Olympic when all direct costs resulting from the oil spill are known.

2) Olympic has removed approximately 1700 barrels (71,400 gallons) of oil from the site.

Apr. 10-13, 1979	Backfilling the pipeline excavation and test pits is underway. Three well points have been installed by Olympic along sections of replaced pipe to continue to remove oil. Test pits and pipeline trench excavations which extend under future plant facilites are backfilled to CH2M HILL's satisfaction.
Apr. 17, 1979	Olympic begins hauling off contaminated soil from site. Hauling is done by Jim Reed Trucking. Contaminated soil not hauled off is being used to backfill the pits dug by Olympic on site. Hauling continues through April 20.
Apr. 24, 1979	Olympic begins excavating for seepage cutoff dams along the storm sewer line. Hoffman welds 4 inch seep rings around pipe at the dam sites. Olympic will backfill dams with a soil cement mix under CH2M HILL's supervision.

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

MEMORANDUM

DATE: August 27, 2004

TO: Bob Wyatt, R.G.
NW Natural

FROM: Rob Ede, R.G.
Hahn and Associates, Inc.

SUBJECT: Comments Generated from Review of CSM Site Summary, Siltronic Corporation Site, 7200 NW Front Avenue, Portland, Oregon

Section 1: Summary of Potential Contaminant Transport Pathways to the River

1. Although data do suggest some of the identified petroleum-related impacts at the site are related to MGP-related waste placement, there are multiple other potential sources of petroleum at the site, including a known release from the Olympic Pipeline, former tugboat re-fueling operations and fuel storage by Western Transportation, and the placement of significant volumes of fill on the site. These additional sources/potential sources are described within *the Phase I Site Characterization Summary Report, Wacker Siltronic Corporation Property*, dated November 7, 2003 (HAI, 2003). It would be beneficial for this section to be updated such that all known potential sources of impact are fully described.

2. The summary states that chlorinated volatile organic compounds (VOCs) are constituents within MGP-related wastes. This statement is incorrect and should be removed. Chlorinated VOCs are not contaminants of interest (COIs) with regard to RI activities associated with historical MGP operations at the Gasco site. As described within the *Final Focused Remedial Investigation Work Plan, Wacker Siltronic Corporation Property,* dated June 1, 2001 (HAI, 2001), TCE was identified as a COI at the Siltronic property as a function of the two TCE spills that occurred in the Fab 1 Building area at the site in 1984.

3. The summary indicates MGP wastes may be transported to the Willamette River sediments by groundwater discharge; direct discharge via seeps; and direct discharge via City of Portland Outfall 22C, while TCE and its degradation products may not discharge to the Willamette River or sediments. Available data indicate primary petroleum-related impacts (e.g., benzene and naphthalene) have been delineated vertically and laterally along the riverfront, with the greatest impacts identified below a depth of 100 feet bgs (similar to the chlorinated solvent plume) and restricted to the northern corner of the property. To date, conclusions have not been finalized with regard to the potential discharge of either petroleum/MGP-related impacts or chlorinated solvent impacts to the Willamette River or sediments.

434 NW 6th AVENUE, SUITE 203 • PORTLAND, OREGON 97209-3651
503-796-0717 Telephone • 503-227-2209 Facsimile

To this end, additional evaluation concerning the transport of petroleum/potential MGP-related impacts to the river have been proposed to work toward resolution of this issue, as provided within the *Preliminary Source Control Evaluation Report, Wacker Siltronic Corporation Property*, dated November 2003 (Anchor, 2003). Similarly, additional evaluation concerning transport of chlorinated solvent-related impacts to the river have been proposed to resolve the same issue as it relates to the chlorinated solvent plume, as provided within the *Remedial Investigation Proposal, Siltronic Corporation Site,* dated April 2004 (Maul Foster & Alongi, Inc., 2004).

Based on the preceding, statements within the CSM that suggest either the discharge of contaminants, or the lack of such discharge, to the Willamette River or its sediments, are premature and should be removed.

4. The summary indicates MGP wastes are being transported to the river via seeps. Section 9.1 indicates that no groundwater seeps above the waterline have been identified at the site. The referenced sheen to the river caused by disturbing bank soils during Siltronic's 1996 bank repair activities is not conclusive of an on-going direct discharge of petroleum. It is, however, evidence of impacted bank soils, all of which are composed of fill.

5. The CSM identifies TCE and "its degradation products" as site-related impacts. It would be beneficial to identify the other chlorinated compounds present at the site as a function of the degradation of TCE.

6. The CSM states that the former Western Transportation refueling operation was supplied or otherwise connected by a buried pipeline from the PG&C/Gasco facility. Section 5 of the CSM indicates that this pipeline likely conveyed petroleum products. As further described in comment 12, the indicated utility line appears to have been a 16-inch diameter natural gas line that was abandoned in 1979. The CSM should be revised accordingly.

Section 1.2 Groundwater

7. This section indicates "shallower MGP-related impacts likely discharge to the river and sediments, while the fate and transport of TCE-related impacts remains unknown....but preliminary evaluation....suggests the TCE plume may not discharge to the river or sediments." Investigations to date do not indicate the presence of concentrations of petroleum in groundwater at shallow depths adjacent to the river that would likely be of concern (Anchor, 2003). However, additional evaluation is necessary with regard to this contaminant pathway, and has been proposed for both chlorinated solvent and inorganic (metals and cyanide) constituents. Until these additional evaluations are complete, there is no basis for concluding that potential MGP or chlorinated solvent wastes or waste-related constituents are discharging to the Willamette River through groundwater.

8. The buried drainage channels and utility lines identified as potential preferential pathways could act as preferential pathways for all contaminants, not merely MGP-related constituents. The CSM incorrectly implies that these zones have not been evaluated and may act as ongoing preferential pathways for MGP-related contaminant migration. NW Natural evaluated these zones of potential preferential pathways to the river for petroleum and chlorinated VOC-related impacts as part of the Phase I Site Characterization (HAI, 2003). Investigatory activities did not identify evidence of preferential contaminant transport (for either contaminant type) to the river along these utility lines. However, one such feature (City of Portland Outfall 22C), located off-site and to the south does remain to be characterized, and with that regard, characterization of all possible zones of preferential contaminant transport to the river, remains incomplete.

Section 1.3 Direct Discharge

9. Discussion is provided indicating City of Portland Outfall 22C may be a direct discharge pathway for MGP-related impacts. This Outfall is to be evaluated with regard to its potential to act as a direct discharge pathway for all contaminants of interest at the Siltronic site, not just potentially MGP-related impacts. As characterization of the City of Portland Outfall 22C is not complete, it is not accurate to infer it only to be of relevance to one particular source of potential impact.

Section 1.4 River Bank Erosion

10. This section indicates the bank to be armored with rip-rap and geo-textile fabric, with erosion expected to be minimal. This section further indicates that MGP wastes may be discharging through the geotextile fabric and rip-rap, as evidenced by the generation of a sheen when silts adjacent to the bank were disturbed during repair of the bank in 1996. Although certain embankment soils beneath the rip-rap are known to be impacted by petroleum-related constituents, the generation of a sheen upon disturbing these soils is not conclusive of an ongoing discharge to the river through the emplaced erosion controls. As such, reference to an ongoing discharge of MGP wastes along the embankment does not appear adequately supported and should be removed.

Section 1.5 Relationship of Upland Sources to River Sediments

11. As stated in comment 3, additional evaluation with regard to potential impacts to the river from petroleum/potential MGP-related impacts, as well as chlorinated solvent impacts, have been proposed, and will be completed to resolve this issue. At this time insufficient evidence exists to support the CSM conclusion that oil or tar in the river "implies a direct connection between upland sources and river sediments". Such conclusions are not supported by the results of the site investigatory activities (HAI, 2003), preliminary source control evaluation activities (Anchor, 2003), or available preliminary results of recent investigation activities conducted by Maul Foster & Alongi, Inc. As such, conclusions regarding the discharge of contaminants to the Willamette River are premature and should not be included in the CSM at this time.

Section 5 Property Description

12. The fourth paragraph of this Section describes utility corridors that cross the property. This paragraph includes discussion regarding a pipeline that was operated by Western Transportation that was connected to PG&C that likely contained petroleum products, and that this alignment has not been characterized. The basis for these conclusions were not provided. Siltronic plans (Drawing P11054.A1, December 1978) depict a 16-inch diameter abandoned line labeled "G" that runs from the NW Natural property, across the Siltronic site, and to the embankment in the vicinity of the former Western Transportation facility. One other utility labeled as "G" on the Siltronic plan references an existing 10-inch diameter natural gas line. NW Natural maps, although they do not show the location of the 16-inch line on the Siltronic property, do indicate the installation of a 10 ¾-inch diameter natural gas line on the property in 1978, and the abandonment of a 16-inch natural gas line at the property in 1979. Based on the preceding, it appears reasonably likely that the utility line in question carried natural gas.

    With regard to characterizing this line with regard to the potential to act as a preferential source of contamination, boring P-8 was installed in the inferred location of the abandoned line. There was no evidence of preferential contaminant transport in this area (HAI, 2003). Again, if additional information is available to support the presence of a fuel line to this area of the site from the PG&C site, it should be specifically referenced. Otherwise, it appears this line, as with other utility lines that extend towards the river, has been evaluated with respect to potential impacts to the river, and the CSM should be revised to indicate as such.

Section 7 Site Use History

13. This Section should be revised to more accurately describe various site historical uses. As written, it implies the entire Siltronic property was used as a treatment, storage, and disposal facility for the MGP operations between 1941 and 1967 – which is not substantiated by aerial photograph review. A distinction should be made between areas that likely received wastes from MGP operations either as direct placement (effluent pond), or as overflow from the pond (adjacent low areas), as well as a description of petroleum-related impacts likely present as a function of fill placement. As stated previously, there are numerous potential sources of petroleum / uses of the property other than the adjacent former MGP plant – none of which are identified within this Section of the CSM.

14. This Section indicates that TCE is the only chemical historically used by Siltronic that could potentially impact Willamette River sediments. The basis for this statement should be provided. Further, this section should discuss the degradation products of TCE that have also been identified at the site and the ongoing evaluation of the potential for these constituents to impact the Willamette River and its sediments.

Section 8 Current and Historic Sources and COPCs

15. Reference to chlorinated VOCs should be removed as COPCs with regard to MGP-related wastes. Chlorinated VOCs have been identified as COPCs at the Siltronic site as a result of Siltronic's use of TCE, and not as a function of MGP-related wastes (HAI, 2001).

Section 8.1 Uplands

16. First bullet: It is unclear what specifically is meant by the degradation products PAHs. It is suggested that reference to PAH and SVOC degradation products be eliminated. Further, a distinction between disposal ponds and low areas adjacent to disposal ponds that potentially received overflow or periodic discharge from these ponds, should be made. Again, reference to chlorinated VOCs should be removed from descriptions of MGP-related waste products.

17. The basis for PG&C Solid Waste Product Fill (Map Location D) should be provided. If petroleum impacts were identified visually during Fab 1, Fab 2, and parking lot construction, then this should be indicated. As drawn, the boundary extends beyond the limits of these former construction areas. If based on aerial photographs, then the year of the photo and a description of the rationale for identifying the material as being MGP-related, should be provided. Due to the heterogeneities in fill, and the multiple possible sources of petroleum impact in fill imported to the site, areas should be identified as "potential", to avoid the suggestion that definitive evidence exists to support the boundaries.

18. Unless Siltronic has documentation to definitively support the presence of MGP disposal areas on the property, it is requested that the word "potentially" or other caveat should be inserted with regard to inferred uses of the various areas identified.

19. Documentation or the basis for concluding that an apparent low area identified in aerial photographs was used as a PG&C waste disposal pond (Map Location E) should be provided. The CSM indicates the disposal pond was used by PG&C from 1955 to 1964. Since the last full year of MGP operations occurred in 1955, and the location of the low area is not proximate to MGP operations or to MGP-related effluent ponds or adjacent low areas, it is not clear why such a use has been implied. Either additional support should be provided to support the conclusion, or it is recommended that Map Location E be revised such that it is instead referred to as a "low area of interest".

20. In the discussion regarding the Koppers Company (Bullet 6), the CSM refers to the placement of waste products in an on-site disposal pit. This Section is confusing and misleading with regard to what operations and disposal practices actually occurred on the Siltronic property. For instance, there is no record that Koppers Company had a disposal pit on the Siltronic property. The bullet does correctly indicate that the drainage ditch located west of Siltronic (Map Location F) receives stormwater runoff from the Koppers Company lease area.

21. Discussion in Bullet 7 regarding the "Former Western Transportation Pipeline" (Map Location G) should be revised as previously commented upon in comment 12.

Section 9.1 Geology/Hydrology

22. The last paragraph of this Section preceding the description of Hydrogeologic parameters for the site should be revised as follows: "the sheens may provide evidence of historic direct discharge of MGP waste to the Willamette River and sediments".

Section 10.1 Soil

23. This Section provides an inaccurate summary of the site with regard to soil impacts, basically indicating that all impacts at the site are from one of two sources – either MGP waste disposal or fill incorporation, or from the former TCE USTs. This section should be consistent with Section 8.1 which describes the known potential sources of impact to the site.

24. With regard to the river bank sample referenced in Section 10.1.2, the CSM should be revised to indicate analysis of the sample indicated the presence of oil-range total petroleum hydrocarbons, PAHs, cyanide, and elevated concentrations (related to background) of copper, lead, and zinc. Further evaluation regarding the riverbank in this area was previously recommended (Anchor, 2003). The statement indicating that the impacted embankment sample indicates a complete pathway from "upland MGP sources to Willamette River sediments" is not substantiated and should be removed.

25. The Summary described in Section 10.1.3 is overly simplistic in the same manner as described above in comment 23. Further, the Summary references Table 3 as evidence that soil throughout the site is substantially impacted by MGP wastes. Table 3 (Maximum Concentrations of Organic Compounds in Soil) does not support this statement. Also, as stated in previous comments, it would be appropriate to reference petroleum impacts as opposed to MGP impacts, since as described in Section 8.1 of the CSM, there are multiple potential sources of petroleum impact to the site, not just MGP wastes.

Section 10.2.1 Groundwater Investigations

26. A more comprehensive description of petroleum-related impacts to groundwater at the site as it relates to potential migration to the river is warranted. Results and conclusions as provided within the *Phase I Site Characterization Report* (HAI, 2003), as supplemented by subsequent data obtained as part of the chlorinated solvent investigation, provide a thorough description and lateral/vertical extent of contaminant conditions in the vicinity of the shoreline. Data indicate the petroleum-related plume to be limited to the northwestern (downstream) portion of the riverfront, with the greatest concentrations limited to between 80 feet and 150 feet bgs. Groundwater data show concentrations attenuate significantly to the east (upriver) of the property line.

27. References to MGP-impacted groundwater should be deleted (see Section 8.1 of the CSM which identifies the multiple potential contaminant sources at the site), and should be replaced by "petroleum-impacted groundwater".

Section 10.2.2 NAPL

28. It may be beneficial to the CSM to discuss evidence for or against the presence of chlorinated solvent DNAPL at the site, based on type of release and the concentrations of chlorinated solvents identified in groundwater [i.e., TCE was identified at concentration of 575 ppm (approximately 58% of it's solubility level of 1,000 ppm) at a depth of 98 feet bgs at boring GP-2-02].

Section 10.2.3 Dissolved Contaminant Plumes

29. Please refer to Comments 26 and 27 with regard to plume characterization and extent. Please refer to Comments 8 and 12 regarding preferential pathways to the river.

30. Regarding groundwater plume temporal trends, *the Phase I Site Characterization Report* (HAI, 2003) provides the results of four quarters of data for riverfront monitoring wells. No temporal trends were observed.

Section 10.2.4 Summary

31. The summary section should be revised in accordance with suggested revisions as identified for all other subsections within Section 10.2.

Section 11.4 Potential for Recontamination from Upland Sources

32. This Section provides a conclusion indicating that substantial potential exists for recontamination of Willamette River Sediments from upland MGP impacts. Although follow-up source control evaluation activities have been recommended, as provided within the *Preliminary Source Control Evaluation Report* (Anchor, 2003), this conclusion is not substantiated. It would be correct to indicate within this Section that final conclusions regarding the potential for the recontamination of sediments or transition zone water resulting from chlorinated solvent and petroleum-related contamination have not yet been developed.

Table 1. Potential Sources and Transport Pathways Assessment

33. Former disposal ponds or adjacent low areas have been buried under 20 to 30 feet of fill, and as such would not be expected to be an impact to surface soil. Table 1 should be revised accordingly.

34. The former Western Transportation Pipeline was likely a natural gas line (see comment 12). This does not appear to be a source of contamination. Table 1 should be revised accordingly.

35. Identification of chlorinated VOCs as COIs related to MGP-related sources should be removed. Chlorinated VOCs were not identified as COIs for MGP wastes within the Phase I Site Characterization Report, and no new information has been generated to indicate that they are. Table 1 should be revised accordingly.

36. The Table omits the potential source referred to as "imported contaminated fill". This potential source should be added to Table 1.

37. Since the CSM indicates the presence of erosion protection along the embankment and that the potential for erosion is minimal, it would not appear that "river bank erosion" is a potentially complete pathway. This pathway is presently indicated as potentially complete for a wide variety of sources. The only source that is located near the embankment would be "imported contaminated fill". The Phase 1 Site Characterization Report and Source Control Evaluation Report identified one location along the embankment not protected by rip rap that could act as a potentially complete pathway for impacted fill to erode into the river. Table 1 should be revised accordingly.

38. Cyanide is a COI with regard to MGP wastes, as well as contaminated fill. Table 1 should be revised accordingly.

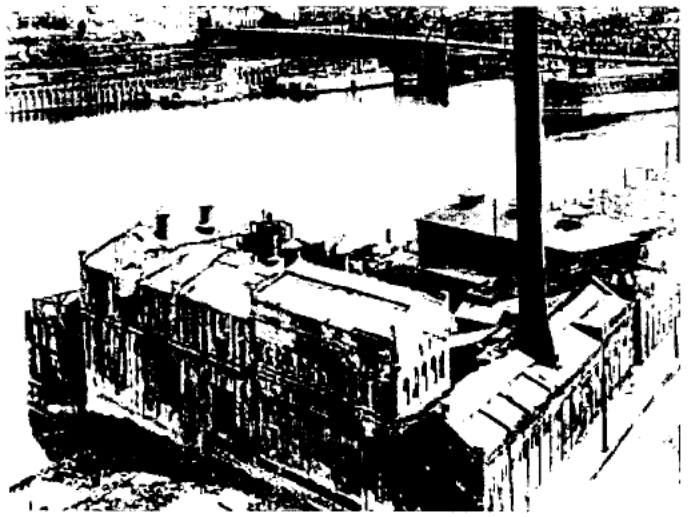
References

Anchor (Anchor Environmental LLC), 2003, *Preliminary Source Control Evaluation Report, Wacker Siltronic Corporation Property*, November 2003.

HAI (Hahn and Associates, Inc.), 2001, *Final Focused Remedial Investigation Work Plan, Wacker Siltronic Corporation Property, 7200 NW Front Avenue, Portland, Oregon*, June 1, 2001.

HAI (Hahn and Associates, Inc.), 2003, *Phase I Site Characterization Summary Report, Wacker Siltronic Corporation Property, 7200 NW Front Avenue, Portland, Oregon*, November 7, 2003.

MFA (Maul Foster & Alongi), 2004, *Remedial Investigation Proposal, Siltronic Corporation Site, 7200 NW Front Avenue, Portland, Oregon*, April 2, 2004.



Portland Gas Light Company - 1910

Circa 1892 coal gas plant of the Portland Gas Light Company, Portland, Oregon, shown here about 1910 at the end of its life, now shown as an abandoned oil-gas plant lying just north of downtown, on the west bank of the Willamette River. The plant received the first-known (to the author) Federal environmental citation under the Refuse Act clause of the Rivers & Harbors Act of 1899, as issued by the Portland District Engineer, U.S. Army Corps of Engineers. The charge: Pollution of the Willamette River by discharge of waste lampblack.(Photograph courtesy of Oregon Historical Society, Portland)

SCOEPA00003572

Gasco Facility ECSI 0084

OVERVIEW

The *former* GASCO facility occupies approximately 35 acres along the west bank of the Willamette River. The site is owned by Northwest Natural Gas Company, now known as Northwest Natural, who operates a liquefied natural gas storage facility on the property. From 1913 until 1956, Northwest Natural, *then* known as the Portland Gas and Coke Company (GASCO), operated an oil gasification plant on the property. By-products from the oil gasification process were often disposed of on-site or, in the early years of operation, discharged directly to the Willamette River. Contaminants of concern at the site include polycyclic aromatic hydrocarbons, benzene, and cyanide.

STATUS

In December 1993, Northwest Natural entered the Voluntary Cleanup Program. In August 1994, Northwest Natural entered into an agreement with DEQ to conduct a remedial investigation and feasibility study at the site. Phase I of the remedial investigation and feasibility study was completed in March 1996. A summary of the data collected to date was submitted to DEQ in July 1996.

Conceptual site models for the human health and ecological risk assessments were submitted in Fall 1996. A Land and Water Use report and a series of technical memorandums were submitted during the Summer of 1997. A Data Analysis report was submitted in October 1998.

Phase II of the remedial investigation and feasibility study began with a series of deep monitoring wells installed along the Willamette River. Other work completed at the site includes the collection of soil samples to support the risk assessment, a Phase II Ecological Risk Assessment and an assessment of contaminant migration to the Willamette River. Interim actions conducted to date include regular riverbank inspections, the posting of signs along the river, the abandonment of two cathodic protection wells to eliminate a potential contaminant migration pathway and installation of a product recovery system. Next steps include the performance of the human health and ecological risk assessments and the evaluation of cleanup alternatives.

ENVIRONMENTAL CONCERNS

Investigative activities completed to-date have detected elevated levels of petroleum-related compounds in soil, groundwater and Willamette River sediments. Tars have been detected across a large portion of the site to a maximum depth of 67 feet. Free-phase product has been observed in 3 monitoring wells. High concentrations of dissolved contaminants have been detected in groundwater adjacent to the Willamette River. Sediment samples collected from the Willamette River adjacent to the site have been found to contain tars and petroleum-related compounds. Riverbank inspections have observed a large zone of tar within the Willamette River, and tar balls are frequently observed along the riverbank.

State of Oregon
Department of Environmental Quality

Northwest Region Voluntary Cleanup Program
Multnomah County
DEQ Project Manager:
Eric Blischke
Ph: (503) 229-5648
www.deq.state.or.us

Updated: 12/2002

Oregon DEQ Facility Profiler 2.0

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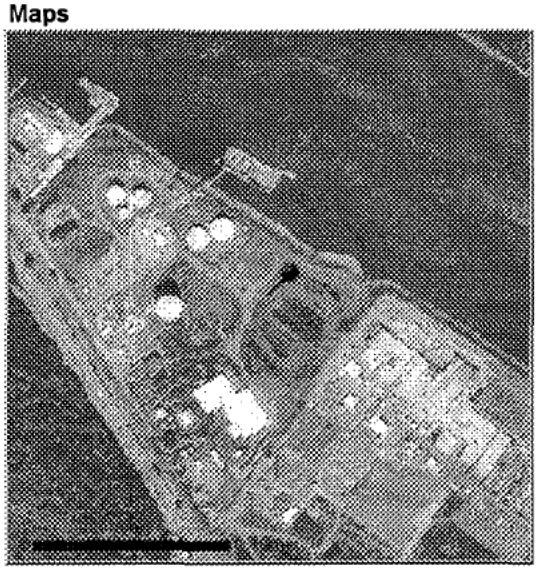
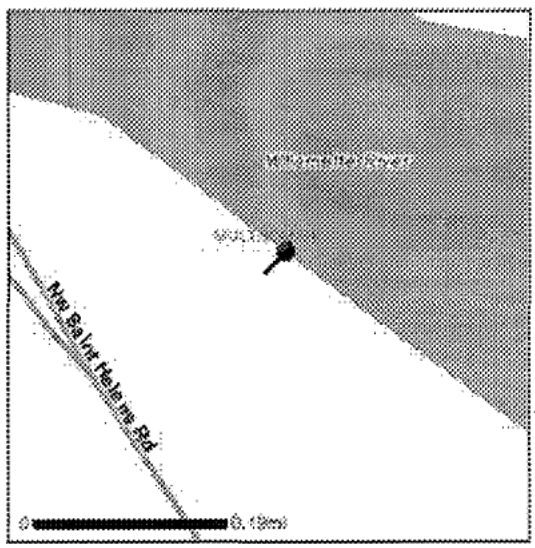
Facility Summary Report

Facility Profiler Print Report

Maps





Facility / Site Information

Location ID:	3989	**Latitude:**	45° 34' 43.68"
Facility/Site Name:	NORTHWEST NATURAL GAS COMPANY	**Longitude:**	-122° 45' 29.88"
		Location Accuracy:	LOW
Address:	7900 NW ST HELENS RD CTR SEC	**Last Updated:**	1/23/2004
City State Zip:	PORTLAND OR 97210-3671		

Aliases

GASCO	ECSI	Koppers Co. - Portland	ECSI
Koppers Industries Inc	HWMS	Koppers Industries Inc.	ECSI
Northwest Natural Gas Co Portland Lng Pl	HWMS	NW Natural Gas Co.	ECSI
Pacific Northern Oil Co.	ECSI	Pittsburgh Acquisition Corporation, Inc.	ECSI

Geographic Features

Township:	T1N-R1W-S12	**Congress Dist:**	3	**Forest Type:**	N/A
County:	MULTNOMAH	**OR Senate Dist:**	17	**Vegetation:**	Urban and industrial
Watershed:	LOWER WILLAMETTE	**OR House Dist:**	33	**Agricultural Land:**	N/A

Oregon DEQ Program Information

Environmental Cleanup (ECSI)

Operation ID	Start Date	Issue Date	Expiration Date	Permit Type	Permit SubType	Status	Detail Information[1]	EPA Number
2348	07/01/1979			Contaminated Site		Suspect site requiring further investigation	ECSI Site Report	027734359
84	07/01/1979			Contaminated Site		Listed on CRL or Inventory	ECSI Site Report	027734359

SIC CODE	SIC Description	PRIMARY
2819	INDUSTRIAL INORGANIC CHEMICALS	Y
2865	CYCLIC CRUDES & INTERMEDIATES	Y
4923	GAS TRANSMISSION/DISTRIBUTION	Y
4925	GAS PRODUCTION/DISTRIBUTION	Y

Hazardous Waste (HWMS)

Identifier	Start Date	Effective Date	Review Date	NFA Date	Type	Sub Type	Detail Information[1]	EPA Number
3609	04/08/1994	02/26/2003			Generator	CEG	HW Site Report	OR0000204701
4790	04/01/1992	02/12/2003			Generator	LQG	HW Site Report	ORD027734359

SIC CODE	SIC Description	PRIMARY
2865	CYCLIC CRUDES & INTERMEDIATES	N
4924	NATURAL GAS DISTRIBUTION	N

[1] Linked reports may be unavailable from 9:00pm to 7:00am PST due to system maintenance.
[2] DEQ does not maintain air discharge permit information for Lane County.

More Information on this location

Oregon DEQ Neighborhood Info (by region/county)
See wells in the same Township Range Section from the Oregon Water Resources Department Well logs Application
See county's scanned assessor maps through ORMAP

[DEQ's Privacy Notice] [Contact DEQ] [Application Feedback]

Disclaimer: *This product is for informational purposes, and may not be suitable for legal, engineering or surveying purposes. This information or data is provided with the understanding that conclusions drawn from such information are the responsibility of the user.*

Oregon DEQ

Home > Programs> Cleanup & Spills > ECSI Query > ECSI Site Details

Environmental Cleanup Site Information (ECSI) Database Site Summary Report - Details for Site ID 84

This report shows data entered as of March 10, 2004 at 10:13:28 AM

See the bottom of this page for a key to certain acronyms and terms used in the report below

Note that other DEQ programs may be active at this site; to check, see DEQ's Facility Profiler.

General Site Information

Site ID: 84	Site Name: GASCO	CERCLIS No: 027734359	
Address:	7900 NW St. Helens RD Portland 97210		
	County: Multnomah	Region: Northwest	
Other location information:	Koppers is located at 7540 NW St. Helens RD		
	Investigation Status: Listed on CRL or Inventory	NPL Site: No	Orphan Site: No Study Area: No
Property:	Twnshp/Range/Sect: 1N , 1W , 12	Tax Lots: 42,111,123,113,129,131,112,130	
	Latitude: 45.5788 deg. Longitude: -122.7583 deg.	Site Size: 35 acres	
Other Site Names:	Koppers Co. - Portland NW Natural Gas Co. Pacific Northern Oil Co.		

Site Characteristics

General Site Description:

Site History:

Contamination Information:

(10/15/1999 ELB/VCP) Portland Gas and Coke Company (GASCO) apparently purchased the site in the 1880s, and built a gasification plant by 1913. All waste products from the gasification operations were discharged directly to the Willamette River until 1925. After 1925, tars were separated from the wastewater in settling ponds. When the plant was shut down in 1956 by GASCO's successor company, Northwest Natural Gas (NWNG), an estimated 30,000 cubic yards of coal tar had accumulated in the ponds. The ponds were buried under 10 feet of fill in 1973. Part of the site was then sold to Wacker Siltronic Corporation (see ECSI #183). Koppers Company leased an 8-acre portion of the site from NWNG in 1965 and built a coal-tar distillation plant. Waste streams of creosote and pitch were cooled and solidified in storage tanks, and apparently dumped into an on-site disposal pit. (The plant shut down in 1973 and has only been used for the bulk transfer of creosote oil and coal tar pitch since 1977).

SCOEPA00003576

	In December 1993, NWNG signed up for DEQ's Voluntary Cleanup Program. In August 1994, NWNG signed an agreement with DEQ to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the site. An RI/FS workplan was submitted to DEQ in January 1995 and approved in August 1995.
Manner and Time of Release:	Wastewater from tar stills and unusable petroleum by-products were discharged to the Willamette River, farmed on portion of site, or disposed of in settling ponds on-site. Lampblack and spent iron oxide waste stored in large on-site waste piles. Time of release: 1913 to 1977.
Hazardous Substances/Waste Types:	Oil gasification wastes including: tars, oil, creosote, phenols, polynuclear aromatic hydrocarbons, BTEX and lead.
Pathways:	
Environmental/Health Threats:	Contamination at the site may represent a threat to human health and the environment by migrating to the Willamette River. Evidence suggests near-shore Willamette River sediments may be contaminated due to past operating practices.
Status of Investigative or Remedial Action:	(10/15/1999 ELB/VCP) During the first phase of the Remedial Investigation, widespread petroleum contamination was identified in site soils, groundwater, and Willamette River sediments. Tars were identified to depths of 70 feet in the vicinity of the former tar disposal area. In the former plant site area, dense non-aqueous-phase liquids (DNAPLs) were identified at three distinct locations. Monitoring wells installed adjacent to the Willamette River detected elevated levels of benzene and naphthalene. Sediment samples were found to contain high concentrations of polynuclear aromatic hydrocarbons (PAHs) and tars. Phase I of the RI was completed in March 1996. Conceptual site models for human health and ecological risk assessments were submitted to DEQ in the fall of 1996. A Land and Water Use report and a series of technical memoranda were submitted during the summer of 1997. Phase II of the RI was completed during the fall of 1998. Groundwater contamination was detected up to 100 feet below the surface along the riverbank. A significant zone of tar contamination extending from the site to the river was also confirmed. (4/17/00 ELB/SRP) In March 2000, two cathodic protection wells that extended 400 feet into the basalt aquifer were abandoned. (9/15/00 ELB/SRP) In August 2000, a product recovery system was installed and soil sampling to support support the upland risk assessment was completed. (4/30/01 ELB/SRP) In March 2001, a source control evaluation was initiated.
Data Sources:	Doane Lake Study Area file (ECSI #36), and NWR project manager files for this site.

Substance Contamination Information

Substance	Media Contaminated	Concentration Level	Date Recorded
BENZENE	Groundwater	16 ppm	
BENZENE	Sediment	22 ppm	
BENZENE	Soil	360 ppm	
CYANIDE (AS ION)	Groundwater	11 ppm	

CYANIDE (AS ION)	Soil	50.7 ppm
NAPHTHALENE	Groundwater	30 ppm
NAPHTHALENE	Sediment	5,100 ppm
NAPHTHALENE	Soil	11,000 ppm
POLYAROMATIC HYDROCARBONS (PAH)	Groundwater	0.36 ppm
POLYAROMATIC HYDROCARBONS (PAH)	Sediment	5,048 ppm
POLYAROMATIC HYDROCARBONS (PAH)	Soil	3,156 ppm

Investigative, Remedial and Administrative Actions

Action	Start Date	Compl. Date	Resp. Staff	Lead Pgm
Site added to CERCLIS	07/01/1979			
EPA Basic Preliminary Assessment	12/23/1987	12/28/1987		
Site added to database	05/03/1988		Michael Rosen	SRS
Responsible party notified re 11/88 Inventory listing	11/30/1988			SAS
EPA Screening Site Inspection 1	12/15/1988	12/15/1988		
SITE EVALUATION	03/16/1993	03/16/1993	Kevin Dana	SAS
PRELIMINARY ASSESSMENT EQUIVALENT	03/17/1993	03/17/1993	Kevin Dana	SAS
Listing Review completed	03/18/1993	03/18/1993	Kevin Dana	SAS
Proposal for Confirmed Release List recommended	03/19/1993	03/19/1993	Kevin Dana	SAS
Proposal for Inventory recommended	03/22/1993	03/22/1993	Kevin Dana	SAS
Other remedial or investigative action recommended	03/23/1993	03/23/1993	Kevin Dana	SAS
VCS Waiting List	08/13/1993	12/16/1993	Michael Rosen	VCS
NEGOTIATIONS	12/16/1993	08/08/1994	Eric Blischke	VCS
Facility proposed for Confirmed Release List	02/10/1994	02/10/1994	Eric Blischke	VCS
Facility proposed for Inventory	02/10/1994	02/10/1994	Eric Blischke	VCS
Owner/operator comments received on listing notification	02/22/1994	02/22/1994		
Beneficial Water Use Assessment	03/21/1994	08/18/1997	Eric Blischke	VCS
REMEDIAL INVESTIGATION	03/21/1994		James Anderson	VCS
Land-Use Assessment	03/21/1994	08/18/1997	Eric Blischke	VCS
Ecological Risk Assessment	03/21/1994	10/21/1996	Eric Blischke	VCS
Review for final listing	04/04/1994	04/04/1994	Eric Blischke	VCS
Listing on Confirmed Release List recommended	04/05/1994	04/05/1994	Eric Blischke	VCS
Listing on Inventory recommended	04/05/1994	04/05/1994	Eric Blischke	VCS
Facility placed on Confirmed Release List	04/06/1994	04/06/1994	Heather Schijf	SAS
Facility placed on Inventory	04/06/1994	04/06/1994	Heather Schijf	SAS
Letter Agreement	08/08/1994	08/08/1994	Eric Blischke	VCS

SCOEPA00003578

EPA Site Inspection Prioritization	02/15/1995 02/16/1995
No Further Remedial Action Planned under Federal program	02/16/1995 02/16/1995

Key to certain acronyms and terms in this report:
CERCLIS No.: The U.S. EPA's Hazardous Waste Site identification number, shown only if EPA has been involved at the site.
Region: DEQ divides the state into three regions, Eastern, Northwest, and Western; the regional office shown is responsible for site investigation/cleanup.
NPL Site: Is this site on EPA's National Priority List (i.e., a federal Superfund site)? (Y/N).
Orphan Site: Has DEQ's Orphan Program been active at this site? (Y/N). The Orphan Program uses state funds to clean up high-priority sites where owners and operators responsible for the contamination are absent, or are unable or unwilling to use their own resources for cleanup.
Study Area: Is this site a Study Area? (Y/N). Study Areas are groupings of individual ECSI sites that may be contributing to a larger, area-wide problem. ECSI assigns unique Site ID numbers to both individual sites and to Study Areas.
Pathways: A description of human or environmental resources that site contamination could affect.
Lead Pgm: This column refers to the Cleanup Program affiliation of the DEQ employee responsible for the action shown. SAS or SAP = Site Assessment; VCS or VCP = Voluntary Cleanup; ICP = Independent Cleanup; SRS or SRP = Site Response (enforcement cleanup); ORP = Orphan Program.

For more information about this page please contact Gil Wistar at (503) 229-5512 or via email at wistar.gil@deq.state.or.us.

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Oregon DEQ

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Environmental Cleanup Site Information (ECSI) Database
Site Summary Report - Details for Site ID 2348

This report shows data entered as of March 10, 2004 at 10:15:10 AM

See the bottom of this page for a key to certain acronyms and terms used in the report below

Note that other DEQ programs may be active at this site; to check, see DEQ's Facility Profiler.

General Site Information

Site ID: 2348	Site Name: Koppers Industries Inc.		CERCLIS No: 027734359	
Address:	7540 NW St. Helens Rd Portland 97210			
	County: Multnomah		Region: Northwest	
Other location information:				
	Investigation Status: Suspect site requiring further investigation	NPL Site: No	Orphan Site: No	Study Area: No
Property:	Twnshp/Range/Sect: 1N , 1W , 12		Tax Lots: 111	
	Latitude: 45.5791 deg.	Longitude: -122.7583 deg.	Site Size: 6.85 acres	
Other Site Names:	Pittsburgh Acquisition Corporation, Inc.			

Site Characteristics

General Site Description:	
Site History:	
Contamination Information:	See ECSI #183 (Wacker Siltronic).
Manner and Time of Release:	
Hazardous Substances/Waste Types:	
Pathways:	
Environmental/Health Threats:	
Status of Investigative or Remedial Action:	Evaluation of this site included in Strategy Recommendation for Wacker Siltronic. Refer to ECSI #183.
Data Sources:	

Substance Contamination Information

Substance	Media Contaminated	Concentration Level	Date Recorded
No information is available			

Investigative, Remedial and Administrative Actions

Action	Start Date	Compl. Date	Resp. Staff	Lead Pgm
Site added to CERCLIS	07/01/1979			

SCOEPA00003580

EPA Screening Site Inspection 1	12/23/1987 12/15/1988		
No Further Remedial Action Planned under Federal program	12/15/1988 12/15/1988		
EPA Site Inspection Prioritization	11/15/1994 02/16/1995		
Site Screening recommended (EV)	05/24/1999 05/24/1999	Stephen Fortuna	SAS
Site added to database	05/24/1999 05/24/1999	Janelle Waggy	VCS
REMEDIAL INVESTIGATION	10/04/2000	Eric Blischke	VCS
Listing Review completed	10/01/2002 10/01/2002	Eric Blischke	VCS
Insufficient information to list	10/01/2002 10/01/2002	Eric Blischke	VCS

Key to certain acronyms and terms in this report:
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Oregon DEQ Hazardous Waste Site Report

[Close Report]

EPA ID: OR0000204701 *Active*
Common Name: Northwest Natural Gas Co Portland Lng Pl
Employee count: 5 **Activity Start:** 4/8/1994
Location: 7900 NW ST HELENS RD CTR SEC
PORTLAND OR 97210-3671
MULTNOMAH County
Latitude: 45.5788 45° 34' 43.6800" **Longitude:** -122.7583 -122° 45' 29.8800"
SIC Codes: 4924 - NATURAL GAS DISTRIBUTION

Facility is a Hazardous Waste Generator
Current Status: CEG as of 2/26/2003

Hazardous Waste Reporting History

Report Year	Generator Status	Number of Waste Streams	Tons Generated	Sent Date	Received Date
2003		0		12/30/2003	
2002	CEG	0		12/24/2002	02/26/2003
2001	CEG	0		12/26/2001	02/15/2002
2000	CEG	0		01/05/2001	03/13/2001
1999	LQG	1	6.077	01/06/2000	03/15/2000

Waste Stream: Soil contaminated with benzene from installing additional monitoring wells **Source:** Investigation derived waste
Waste Codes: D018 **CAS Codes:**
Form: Soil contaminated with organics
Reported: 13400.00 LB = 6077.00 KG **Managed Onsite:** 0 KG
Shipments: 09/23/1999 01746 MID000724831 13400.00 LB Incineration-solids

1998	LQG	2	4.626	01/15/1999	03/15/1999

Waste Stream: Sludge and rinse water from UST diesel tank decommissioning. Hazardous due **Source:** Other production-derived one-time and intermittent processes
Waste Codes: D018 **CAS Codes:**
Form: Oil-water emulsion or mixture
Reported: 200.00 LB = 91.00 KG **Managed Onsite:** 0 KG
Shipments: 12/30/1998 37821 WAD000812909 200.00 LB Incineration-solids

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Waste Stream: Soils from digging area for compressor pad foundation. Hazardous due to be **Source:** Other production-derived one-time and intermittent processes
Waste Codes: D018 **CAS Codes:**
Form: Soil contaminated with organics
Reported: 10000.00 LB = 4535.00 KG **Managed Onsite:** 0 KG

SCOEPA00003582

Shipments: 03/13/1998 435850 MID000724831 10000.00 LB Incineration-solids

1997 LQG 3 0.411 12/29/1997 02/20/1998

Waste Stream: Waste paint related material, outdated **Source:** Discarding out-of-date products or chemicals

Waste Codes: D001, D008, F003, F005 **CAS Codes:**

Form: Organic paint, ink, lacquer, or varnish

Reported: 25.00 GAL = 94.00 KG **Managed Onsite:** 0 KG

Shipments: 08/25/1997 26558 WAD991281767 25.00 GAL Energy recovery-liquids

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Waste Stream: Waste chlorate and borate mixture **Source:** Discarding out-of-date products or chemicals

Waste Codes: D001 **CAS Codes:**

Form: Other waste inorganic solids

Reported: 100.00 LB = 45.00 KG **Managed Onsite:** 0 KG

Shipments: 08/25/1997 26558 WAD991281767 100.00 LB Incineration-solids

---

Waste Stream: Waste potassium nitrate **Source:** Discarding out-of-date products or chemicals

Waste Codes: D001 **CAS Codes:**

Form: Other waste inorganic solids

Reported: 600.00 LB = 272.00 KG **Managed Onsite:** 0 KG

Shipments: 08/25/1997 26558 WAD991281767 600.00 LB Incineration-solids

1996 CEG 0 12/30/1996 02/28/1997

1995 LQG 3 14.623 12/27/1995 02/29/1996

Waste Stream: Waste carbon from filtration of tank containing by-products of LNG producti **Source:** Discontinue use of process equipment

Waste Codes: D018, F003, F005 **CAS Codes:**

Form: Spent carbon

Reported: 55.00 GAL = 237.00 KG **Managed Onsite:** 0 KG

Shipments: 07/14/1995 95017 WAD000812909 55.00 GAL Incineration-solids

---

Waste Stream: Spill cleanup debris from cleanout of discontinued tank. Hazardous due to **Source:** Cleanup of spill residues

Waste Codes: D001, D018 **CAS Codes:**

Form: Paint thinner or petroleum distillates

Reported: 15.00 GAL = 68.00 KG **Managed Onsite:** 0 KG

Shipments: 07/14/1995 95017 WAD000812909 15.00 GAL Incineration-liquids

Waste Stream: Subsurface borings and monitoring well tailings. Hazardous due to Benzene.

Source: Other remediation

Waste Codes: D018

CAS Codes:

Form: Drilling mud

Reported: 15.75 ST = 14318.00 KG

Managed Onsite: 0 KG

Shipments:

1994	CEG	0	12/30/1994	02/27/1995

Oregon DEQ Hazardous Waste Site Report

[Close Report]

EPA ID: ORD027734359 *Active*
Common Name: Koppers Industries Inc
Employee count: 4 **Activity Start:** 4/1/1992
Location: 7540 NW ST HELENS RD
PORTLAND OR 97210
MULTNOMAH County
Latitude: 45.5788 45° 34' 43.6800" **Longitude:** -122.7583 -122° 45' 29.8800"
SIC Codes: 2865 - CYCLIC CRUDES & INTERMEDIATES

Facility is a Hazardous Waste Generator
Current Status: LQG as of 2/12/2003

Hazardous Waste Reporting History

Report Year	Generator Status	Number of Waste Streams	Tons Generated	Sent Date	Received Date
2003		0		12/24/2003	
2002	LQG	1	134.807	12/24/2002	02/12/2003

Waste Stream: Tank residues **Source:** Tank sludge removal
Waste Codes: D018, U051 **CAS Codes:** 71-43-2, 8001-58-9
Form: Resins, tars, or tarry sludge
Reported: 297249.00 LB = 134807.00 KG **Managed Onsite:** 0 KG
Shipments:

08/26/2002	03726	UTD981552177	21262.00 LB	Incineration-sludges
11/09/2002	10304	UTD981552177	44820.00 LB	Incineration-sludges
11/13/2002	10305	UTD981552177	29220.00 LB	Incineration-sludges
11/19/2002	10307	UTD981552177	42540.00 LB	Incineration-sludges
12/02/2002	10306	UTD981552177	41360.00 LB	Incineration-sludges
12/11/2002	10340	UTD981552177	46420.00 LB	Incineration-sludges
12/06/2002	10342	UTD981552177	45180.00 LB	Incineration-sludges
12/11/2002	10324	UTD981552177	21834.00 LB	Incineration-solids
12/11/2002	10324	UTD981552177	4613.00 LB	Incineration-liquids

2001	CEG	0		12/26/2001	01/23/2002
2000	CEG	0		01/05/2001	01/26/2001
1999	CEG	0		01/06/2000	03/09/2000
1998	CEG	0		01/15/1999	02/09/1999
1997	CEG	0		12/29/1997	02/20/1998
1996	CEG	0		12/30/1996	01/10/1997
1995	CEG	0		12/27/1995	01/03/1996
1994	CEG	0		12/30/1994	04/10/1995
1993	CEG	1	0.626	12/30/1993	02/03/1994

Waste Stream: Discarded cleanup materials from a creosote spill. Hazardous due to toxici **Source:** Cleanup of spill residues
Waste Codes: U051 **CAS Codes:**
Form: Soil contaminated with organics

SCOEPA00003585

Reported: 1378.00 LB = 626.00 KG **Managed Onsite:** 0 KG

Shipments:	05/18/1993	713957	CAD000633164	1378.00 LB	Landfill
1992	CEG	0		12/29/1992	02/10/1993
1991	CEG	0		11/01/1991	04/01/1992

SCOEPA00003586

Oregon DEQ

Home > Programs> Cleanup & Spills > ECSI Query > ECSI Site Details

Environmental Cleanup Site Information (ECSI) Database Site Summary Report - Details for Site ID 84

This report shows data entered as of March 10, 2004 at 10:16:15 AM

See the bottom of this page for a key to certain acronyms and terms used in the report below

Note that other DEQ programs may be active at this site; to check, see DEQ's Facility Profiler.

General Site Information

Site ID: 84	Site Name: GASCO	CERCLIS No: 027734359	
Address:	7900 NW St. Helens RD Portland 97210		
	County: Multnomah	Region: Northwest	
Other location information:	Koppers is located at 7540 NW St. Helens RD		
	Investigation Status: Listed on CRL or Inventory	NPL Site: No	Orphan Site: No Study Area: No
Property:	Twnshp/Range/Sect: 1N , 1W , 12	Tax Lots: 42,111,123,113,129,131,112,130	
	Latitude: 45.5788 deg. Longitude: -122.7583 deg.	Site Size: 35 acres	
Other Site Names:	Koppers Co. - Portland NW Natural Gas Co. Pacific Northern Oil Co.		

Site Characteristics

General Site Description:

Site History:

Contamination Information:

(10/15/1999 ELB/VCP) Portland Gas and Coke Company (GASCO) apparently purchased the site in the 1880s, and built a gasification plant by 1913. All waste products from the gasification operations were discharged directly to the Willamette River until 1925. After 1925, tars were separated from the wastewater in settling ponds. When the plant was shut down in 1956 by GASCO's successor company, Northwest Natural Gas (NWNG), an estimated 30,000 cubic yards of coal tar had accumulated in the ponds. The ponds were buried under 10 feet of fill in 1973. Part of the site was then sold to Wacker Siltronic Corporation (see ECSI #183). Koppers Company leased an 8-acre portion of the site from NWNG in 1965 and built a coal-tar distillation plant. Waste streams of creosote and pitch were cooled and solidified in storage tanks, and apparently dumped into an on-site disposal pit. (The plant shut down in 1973 and has only been used for the bulk transfer of creosote oil and coal tar pitch since 1977).

SCOEPA00003587

	In December 1993, NWNG signed up for DEQ's Voluntary Cleanup Program. In August 1994, NWNG signed an agreement with DEQ to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the site. An RI/FS workplan was submitted to DEQ in January 1995 and approved in August 1995.
Manner and Time of Release:	Wastewater from tar stills and unusable petroleum by-products were discharged to the Willamette River, farmed on portion of site, or disposed of in settling ponds on-site. Lampblack and spent iron oxide waste stored in large on-site waste piles. Time of release: 1913 to 1977.
Hazardous Substances/Waste Types:	Oil gasification wastes including: tars, oil, creosote, phenols, polynuclear aromatic hydrocarbons, BTEX and lead.
Pathways:	
Environmental/Health Threats:	Contamination at the site may represent a threat to human health and the environment by migrating to the Willamette River. Evidence suggests near-shore Willamette River sediments may be contaminated due to past operating practices.
Status of Investigative or Remedial Action:	(10/15/1999 ELB/VCP) During the first phase of the Remedial Investigation, widespread petroleum contamination was identified in site soils, groundwater, and Willamette River sediments. Tars were identified to depths of 70 feet in the vicinity of the former tar disposal area. In the former plant site area, dense non-aqueous-phase liquids (DNAPLs) were identified at three distinct locations. Monitoring wells installed adjacent to the Willamette River detected elevated levels of benzene and naphthalene. Sediment samples were found to contain high concentrations of polynuclear aromatic hydrocarbons (PAHs) and tars. Phase I of the RI was completed in March 1996. Conceptual site models for human health and ecological risk assessments were submitted to DEQ in the fall of 1996. A Land and Water Use report and a series of technical memoranda were submitted during the summer of 1997. Phase II of the RI was completed during the fall of 1998. Groundwater contamination was detected up to 100 feet below the surface along the riverbank. A significant zone of tar contamination extending from the site to the river was also confirmed. (4/17/00 ELB/SRP) In March 2000, two cathodic protection wells that extended 400 feet into the basalt aquifer were abandoned. (9/15/00 ELB/SRP) In August 2000, a product recovery system was installed and soil sampling to support support the upland risk assessment was completed. (4/30/01 ELB/SRP) In March 2001, a source control evaluation was initiated.
Data Sources:	Doane Lake Study Area file (ECSI #36), and NWR project manager files for this site.

Substance Contamination Information

Substance	Media Contaminated	Concentration Level	Date Recorded
BENZENE	Groundwater	16 ppm	
BENZENE	Sediment	22 ppm	
BENZENE	Soil	360 ppm	
CYANIDE (AS ION)	Groundwater	11 ppm	

CYANIDE (AS ION)	Soil	50.7 ppm
NAPHTHALENE	Groundwater	30 ppm
NAPHTHALENE	Sediment	5,100 ppm
NAPHTHALENE	Soil	11,000 ppm
POLYAROMATIC HYDROCARBONS (PAH)	Groundwater	0.36 ppm
POLYAROMATIC HYDROCARBONS (PAH)	Sediment	5,048 ppm
POLYAROMATIC HYDROCARBONS (PAH)	Soil	3,156 ppm

Investigative, Remedial and Administrative Actions

Action	Start Date	Compl. Date	Resp. Staff	Lead Pgm
Site added to CERCLIS	07/01/1979			
EPA Basic Preliminary Assessment	12/23/1987	12/28/1987		
Site added to database	05/03/1988		Michael Rosen	SRS
Responsible party notified re 11/88 Inventory listing	11/30/1988			SAS
EPA Screening Site Inspection 1	12/15/1988	12/15/1988		
SITE EVALUATION	03/16/1993	03/16/1993	Kevin Dana	SAS
PRELIMINARY ASSESSMENT EQUIVALENT	03/17/1993	03/17/1993	Kevin Dana	SAS
Listing Review completed	03/18/1993	03/18/1993	Kevin Dana	SAS
Proposal for Confirmed Release List recommended	03/19/1993	03/19/1993	Kevin Dana	SAS
Proposal for Inventory recommended	03/22/1993	03/22/1993	Kevin Dana	SAS
Other remedial or investigative action recommended	03/23/1993	03/23/1993	Kevin Dana	SAS
VCS Waiting List	08/13/1993	12/16/1993	Michael Rosen	VCS
NEGOTIATIONS	12/16/1993	08/08/1994	Eric Blischke	VCS
Facility proposed for Confirmed Release List	02/10/1994	02/10/1994	Eric Blischke	VCS
Facility proposed for Inventory	02/10/1994	02/10/1994	Eric Blischke	VCS
Owner/operator comments received on listing notification	02/22/1994	02/22/1994		
Beneficial Water Use Assessment	03/21/1994	08/18/1997	Eric Blischke	VCS
REMEDIAL INVESTIGATION	03/21/1994		James Anderson	VCS
Land-Use Assessment	03/21/1994	08/18/1997	Eric Blischke	VCS
Ecological Risk Assessment	03/21/1994	10/21/1996	Eric Blischke	VCS
Review for final listing	04/04/1994	04/04/1994	Eric Blischke	VCS
Listing on Confirmed Release List recommended	04/05/1994	04/05/1994	Eric Blischke	VCS
Listing on Inventory recommended	04/05/1994	04/05/1994	Eric Blischke	VCS
Facility placed on Confirmed Release List	04/06/1994	04/06/1994	Heather Schijf	SAS
Facility placed on Inventory	04/06/1994	04/06/1994	Heather Schijf	SAS
Letter Agreement	08/08/1994	08/08/1994	Eric Blischke	VCS

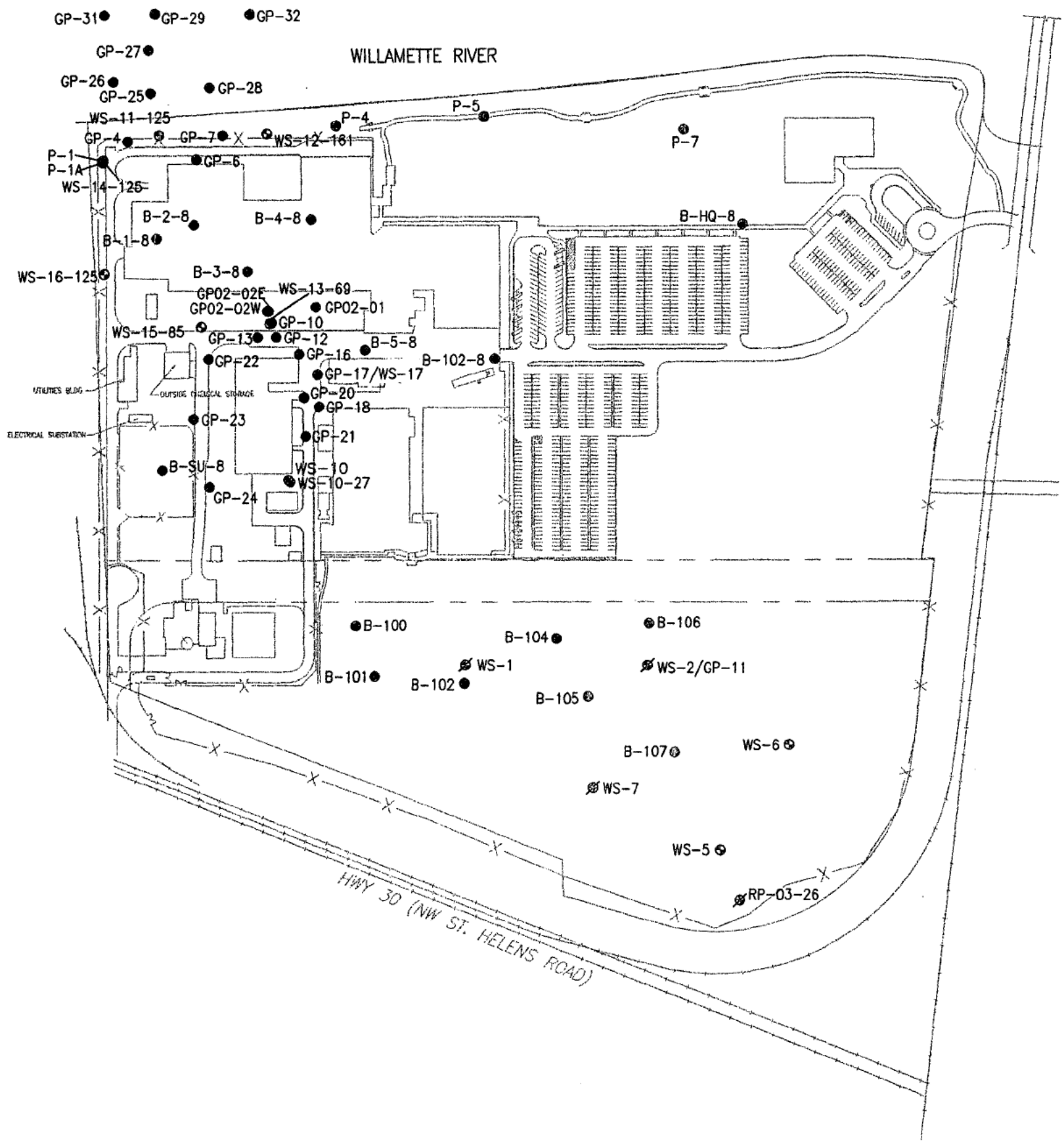
SCOEPA00003589

EPA Site Inspection Prioritization	02/15/1995 02/16/1995
No Further Remedial Action Planned under Federal program	02/16/1995 02/16/1995

Key to certain acronyms and terms in this report:
CERCLIS No.: The U.S. EPA's Hazardous Waste Site identification number, shown only if EPA has been involved at the site.
Region: DEQ divides the state into three regions, Eastern, Northwest, and Western; the regional office shown is responsible for site investigation/cleanup.
NPL Site: Is this site on EPA's National Priority List (i.e., a federal Superfund site)? (Y/N).
Orphan Site: Has DEQ's Orphan Program been active at this site? (Y/N). The Orphan Program uses state funds to clean up high-priority sites where owners and operators responsible for the contamination are absent, or are unable or unwilling to use their own resources for cleanup.
Study Area: Is this site a Study Area? (Y/N). Study Areas are groupings of individual ECSI sites that may be contributing to a larger, area-wide problem. ECSI assigns unique Site ID numbers to both individual sites and to Study Areas.
Pathways: A description of human or environmental resources that site contamination could affect.
Lead Pgm: This column refers to the Cleanup Program affiliation of the DEQ employee responsible for the action shown. SAS or SAP = Site Assessment; VCS or VCP = Voluntary Cleanup; ICP = Independent Cleanup; SRS or SRP = Site Response (enforcement cleanup); ORP = Orphan Program.

For more information about this page please contact Gil Wistar at (503) 229-5512 or via email at wistar.gil@deq.state.or.us.

DEQ Online is the official web site for the Oregon Department of Environmental Quality.



LEGEND:
BORING OR MONITORING WELL WITH VISIBLE IMPACTS (OIL OR TAR) CHARACTERISTIC OF MGP WASTE

PLANT NORTH

TRUE NORTH

NOTE:
BORING/MONITORING WELL LOCATIONS ARE APPROXIMATE.

0 300 600
SCALE IN FEET

Vancouver: (360) 694-2691
Portland: (971) 544-2139

MAUL FOSTER ALONGI INC.

DATE 12/02/04
DWN. DLG
APPR.
REVIS.
PROJECT NO.
8128.01.08

Figure 3
SILTRONIC CORPORATION
PORTLAND, OREGON

MGP IMPACTS IN BORINGS AND MONITORING WELLS

File: G:\8000\8128-01_WACKER SILTRONIC\08\TASK2_CASCO\FIG03_BORING OR MONITORING WELL.DWG Last edited: DEC. 14, 2004 @ 10:03 a.m. by: dglaus Xrefs: gis-base-NOPHOTO, SITE-BASE, MGP-sample points black/white

LAYOUT: 1

Oregon
Theodore R. Kulongoski, Governor

Department of Environmental Quality
Northwest Region Portland Office
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987
(503) 229-5263
FAX (503) 229-6945
TTY (503) 229-5471

March 14, 2005

Mr. Bob Wyatt
Northwest Natural
220 NW Second Avenue
Portland, OR 97209

Mr. Tom McCue
Wacker Siltronic Corporation
7200 NW Front Avenue
Portland, OR 97210

Re: Intended Revised Phase I Report Cross-Sections

Dear Bob and Tom:

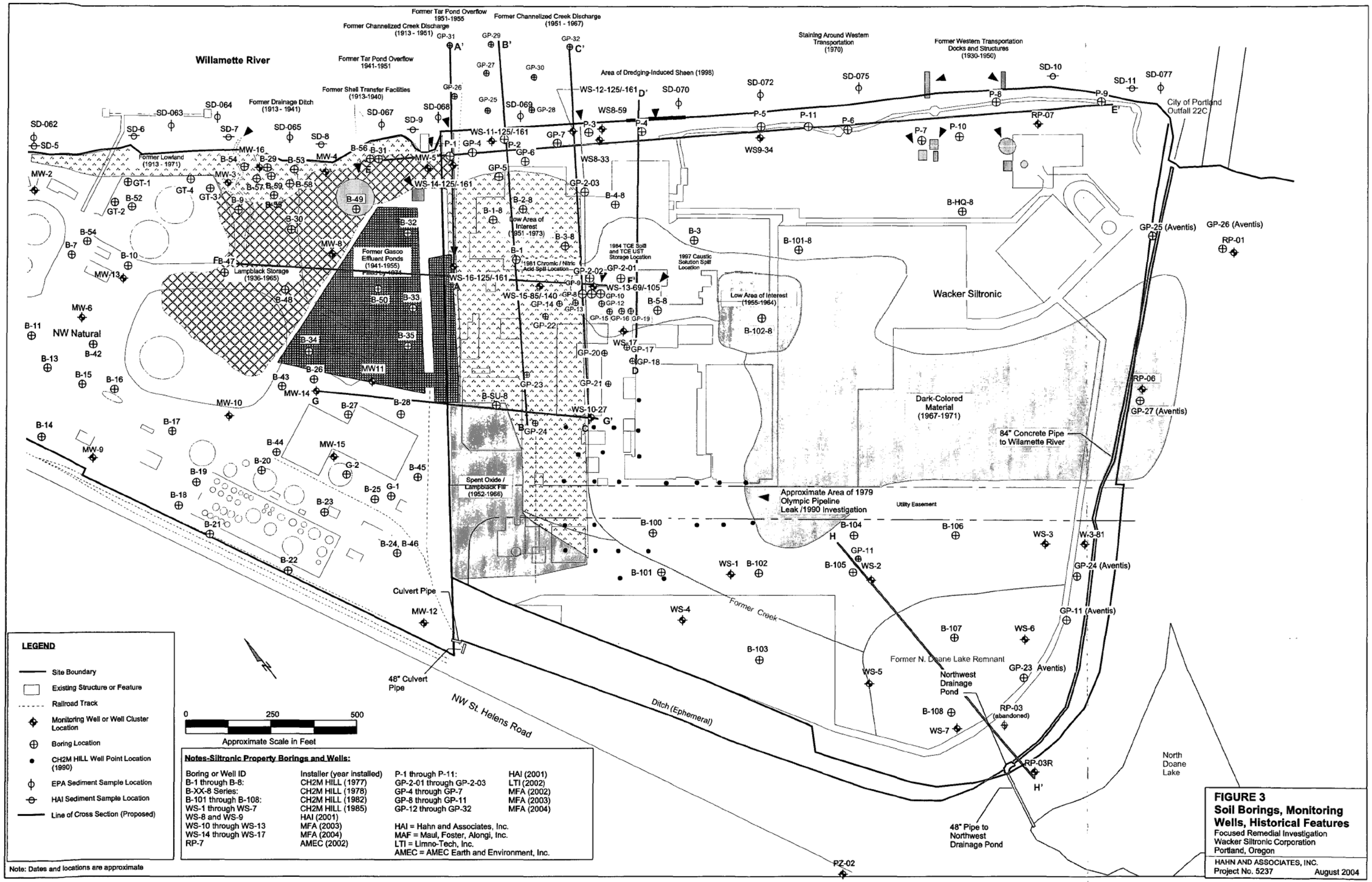
The Department of Environmental Quality (DEQ) reviewed the intended cross-section map for the Revised Phase I Site Characterization Summary Report for the Siltronic Corporation Facility submitted to DEQ by Hahn and Associates on March 2, 2005 and the March 11, 2005 comments prepared by Maul Foster Alongi, Inc. (MFA) on behalf of Siltronic Corporation on the intended cross-sections. DEQ finds the MFA comments relevant and request that the cross-section figures be modified to address the MFA recommendations.

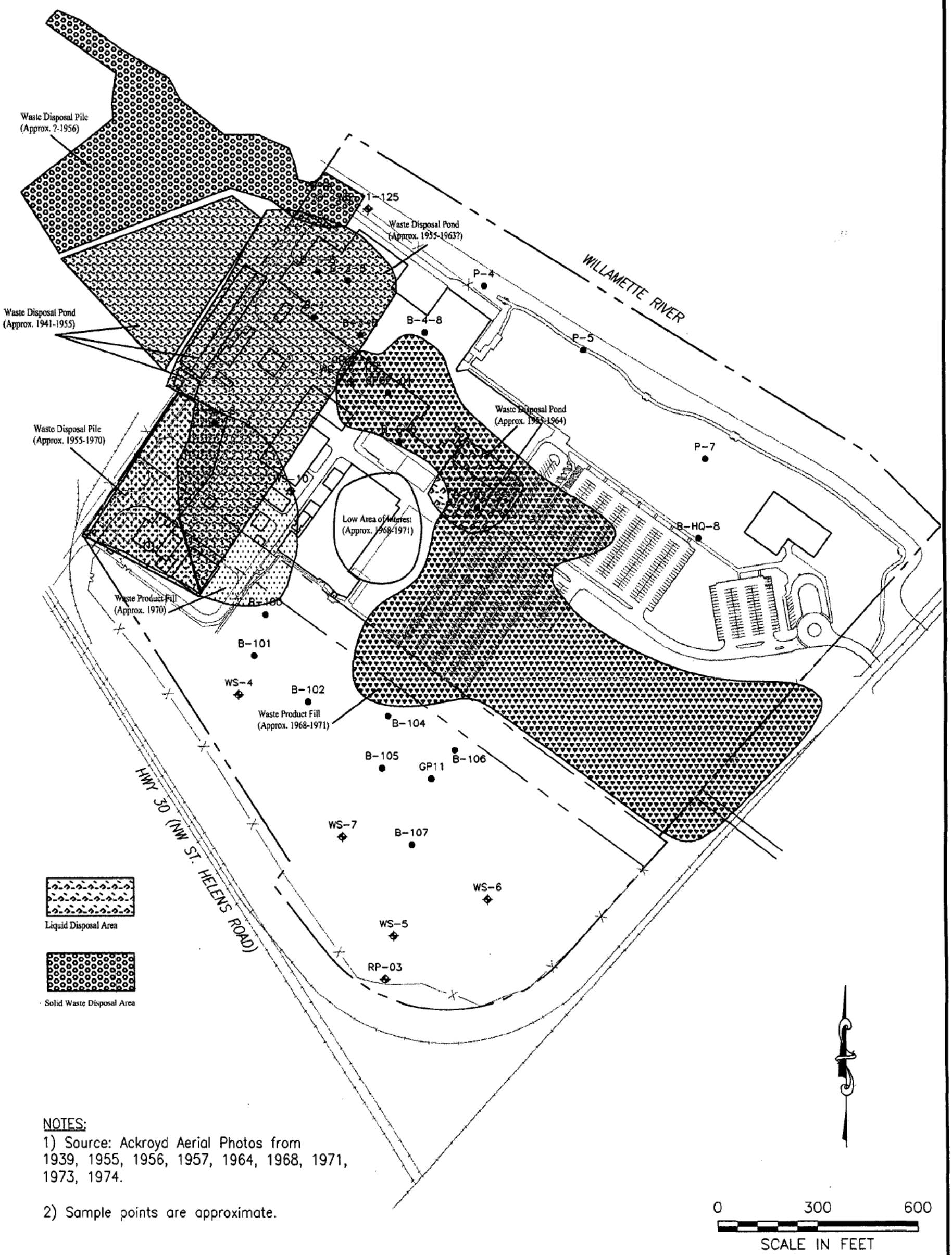
Please contact me at (503) 229-5538 if you have any questions.

Sincerely,

Matt McClincy
Project Manager
Cleanup and Portland Harbor Section

Cc: Rod Struck, DEQ NWR
Rob Ede, Hahn and Associates, Inc.
James Peale, Maul Foster Alongi
James Maul, Maul Foster Alongi


Willamette River
Former Tar Pond Overflow 1951-1955
Former Channelized Creek Discharge (1951 - 1967)
Former Channelized Creek Discharge (1913 - 1951)
Former Tar Pond Overflow 1941-1951
Former Shell Transfer Facilities (1913-1940)
Former Drainage Ditch (1913 - 1941)
Staining Around Western Transportation (1970)
Former Western Transportation Docks and Structures (1930-1950)
Area of Dredging-Induced Sheen (1998)
City of Portland Outfall 22C
Former Lowland (1913 - 1971)
Former Gasco Effluent Ponds (1941-1955) Filled by 1974
Lampblack Storage (1936-1965)
Low Area of Interest (1951 -1973)
1984 TCE Spill and TCE UST Storage Location
1981 Chromic / Nitric Acid Spill Location
1997 Caustic Solution Spill Location
Low Area of Interest (1955-1964)
Wacker Siltronic
NW Natural
Dark-Colored Material (1967-1971)
84" Concrete Pipe to Willamette River
Spent Oxide / Lampblack Fill (1952-1966)
Approximate Area of 1979 Olympic Pipeline Leak /1990 Investigation
Utility Easement
Culvert Pipe
48" Culvert Pipe
Former Creek
Former N. Doane Lake Remnant
Northwest Drainage Pond
48" Pipe to Northwest Drainage Pond
Ditch (Ephemeral)
NW St. Helens Road
North Doane Lake
LEGEND
Site Boundary
Existing Structure or Feature
Railroad Track
Monitoring Well or Well Cluster Location
Boring Location
CH2M HILL Well Point Location (1990)
EPA Sediment Sample Location
HAI Sediment Sample Location
Line of Cross Section (Proposed)
0 250 500
Approximate Scale in Feet
Notes-Siltronic Property Borings and Wells:
Boring or Well ID | Installer (year installed)
B-1 through B-8: CH2M HILL (1977)
B-XX-8 Series: CH2M HILL (1978)
B-101 through B-108: CH2M HILL (1982)
WS-1 through WS-7 CH2M HILL (1985)
WS-8 and WS-9 HAI (2001)
WS-10 through WS-13 MFA (2003)
WS-14 through WS-17 MFA (2004)
RP-7 AMEC (2002)
P-1 through P-11: HAI (2001)
GP-2-01 through GP-2-03 LTI (2002)
GP-4 through GP-7 MFA (2002)
GP-8 through GP-11 MFA (2003)
GP-12 through GP-32 MFA (2004)
HAI = Hahn and Associates, Inc.
MAF = Maul, Foster, Alongi, Inc.
LTI = Limno-Tech, Inc.
AMEC = AMEC Earth and Environment, Inc.
Note: Dates and locations are approximate
FIGURE 3
Soil Borings, Monitoring Wells, Historical Features
Focused Remedial Investigation
Wacker Siltronic Corporation
Portland, Oregon
HAHN AND ASSOCIATES, INC.
Project No. 5237 August 2004



NOTES:

1) Source: Ackroyd Aerial Photos from 1939, 1955, 1956, 1957, 1964, 1968, 1971, 1973, 1974.

2) Sample points are approximate.

Vancouver: (360) 694-2691
Seattle: (425) 744-1489
Portland: (971) 544-2139

MAUL FOSTER ALONGI

DATE 3/11/04
DWN.
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REVIS.
PROJECT NO.
8128.01.08

Figure 1
SILTRONIC CORPORATION
PORTLAND, OREGON
GASCO WASTE DISPOSAL AREAS AND BORINGS OR MONITORING WELLS WITH VISIBLE OIL OR TAR

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LAYOUT: 1

WILLAMETTE RIVER

WS-12-125/161
WS-11-125/161
P-3
WS-8-59
P-4
WS-8-33
GP-4
P-2
GP-7
P-5
P-11
WS-9-34
P-6
P-7
P-1
GP-6
GP-5
GP02-03
FAB 1
BUILDING
GP02-02
GP02-01
WS-13-69/105
GP-8
GP-9
GP-10
UTILITIES BLDG.
ACID SOLVENT STORAGE
ELECTRICAL SUBSTATION
FACILITIES BLDG.
WAREHOUSE
FAB 2 BUILDING
WS-10-27
UTILITY CORRIDOR
FAB 1
FAB 2
GP-11
HWY 30 (NW ST. HELENS ROAD)

LEGEND

- NEW GEOPROBE BORING
- NEW MONITORING WELL PAIR
- NEW SHALLOW MONITORING WELL
- PREVIOUS EXPLORATORY BORING
- PREVIOUS MONITORING WELL

GP = GEOPROBE

NOTES:
1) LOCATIONS OF ALL BORINGS AND MONITORING WELLS ARE APPROXIMATE.

2) GP-11 IS APPROXIMATELY CO-LOCATED WITH FORMER MW-2/WS-2 (ABANDONED).

0 160 320
SCALE IN FEET

Vancouver: (360) 694-2691
Seattle: (425) 744-1489
Portland: (971) 544-2139
MAUL FOSTER ALONGI

DATE 03/04/03
DWN. JLN
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8128.01.05

Figure 2
WACKER SILTRONIC CORPORATION
PORTLAND, OREGON

BORING AND WELL LOCATIONS

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LAYOUT: Scenario 3

GASCO Rpt

REVISED
BASELINE ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT REPORT

NW NATURAL "GASCO" SITE

Prepared for

NW Natural

220 NW 2nd Avenue

Portland, Oregon 97209

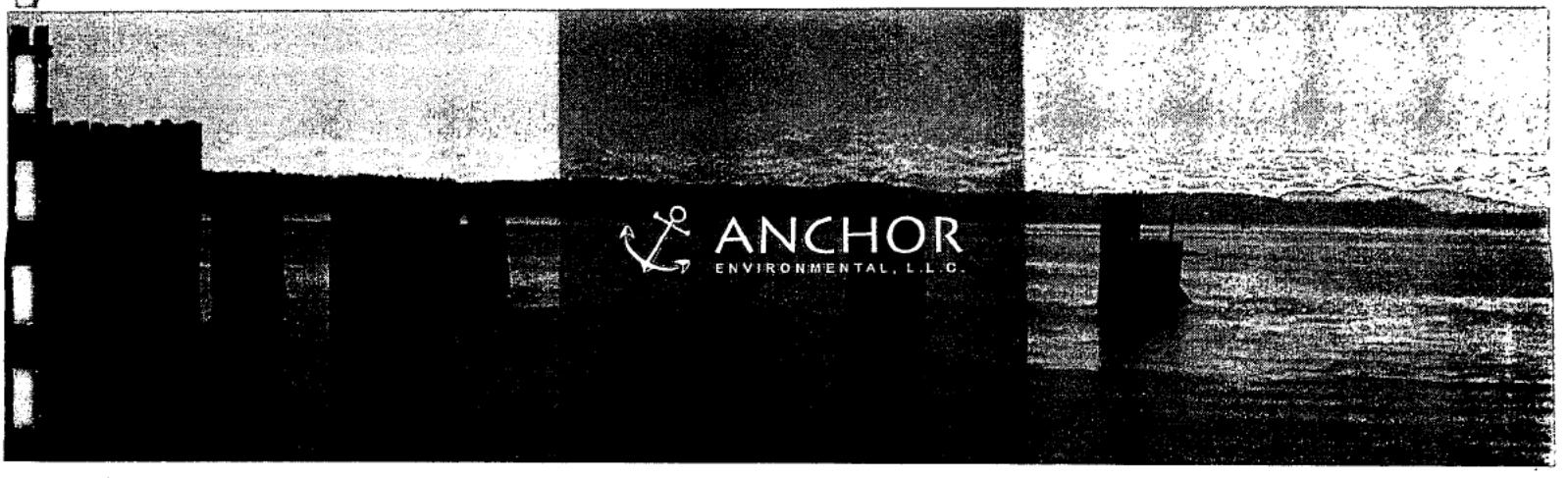
Prepared by

Anchor Environmental, L.L.C.

1423 Third Avenue, Suite 300

Seattle, Washington 98101

December 2004



REVISED
BASELINE ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT REPORT

NW NATURAL "GASCO" SITE

Prepared for

NW Natural

220 NW 2nd Avenue

Portland, Oregon 97209

Prepared by

Anchor Environmental, L.L.C.

1423 Third Avenue, Suite 300

Seattle, Washington 98101

December 2004

DEC 16 2004

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SCOEPA00003599

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Appendix D – Risk Characterization Tables
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SCOEPA00003600

AST	aboveground storage tank
BCF	Bioconcentration factors
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
BTU	british thermal unit
CDM	Camp Dresser McKee
COI	Contaminant of Interest
COPC	Chemicals of Potential Concern
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbons
CTE	Central Tendency Estimate
DEQ	Oregon Department of Environmental Quality
DNAPL	Dense Non-Aqueous Phase Liquid
EC	Exposure Concentrations
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
FAMM	Fuel and Marine Marketing
FS	Feasibility Study
GIS	Geographical Information System
GPS	Global Positioning System
HAI	Hahn and Associates, Inc.
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HPAH	High Molecular Weight Polycyclic Aromatic Hydrocarbons
HQ	Hazard Quotient
HSDB	Hazardous Substances Data Base
IRIS	Integrated Risk Information Systems
KII	Koppers Industries, Inc.
LD50	Lethal Dose 50
LNG	Liquified Natural Gas
LOF	Locality of Facility
LPAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbons
mg/kg	milligrams per kilogram
MGP	Manufactured Gas Plant
msl	mean sea level
OAR	Oregon Administrative Rules
ORNL	Oak Ridge National Laboratories

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PacTerm	Pacific Terminal Services, Inc.
PAHs	Polycyclic Aromatic Hydrocarbons
PG&C	Portland Gas and Coke Company
PNO	Pacific Northern Oil
RDL	reporting detection limit
RI	Remedial Investigation
RME	Reasonable Maximum Estimate
ROC	Receptors of Concern
Site	NW Natural "Gasco" Site
SLV	Screening Level Value
TE	Threatened or Endangered
UCL	upper confidence limit
WBZ	Water-Bearing Zone

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1 INTRODUCTION

This report provides a Baseline Risk Assessment for the NW Natural "Gasco" Site (Site) following Oregon Department of Environmental Quality (DEQ) guidance (DEQ 2002a and DEQ 2000). The purpose of the risk assessment is to estimate the existing potential risks associated with chemicals present at the Site. Both risks to people (human health) and ecology are evaluated.

Because this risk assessment is being conducted as a part of the Oregon Voluntary Cleanup Program for the upland portions of the Site, the assessment considers risks from chemicals in upland soils, groundwater, and temporary surface water features on the upland portion of the Site. Potential risks in the river associated with sediments, river water, or potential discharges to the river from the upland portions of the Site are not evaluated in this document. These risks are being evaluated as a part of the overall aquatic risk assessment being conducted for the Portland Harbor Superfund Site. The U.S. Environmental Protection Agency (EPA) is leading this effort.

The information here builds on the work of previous investigations including the Site Remedial Investigation (RI; Hahn and Associates, Inc. [HAI] 1998), subsequent data collections, and preliminary risk assessments (Anchor 2001a, Anchor 2001b, and Anchor 2003).

This report is organized into the following sections:

- Site History and Description – location and current conditions (Section 1.1)
- Site Use – identification of current and future land and water use (Section 1.2)
- Summary of Upland Data – review of existing upland data (Section 1.3)
- Summary of Previous Risk Assessments (Section 1.4)
- Assessment Objectives and Scope (Section 1.5)
- Baseline Level II Ecological Screening Risk Assessment (Section 2)
- Baseline Level III Human Health Risk Assessment (Section 3)
- Conclusions (Section 4)

1.1 Site History and Description

The Site history and current Site conditions are described in detail by HAI (1998), to be expanded and supplemented in an RI Report update currently in preparation by HAI. This

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section contains a summary of this information to provide context to the risk assessment and unless cited otherwise comes from the RI.

1.1.1 Site History

The Portland Gas & Coke Company (PG&C) purchased the subject property (then undeveloped) around 1910. At that time, the property was approximately 85 acres larger than it is today, as it included what is now the Siltronic property immediately south of the existing site. PG&C built and operated an oil manufactured gas plant (MGP) on the current site footprint between 1913 and 1956. The southern portion of the site was sold by NW Natural Gas in 1962.

1.1.1.1 Manufactured Gas Plant Operations

An extensive description of the production methods used at the PG&C Gasco site as part of oil gas manufacture is provided within an August 1939 document entitled *Report on Portland Gas & Coke Company* (Ebasco Services, Inc. and PG&C); a 1941 paper entitled *Aromatics, Gas and Coke from Heavy Petroleum* (Hall, 1941); a 1952 paper entitled *Oil Gas Manufacture, A Staff-Industry Collaborative Report* (Hall and Kohlhoff, 1952); as well as a June 1987 Camp Dresser & McKee, Inc. (CDM) document entitled *North Doane Lake Site Characterization Work Plan*, (CDM 1987). The following summary of historical MGP operations at the Gasco site was primarily obtained from HAI'S review of these sources, as well as available historical company records.

PG&C constructed an oil MGP, known as the Gasco facility, on the subject property in 1912 and 1913, with operations beginning in late 1913. Company records indicate that site preparation involved the filling of approximately 10 acres of low-lying land with 205,381 cubic yards of material dredged from the Willamette River.

The Gasco facility used the "Pacific Coast Oil Gas Process" throughout the plant's life. This process involved thermal cracking of oil at near atmospheric pressure in a cylindrical shell containing heated refractory checker brick. In this process, heavy oils were introduced to the gasified vessel after pre-heating the checker brick to 2,000°F. These oils were then thermally cracked as they moved downward through the gasifier producing gas, lampblack, and tar. The lampblack and tar was

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subsequently removed from the gas after which the gas passed through gas purifiers where sulfur and other impurities were removed. Further, absorption towers were used with light oil to absorb benzol vapors, with the oil subsequently distilled to recover the benzol. The lampblack would be recovered in wash boxes, dried, and then fed to a rotary press, producing cylindrical or pillow shaped briquettes.

During the life of the Gasco plant operations, it is reported that approximately 70,000,000 barrels (2,940,000,000 gallons) of petroleum feedstock (8.4 degree API [specific gravity of 1.011] oil) were processed. This process generated the following products and by-products for each 100 gallons of 8.4 degree API oil used:

- 10,000 cubic feet oil gas
- 283 pounds of lampblack
- 3.8 gallons of tar
- 4.6 gallons of light oil

In 1941 a coke oven was installed at the plant to generate electrode grade coke and high oil gas for re-forming in the existing retorts. The coke ovens produced the following products for each 100 gallons of 8.4 degree API feedstock oil and 90 pounds of lampblack:

- 5,400 cubic feet of oil gas
- 195 pounds coke
- 36 gallons tar
- 6.6 gallons light oil
- 0.6 gallons creosote oil

In addition to the preceding by-products, spent oxide (also called purifier box wastes) was generated from the use of iron oxide (iron-impregnated wood chips) or lime as solid reactants for the removal of sulfur from the oil gas. Spent oxide is primarily a blend of iron sulfides, sulfur, iron oxides and wood substrate and/or lime, however spent oxide material may also contain hydrocarbons that passed through the upstream gas processing equipment, as well as cyanides that would be removed from the gas along with the sulfur. Concentrations of cyanide gas, however, were significant only within coal gas, with cyanide impacts only found in

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significant quantities at former coal carbonization sites (Hayes 1996), and not at former oil gasification sites such as Gasco. In addition to the preceding, spent oxide wastes have been found to contain varying amounts arsenic, chromium, copper, lead, nickel, and zinc (Fischer 1999).

Due to the large scale of operations at the Gasco site, economic recovery of many of the by-products typically wasted at other plants of this type, was possible, thereby reducing the quantities of waste from this site. According to information provided within the 1952 Hull and Kohloff paper, gasification by-products were refined to produce the following products at the Gasco site:

- lampblack briquettes
- soft pitch
- specification tars and tar distillates
- specification creosote
- hard pitch
- electrode grade pitch
- crude naphthalene
- crude benzene
- motor fuel
- toluene
- xylene
- solvent naphtha

With regard to by-product reclamation, the plant initially produced pressed lampblack briquettes which were sold in the area as fuel. Company records indicate that in 1914 approximately 11,500 tons of briquettes were sold, with sales increasing to approximately 40,000 tons per year by 1920, and to between 50,000 tons and 60,000 tons by 1940.

In 1923, the gasification process was modified to optimize aromatic generation and light oil recovery for use as motor fuel. Company records indicate that subsequent to 1929 approximately 2,000,000 gallons of "benzol" were produced annually for use in motor fuel, limited only by the volume of light oil available for recovery. Benzol

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was sold to the Shell Oil Company, where it was used to blend with gasoline, trade-named "Gasco Motor Fuel" (Ebasco and PG&C 1939).

Tar recovery and refining were incorporated into the process in 1925 to provide tar for use as a road binder. During the first year of production (1925), approximately 70,000 gallons of road binder were sold, with sales growing to approximately 1,200,000 gallons in 1930, and to approximately 1,800,000 gallons in 1937.

As of 1939, the plant had a maximum capacity of 35,000,000 cubic feet of gas per day. The largest year of gas production (prior to 1939) occurred in 1929, when 4,435,676,000 cubic feet of gas were produced. The oil feedstock required to produce stated volume of gas in 1929 was recorded as 43,527,291 gallons (approximately 1 gallon of oil per 100 cubic feet of gas). As an example of the scale of the by-product regeneration, the following by-products were recovered in 1929:

- 49,384 tons of briquettes
- 2,252,640 gallons of light oil
- 1,202,264 gallons of tar
- 20,083 pounds of naphthalene

Once natural gas became available in the 1950s, much of the plant was shut down, with the last full year of plant operation occurring in 1955 (CDM 1987). With the arrival of natural gas, PG&C changed its name to Northwest Natural Gas Company, and more recently to NW Natural. The Northwest Natural Gas Company constructed a liquefied natural gas (LNG) plant at the site in the late 1960s, at which time most of the old gasification plant was demolished and associated underground utilities were removed.

1.1.1.2 MGP Waste Disposal Practices

From 1913 to 1925, only British Thermal Unit (BTU) gas and lampblack briquettes were produced at the Gasco facility, with no known recovery of aromatic hydrocarbons and tars (other than burning for fuel) during the production process. During this timeframe, all wastewaters and tars not usable as fuel would have been

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discharged to drainage features/sewers leading from the production area to the Willamette River.

After 1925, when tar refining operations began, the quantity of tar within the waste stream would have been only a small percentage of the total tar produced (CDM 1987). However, prior to plant expansions in 1941, waste by-products from the oil gasification process that did not have a market (wastewater with petroleum emulsions containing lampblack and tars) would have continued to have been discharged to low lying areas of the site and drainage features leading from the production area to the Willamette River (CDM 1987). Historical facility records indicate the primary facility sewer outfall was formerly located south of the current southernmost fuel storage tank area, which discharged to a low area/ditch that then flowed directly to the Willamette River. Further, historical aerial photographs from 1936 and 1940 indicate lampblack placement and effluent discharge (either emanating from the sewer, or from overland discharge) to this area. RI activities completed at the Gasco facility have confirmed the presence of MGP wastes in the area of the former discharge, with the presence of buried bulk tar, oil, and lampblack identified at this portion of the site, as well as the surface expression of a tar body covering sediments in the river adjacent to this area.

Plant expansions in the 1930s and 1940s involved the construction and use of two effluent settling ponds (i.e., tar ponds) on the southeastern portion of the Gasco property, with the ponds operational by 1941. The larger of these ponds, estimated at 2.5 acres, was located near the southeastern corner of the property near the current NW Natural/Siltronic property line, while a small, elongate pond was located immediately south of the larger pond, on the current NW Natural/Siltronic property line. By 1981, the ponds were substantially filled similar to the current configuration on the site.

1.1.1.3 Creosote Formulation, Coal Tar and Pencil Pitch Distribution

Koppers Industries Inc. (KII, Carbon Materials and Chemicals Division), currently leases the southwestern portion of the Gasco site (approximately 6.4 acres), which is addressed as 7540 NW Saint Helens Road, Portland, Oregon. This portion of the

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property contains the former MGP light oil plant, tank farm, pitch plant, coke ovens, and tar processing areas.

As described within a 1994 Site Inspection Prioritization Report prepared for the EPA by URS Consultants, Inc., the predecessor to KII, Koppers Company, Inc. (Koppers), operated a coal tar distillation facility at this portion of the property from 1966 to 1973. During this timeframe Koppers produced chemical oil, creosote, and pitch from coal tar distillates (URS, 1994). From 1974 through 1977, Koppers manufactured electrode grade pitch, a product derived from both coal tar and petroleum residuals. From 1977 through the present, Koppers, and now KII, has used the facility as a terminal for the bulk transfer and distribution of liquid creosote coal tar and solid coal tar pitch.

Currently, coal tar pitch is imported via bulk and/or liquid cargo vessels. The product is then stored at the site prior to distribution via tank truck or tank rail cars. Specifically, solid coal tar pitch (e.g., pencil pitch) arrives at the site by truck, while liquid coal tar pitch is imported via a bulk cargo vessel. Liquid coal tar pitch operations at the facility began in 1999, with the objective being the phase out of management of solid pencil pitch. The liquid coal tar pitch is received at the NW Natural Gasco dock on the Willamette River, where it is pumped from the vessel, through a heated pipeline that is about 2,400 feet long, to a storage tank on the KII lease area. KII retains stockpiles of solid pencil pitch on site in a large structure located near the eastern corner of their lease area.

With regard to waste disposal practices, Koppers reportedly generated approximately 1,500 gallons of wastewater per day during the timeframe that the plant was used as a coal tar distillation facility (CDM, 1987). Koppers land-disposed these wastewaters at the eastern portion of their facility, a location immediately southwest of the former tar settling ponds, coinciding with the location of the current pencil pitch storage structure.

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1.1.1.4 Marine Fuel Storage and Distribution

Pacific Terminal Services, Inc. (PacTerm), under contract with Fuel and Marine Marketing (FAMM), operates a fuel storage and distribution facility at the northern portion of the site. From the 1960s until FAMM acquired the operation in 1999, the distribution facility was operated by Pacific Northern Oil (PNO). The terminal receives, stores, blends, and ships marine fuels and lubricants, utilizing both barge and truck for transport. FAMM uses two above-ground storage tank (AST) farms for storage and distribution of fuel. The portion of the site leased by FAMM contains former MGP oil storage tanks, the former oxide reactor area, and spent oxide storage pile area.

1.1.1.5 Liquefied Natural Gas Storage

Northwest Natural Gas constructed the company's first LNG storage tank on the Gasco site in 1969. This LNG storage facility is used to liquefy natural gas during times of low peak demand for storage until the gas is needed during times of peak demand, typically during the winter heating season. In addition to the LNG storage tank, NW Natural maintains LNG storage control and distribution facilities at the site. The portion of the site utilized for LNG storage contains former tar processing area and the former naphthalene plant.

The locations of Site features associated with the NW Natural, KII, and FAMM facilities are shown in Figure 1-2.

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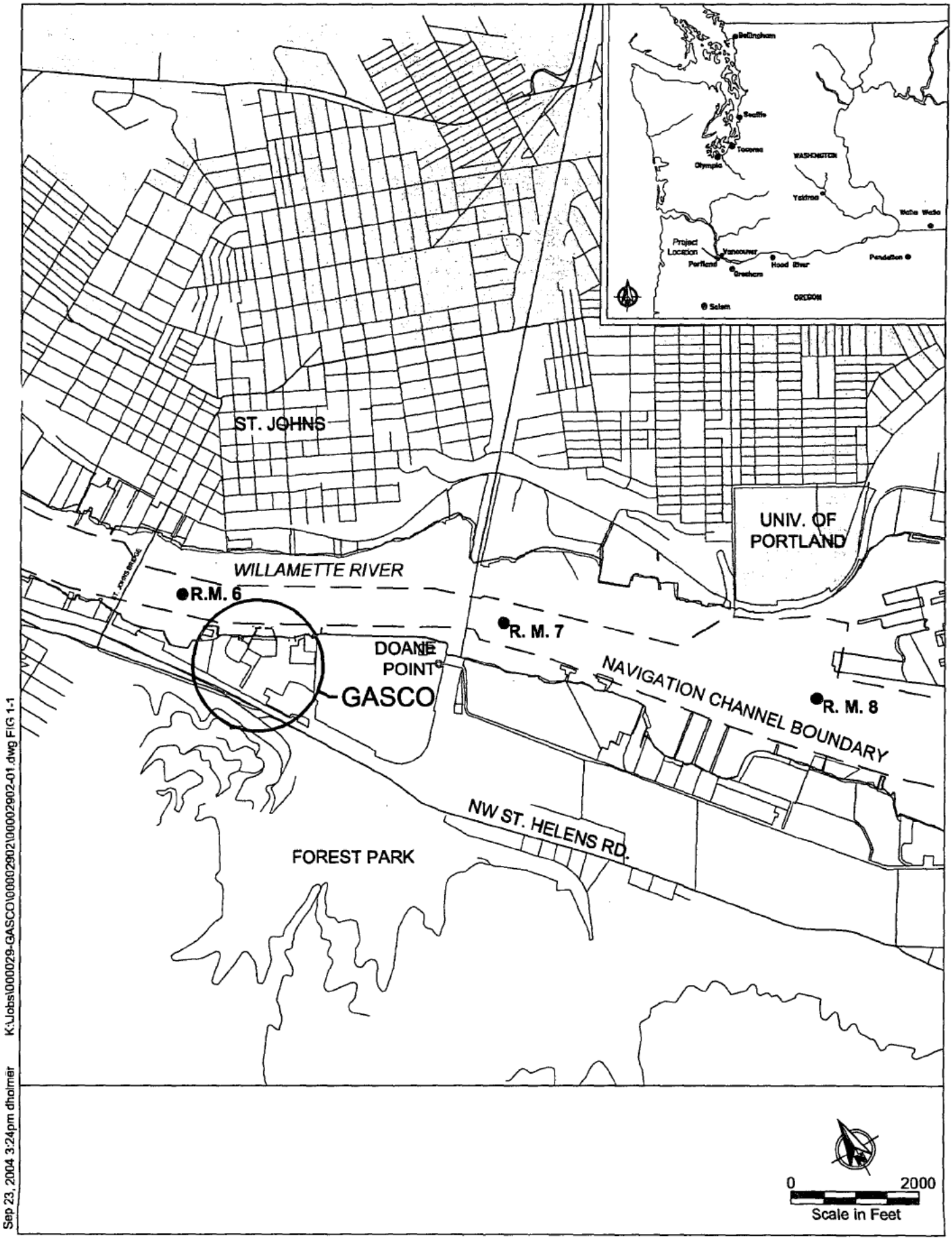

Sep 23, 2004 3:24pm dholmer K:\Jobs\000029-GASCO\00002902\00002902-01.dwg FIG 1-1

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1-1
Vicinity Map
NW Natural "Gasco" Site

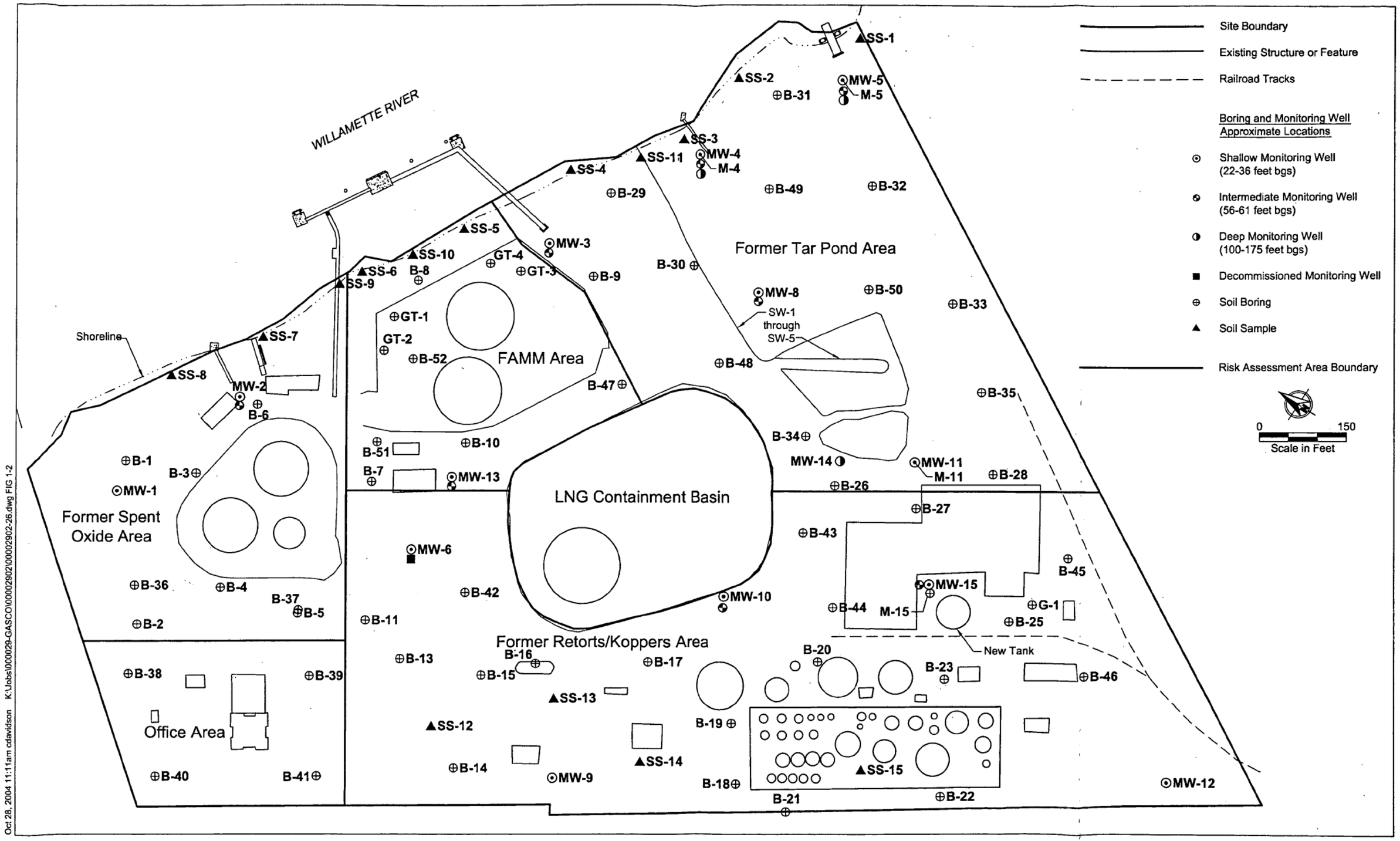

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Figure 1-2
Site Map
NW Natural "Gasco" Site

1.1.2 Site Description

The Site comprises approximately 45 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 to the northeast 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 riprap, 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).

Site surface features include buildings, storage tanks, and equipment used in ongoing industrial processes at the Site. The Site ranges from mostly paved in the area leased by KII, to gravel, to mixed grass and trees in the former Spent Oxide and Tar Pond Areas. Additional site features include a utility easement that crosses the southwestern portion of the property. Utilities that exist within the easement include oil, gasoline, natural gas, water, and sewer pipelines. In addition to the preceding, numerous utilities (e.g., water, oil, stormwater) exist as part of the site infrastructure. Figure 1-2 presents some of the general Site surface features.

Site Geology

Site geology can be subdivided into three main geologic units: Columbia River Basalt Group, Alluvial Deposits, and Surficial Fill Deposits, which are detailed in HAI 1998. The Columbia River Basalt Group is the oldest and deepest geologic unit at the Site. The depth of the Columbia River Basalt Group inclines steeply, ranging from approximately -20 feet msl at the southern portion of the Site to approximately -175 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

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from approximately 30 feet near the southern portion of the Site to over 150 feet along the northern portion of the Site (adjacent to the Willamette River). A silt unit defines the top of the undifferentiated Alluvial Deposits across a majority of the site. 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 and eastern portions of the Site). This Surficial Fill layer consists primarily of hydraulically placed dredge materials, but also includes quarry reject rock, building debris, and miscellaneous MGP-related and Koppers-related (e.g. oil and pencil pitch) by-products such as tar, lampblack, and spent oxide materials.

Site Groundwater

Groundwater can be found in three hydrologic zones at the Site: the Unconfined Surficial Fill Water-Bearing Zone (WBZ), the Semi-Confined Alluvial Sand WBZ, and the confined bedrock aquifers in the Columbia River Basalt. A low permeability silt unit separates the Surficial Fill and the Alluvial Sand WBZs over most of the Site.

Groundwater levels within the Surficial Fill WBZ vary seasonally and average between 9 and 27 feet below ground surface (bgs). 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, although the low permeability silt unit that separates these units restricts vertical flow.

The overall groundwater flow direction within the semi-confined Alluvial Sand WBZ is also directed northeast towards the Willamette River. Hydraulic gradients are greatest in the central portion of the Site, but diminish near the riverbank. Groundwater in the underlying basalt unit exists primarily as isolated confined aquifers in the permeable fracture zones between the individual basalt flows.

1.2 Site Use

The Site has remained industrial since it was first developed in the early 1900s. All subsequent development adjacent to the Site has also been for industrial purposes. In a

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memorandum dated July 16, 1998, DEQ determined that the current and reasonably likely future land use for the property is industrial (DEQ 1998).

The 1998 DEQ evaluation was later supplemented in a letter from HAI dated April, 15, 2000 (HAI 2000). The only outstanding issue identified by DEQ in its response on March 1, 2001 (DEQ 2001a), was the potential for the Basalt WBZ to be in the Locality of Facility (LOF) and potentially subject to future industrial uses. NW Natural proposed to provide institutional controls to prevent such use of this zone (NWN 2002), and DEQ agreed (DEQ 2003a). Consequently, no further evaluation of this basalt zone has been conducted either for the RI or this risk assessment. The following subsections summarize the other land and water use determinations that have been made through these previous efforts and discussions.

1.2.1 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, DEQ has determined that the current and reasonably likely future use of properties located between the river and U.S. Highway 30 is industrial (DEQ 1998).

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, DEQ has determined that the reasonably likely future use of off-site properties located west of U.S. Highway 30 is residential (DEQ 1998).

1.2.2 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 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

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seepage; however, recent pumping by Site personnel has resulted in much lower levels. Furthermore, the LNG containment basin does not contain suitable ecological habitat to support avian or aquatic receptors. Although there are likely no current or future beneficial uses of on-site surface water, pathways that include surface water will be evaluated in this risk assessment.

1.2.3 Off-Site Surface Water

Off-site surface water is not evaluated in this current risk assessment. Off-site surface water risks will be evaluated after completing the Willamette River source control investigations which are currently being completed under the direction of DEQ. In addition, the Siltronic Remedial Investigation/Feasiblity Study (RI/FS) includes similar evaluations of surface water for that site.

1.2.4 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 the Surficial Fill and the Alluvial zones has not historically been, nor is it currently, used for any beneficial uses within the study area.

Groundwater within the Basalt WBZ under the Site historically has 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. NW Natural has agreed to accept institutional controls precluding use of the Basalt WBZ at the property (DEQ. 2001a)

Additionally, the readily available nature of the municipal water supply to any new user, as well as the fact that all property within the vicinity of the LOF is currently connected to the municipal water supply, indicate that the future use of groundwater within the LOF for any purpose other than surface water recharge is not reasonably likely.

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1.2.5 Off-Site Groundwater

Off-site groundwater is not included in the LOF and is not evaluated in the current risk assessment.

1.3 Summary of Upland Data

NW Natural and the DEQ entered into an agreement for the completion of an RI/FS (DEQ Agreement No. ECVC-WMCVC-NWR-94-13) for the Site in 1994. RI activities were subsequently implemented by NW Natural in September 1995. The Preliminary Phase I RI (HAI 1998) was completed in 1998. Post-RI results were collected under a supplemental sampling program documented in correspondence from HAI to DEQ dated August 15, 2000. Surface and subsurface soil samples from approximately 21 locations throughout the study area were collected (Figure 1-2). Additional investigations have been conducted since that time, and have been included in quarterly progress reports to DEQ. This section summarizes the results of the groundwater and soil investigations conducted at the Site through the end of 2003. Additional data collections are ongoing for specific purpose (e.g., source control evaluation), but results were not available in time for incorporation into this risk assessment.

1.3.1 Groundwater

Preliminary groundwater sampling occurred in 1995 during the Phase I Preliminary RI. Groundwater monitoring at the Site has occurred on a quarterly basis since completion of the Phase I RI. Prior to 2004, a total of 25 monitoring wells (14 locations with multiple depths) have been installed at the Site (Figure 1-2). Twelve of the wells are screened within the Surficial Fill WBZ, 11 are screened in the Alluvial Sand WBZ and two are screened between the Surficial Fill WBZ and the Alluvial Sand WBZ. Three additional monitoring wells (the MW-16 well cluster) were being installed adjacent to the river at the Site at the time of this revision to assist in ongoing source control evaluation activities.

The Phase I RI (HAI 1998) and associated quarterly reports (e.g., HAI 2002) provide detailed descriptions of the available groundwater quality data for the Site. These groundwater characterization data demonstrate that both the Surficial Fill and portions of the Alluvial Sand WBZs contain elevated concentrations (above area background) of

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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 downgradient 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 the chemicals noted above.

1.3.2 Surface Water

Surface water samples were taken from the temporary pond and drainage ditch present in the Tar Pond area. These data have been compiled by HAI and are summarized in the data tables of HAI (2002).

1.3.3 Soil Data

The majority of the upland soil data for the Site was collected during 1995 and 1996 as part of the Phase I Remedial Investigation (HAI 1998). As of December 2003, in total, 52 soil borings (B-1 through B-52), 15 monitoring well clusters (MW-1 through MW-15), and four geotechnical soil borings (GT-1 through GT-4) were used to evaluated soil contamination at the Site. Figure 1-2 presents an overview of Phase 1 RI sample locations and Appendix A contains a summary of the soil data used in the risk assessment.

Field observations as identified in soil boring logs, and as summarized on HAI data tables (2002) indicate that residual tar, oil, and carbon pitch solids are present in soils at the Gasco site.

Oil and tar have been differentiated in the field by their physical characteristics. Specifically, tars are observed as black, viscous to semi-solid material, while oils are observed as a brown to black liquid or a patchy coating on soils.

Carbon pitch solids refer to a dry black granular or powdery material derived from the coal or petroleum coking process. Two types of carbon pitch solids are known to be present at the site: the first, lampblack, is a by-product of the former Gasco oil gas MGP

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process, while the second, pencil pitch or solid carbon pitch, is a Koppers and KII product derived from coal tar. The Gasco operation stored piles of lampblack at the site, which in turn was used for production of lampblack briquettes that were distributed as a fuel source or for use by the aluminum industry. Solid coal tar pitch (pencil pitch), managed on the Site by Koppers and KII, is a raw material supplied to the aluminum industry for use in preparation of carbon anodes. As the physical and chemical properties of lampblack and pencil pitch are similar, it is difficult to distinguish between the two, and therefore both materials may be referred to generically as solid carbon pitch.

Residual oil has been identified in soil borings installed throughout the southern and central portion of the site, primarily corresponding to the locations of the former Light Oil Plant/Koppers Tank Farm and the adjacent rail spur, northeastward through the former Tar Ponds, and northwestward through the area of the former Retort Area. Additionally, two apparently small and isolated areas of residual oil contamination have been identified in borings installed in the vicinity of the former Spent Oxide Storage area (MW-1 and B-1) and the FAMM tank farm (GT-1).

The distribution of oil within soils across the sites suggests that multiple source areas for the contamination exist. However, the widespread nature of oil impacts within the surficial fill across much of the southwestern and southeastern portions of the property make interpretation of individual sources difficult. Even so, the varying depth of residual oil and dense non-aqueous phase liquid (DNAPL) occurrence across the property is indicative of several likely overall sources, including the former Light Oil and Koppers Tank Farm and adjacent railway siding; the former Retort Area; the former Coke Oven/Koppers Land Disposal Area; and the former Tar Settling Ponds/Drainage Area.

In addition to oil, a highly viscous to semi-solid tar was identified during the investigation in a number of soil borings at the Site. Specifically, tar has been identified in soil borings installed throughout the southeastern portion of the site corresponding to the location of the Former Tar Ponds and the former drainage feature. Additionally,

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isolated areas of tar were identified at the location of the former Naphthalene Plant (MW-10), and in the FAMM Lease Area at boring B-6.

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 (HAI 1998). Non carcinogenic PAH concentrations at the Site ranged from less than 0.5 milligrams per kilogram (mg/kg) to as high as 20,700 mg/kg. Carcinogenic PAH (cPAH) concentrations ranged from 0.03 to 8,480 mg/kg. The highest PAH and cPAH concentrations were detected in soil borings located near historic shoreline fill materials within the former drainage feature. Total BTEX concentrations in Site soils ranged from 1.3 to 360 mg/kg (maximum values was for benzene), 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 Site is associated with the spent oxide material, which was likely incorporated into fill used at the Site. As such, detectable cyanide concentrations were present over much of the Site.

1.3.4 Contaminants of Interest

Based on the investigations conducted at the Site, a contaminant of interest (COI) list was prepared for use in conducting previous screening level risk assessments (Anchor 2001a). 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 is located in Appendix A.

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Table 1-1
Site Contaminants of Interest

Metals and Inorganics	Monocyclic Aromatic Compounds	Polycyclic Aromatic Compounds
Antimony	2,3,4,6-Tetrachlorophenol	Acenaphthene
Arsenic	2,4,5-Trichlorophenol	Acenaphthylene
Beryllium	2,4,6-Trichlorophenol	Anthracene
Cadmium	2,4-Dichlorophenol	Benzo(a)anthracene
Chromium IV	2,4-Dinitrophenol	Benzo(a)pyrene
Copper	2-Chlorophenol	Benzo(b)fluoranthene
Lead	2-Methyl-4,6-Dinitrophenol	Benzo(g,h,i)perylene
Mercury	2-Methylphenol	Benzo(k)fluoranthene
Nickel	2-Nitrophenol	Chrysene
Selenium	3-Methylphenol	Dibenzo(a,h)anthracene
Silver	4-Chloro-3-Methylphenol	Fluoranthene
Thallium	Antimony	Fluorene
Zinc	Arsenic	Indeno(1,2,3-cd)perylene
Cyanide	Beryllium	Naphthalene
	Cadmium	Phenanthrene
	4-Methylphenol	Pyrene
	4-Nitrophenol	
	Benzene	
	Ethylbenzene	
	Pentachlorophenol	
	Phenol	
	Toluene	
	Xylenes	

1.3.5 Locality of Facility and Nature Extent of Contamination

"Locality of Facility," (LOF) 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 the Gasco LOF, 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 DEQ in correspondence dated August 1, 1997 (HAI 1997).

As presented in the previous RI Reports, the lateral extent of soil and groundwater contamination associated with the Site has been found to be primarily restricted to the Site boundaries. Two exceptions are the presence of tar and contaminated sediments

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within the Willamette River adjacent to the Site and soils and groundwater at the Siltronic facility to the southeast.

Vertically, soil and groundwater impacts have been identified within the Surficial Fill WBZ, as well as within portions of the Alluvial Sand WBZ. The most widespread contaminant impacts at the Site 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 Site and has prevented the vertical migration of contaminants to the underlying Alluvial Sand WBZ in most areas. There is impact to the upper portion of the Alluvial Sand WBZ downgradient of the primary area of former waste placement (i.e., former effluent discharge area and adjacent tar 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 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 DEQ, the LOF, as it pertains to soil and groundwater contamination, has been defined as the boundaries of the Site itself. With regard to the hydrogeologic WBZs, both the Surficial Fill and the Alluvial Sand WBZs beneath the Site are included within the LOF. Site data indicate little potential for the presence of impacts to WBZs within the bedrock. DEQ has previously indicated there was the potential for the Basalt WBZ to be in the LOF and potentially subject to future industrial uses. NW Natural has offered to provide institutional controls to prevent such use of water in the Basalt WBZ (NWN 2002), and DEQ agreed (DEQ 2003a). Consequently, no further evaluation of the Basalt WBZ has been conducted either for the RI or this risk assessment.

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Soil and groundwater contamination extends beyond the Site boundary to the southeast to the Siltronic site. A separate investigation is being conducted to evaluate the need for source control to the Willamette River at that site. Thus, the Siltronic site is not included in the Gasco Site LOF.

1.4 Summary of Previous Risk Assessments

A Level II Risk Screening for Human Health and Ecological Receptors was completed for the Site in February 2001 (Anchor 2001a) following DEQ Guidance (DEQ 2002a and 2000). This risk-screening document presented a conceptual Site model, which outlined the potential pathways from chemicals present in Site soils and groundwater to receptors potentially occurring on the Site. DEQ requested additional details regarding pathways and receptor selection (DEQ 2001b). An Interim Technical Memorandum was submitted in response to these comments later in 2001 (Anchor 2001b). Final agreement was reached on the human health and ecological receptors and pathways, as described in letters from DEQ (DEQ 2002b and DEQ 2003a) and NW Natural (NWN 2002). This agreement also established the COPCs for the Site, which are summarized in Table 1-2.

A draft Baseline Level III Ecological and Human Health Risk Assessment was completed in June 2003 (Anchor 2003). Based on comments from DEQ, it was concluded that the ecological portion of the risk assessment would be more efficiently evaluated as a Level II Screening Level assessment, while the Human Health section will continue as a Level III assessment. This approach was agreed to by DEQ Site Manager, Matt McClincy in a meeting on June 11, 2004.

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Table 1-2
Site Chemicals of Potential Concern

	Ecological COPC	Human Health COPC
Metals and Inorganics		
Chromium IV	-	X
Zinc	X	-
Monocyclic Aromatic Compounds		
Benzene		X
Xylenes	X	X
Polycyclic Aromatic Compounds		
Acenaphthene	X	-
Acenaphthylene		X
Anthracene	X	-
Benzo(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene	X	X
Benzo(g,h,i)perylene	X	X
Benzo(k)fluoranthene	X	X
Chrysene	X	X
Dibenzo(a,h)anthracene	X	X
Fluoranthene	X	-
Fluorene	X	-
Indeno(1,2,3-cd)pyrene	X	X
Naphthalene	X	X
Phenanthrene	X	X
Pyrene	X	-

X = COPC to be assessed in Risk Assessment
- = Not a COPC

1.5 Assessment Objectives and Scope

The primary objective of the Level II Ecological Risk Assessment (ERA) and the Level III Human Health Risk Assessment (HHRA) is to determine risks related to chemicals in upland matrices in sufficient detail so that the FS can proceed. The risks determined are related to the spatial characteristics of the exposure for each receptor. For example, occupational human health risks are generally associated with areas of the Site where people conduct work. Consequently, this risk assessment does not provide a numeric level or cleanup goal for each matrix. Rather, the risk assessment defines the level of risk that may exist at the Site given the current and likely future Site configuration and uses by

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people and organisms. This approach is consistent with DEQ as well as EPA guidance on risk assessment (DEQ 2002a and 2000; EPA 1999).

However, the calculations conducted within this risk assessment can be used in the future FS to determine risk-based cleanup goals or other measures of remediation such as residual risk assessments as needed for that purpose.

As noted above, the scope of this risk assessment is limited to chemicals in upland matrices and does not include evaluation of chemical risks in the Willamette River or due to any potential pathway to the river. These risks are being evaluated in the Portland Harbor RI/FS.

Per DEQ's guidance, this document describes estimates of baseline risks currently present at the Site. NW Natural anticipates that there will be a re-development opportunity for the Site in the former Tar Pond area, and/or a removal action that addresses the elevated soil concentrations present in that area. To that end, parallel with developing this risk assessment, NW Natural has submitted a decision scoping document for a removal action in the former Tar Pond area. The action that is ultimately taken in that area will have a significant effect on reducing Site-wide risks. Therefore, a risk assessment that evaluates residual risk following an action at this location will be presented in future submittals.

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2 ECOLOGICAL SCREENING LEVEL RISK ASSESSMENT

This section contains the methods and results of the Level II ERA conducted for the Site. The purpose of the ERA is to determine risks to ecological receptors related to chemicals in upland matrices under existing Site conditions.

2.1 Site Survey

A Site survey was completed in the Level II Risk Screening (Anchor 2001a). The overall objective of the Site survey was to gather the site-specific qualitative and semi-quantitative data necessary for identifying relevant and complete contaminant-pathway-receptor relationships. The survey included a habitat/vegetation inventory and a terrestrial receptor observation.

The survey used visual and physical observations such as the presence of scat, animal tracks, and/or night-time bedding area, as well as actual observations of animals. The 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.

Five habitat types were identified at the Site and are presented in Figure 2-1:

Beach/riverbank (approximately 1.2 acres)
Industrial/paved (approximately 27.2 acres)
Grass/low shrub (approximately 8.8 acres)
High shrub/tree (approximately 2.6 acres)
Pond/ditch (approximately 1.1 acres)

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0 250 500 1,000
Scale in Feet

Figure 2-1
Ecological Habitats
NW Natural Gasco Site

Type 1 (beach/riverbank) is sparsely vegetated, with algae on the lower elevation soils and some vegetation in the riprap on the bank slope. 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 and is occasionally interspersed with Type 4. 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 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 portions of the Site. The southeast has a number of mature cottonwoods (*Populus balsamifera*) and willows. There are at least three 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 three 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 riverbank 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 stormwater/ effluent settling ponds, associated drainage ditch, and the seasonal pond near the northern portion of the site in Spent Oxide area. Common rush (*Juncus effusus*) is found at edge of the ponds and ditch. There is an

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alder (*Alnus rubra*) tree by the ditch that is probably about 10 years old. The ponds were completely dry at the August Site visit.

Animals observed on-site during numerous Site visits between March and September 2000 include various species of songbirds, killdeer, insects, deer, Canada geese, egrets, nutria, and dogs. Animal scat indicates use of the Site by geese, dogs, and deer. Larger mammals are suspected to be temporary visitors to the site from their larger habitat in Forest Park. 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.

2.2 Site Specific Ecological Receptors

Per DEQ Guidance (2002a), particular species that are known to exist on or near the site are chosen as representatives for each of the ecological receptor group categories. Thus, it is necessary to have at least one species selected that is representative of each of the potential contaminant pathways.

To begin the species selection process, a working list of species that are potentially present on or around the site was developed. Potential ecological receptors at the 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), from observations made during Site visits (described above), and from discussions with DEQ.

Terrestrial wildlife species known or projected 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*). The existing documentation did not include any large mammalian predators, although the two most likely mammalian predators in the area are feral dogs (*Canis familiari*) and coyotes (*Canis latrans*) (Forbes 1990).

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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. Based on the Audubon Society's list (Davis 1984) for habitat and feeding needs, the two most likely avian species at the Site would be the killdeer (*Charadrius vociferou*) and the Northern flicker (*Colaptes auratus*). Bewick's wren (*Thyromanes bewickii*), European starling (*Sturnus vulgaris*), Brewer's blackbird (*Euphagus cyanocephalus*), and American robin (*Turdus migratorius*) also appear to be likely potential species in the area.

Threatened and endangered species that may potentially utilize the study area habitats include the peregrine falcon and the bald eagle. 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 (Anchor 2001b). But according to a DEQ letter of March 26, 2001, bald eagles have been observed downstream of the Site. Furthermore, there are three peregrine falcon nests along the Willamette River in the Portland area (Audubon Society 2001). The nests are on the Fremont Bridge (the 405 bridge) about 5 miles southeast of the Site, the St. Johns Bridge about 0.25 mile downstream, and the Abernathy/Route 205 bridge about 20 miles upstream. Neither bald eagles nor peregrine falcons have been observed at or near the Site during biological surveys. Of the two species, peregrine falcons would more likely utilize the Site habitat for hunting because their primary diet consists mostly of birds, whereas the bald eagle diet consists mostly of fish. Based on this information, peregrine falcons have been selected as the threatened or endangered (TE) species in this risk assessment, rather than bald eagles.

Representative ecological receptors identified for the Site include garter snake, shrew, killdeer, American kestrel, and TE species (DEQ 2002b). The peregrine falcon was selected as the most likely TE species to have a complete and significant pathway to COPCs. This information was reviewed in detail in Anchor (2001b).

2.3 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

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receptors. The fate and transport steps that determine potential complete pathways are discussed below.

2.3.1 Chemical Sources

The source of the COPCs discussed in this document is a result of historic operations at the Site. Historic operations have led to direct and indirect transport of COPCs 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.

2.3.2 Transport Media

Due to historical operations, chemicals may now be present in soils or groundwater. 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 groundwater 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. COPCs 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.

2.3.3 Points of Environmental Contact

Terrestrial plants and animals may be in contact with soils, transitory surface waters, or airborne COPCs. Theoretically, some larger plants (like trees) could also be in contact

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with groundwater. However, there is no well-developed plant community on Site with extensive root systems; therefore, groundwater is expected to be an unlikely point of contact for plants. Similarly, no evidence of extensive burrow systems was observed on Site. Therefore, burrowing to depths of groundwater (greater than 8 feet[1]) by key animal receptors appears unlikely. However, if some burrowers are present, they would likely contact subsurface soils (deeper than 0.2 feet). A depth of 3.5 feet bgs was chosen as a conservative approach to addressing receptors that may burrow extensively (see detailed discussion in Anchor 2001b).

Exposure of plants to surface water (rainwater percolating through soils) is considered significant because this is the primary source of water available for plant growth. However, plant uptake is primarily considered as a function of the soil's chemical concentrations (ORNL 1998). Because these uptake rates are all based on experiments or observations of plants in watered soils, the surface water component can be considered as a part of the soil's uptake path. Surface water is also present intermittently in ponds and ditches at the Site. However, there are no significant aquatic plant communities associated with these intermittent water features. Consequently, a pathway from these surface water features to plants is not considered significant.

Soils that contact animals are assumed to be periodically wetted by surface water (e.g., rain/runoff). Therefore, the primary issue regarding animal exposures to surface water is contact with and use of intermittent surface water features (i.e., ponds and ditches). This exposure is expected to be significant for some but not all animals living on or frequenting the site. Small mammals living in close proximity to intermittent ponds or ditches may drink surface water from these features. Similarly, birds may occasionally drink from or alight on intermittent surface water features. Other animals may rarely, if ever, drink from these intermittent surface water features. Consequently, the surface water pathway may be significant for some animal receptors but not others.

[1] Of the 521 groundwater level measurements taken from 25 wells over 5 years, only five measurements were shallower than 5 feet bgs. The average groundwater level was deeper than 8 feet bgs for all 25 monitoring wells. The 5th percentile groundwater level was shallower than 5 feet bgs at all wells with one exception (MW-9-29 with a 5th percentile level of 4.77 feet bgs).

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2.3.4 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 2.2, the potential ecological receptors at this Site are limited due to the Site's 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 likely not relevant in terms of long-term exposures and potential Site cleanup decisions. However, DEQ has requested that surface water be screened for this site and this screening has been conducted.

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. Consequently, the air

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uptake route is considered potentially complete but relatively insignificant in terms of overall exposure as compared to soils.

2.4 Preliminary Conceptual Site Model

Based on the information discussed in the previous sections, a preliminary conceptual Site model was developed and is shown in Figure 2-2. The likely complete and significant pathways at the Site are from soils to primary plants and animals. It is conceivable that higher level secondary consumers may be exposed to potentially bioaccumalative compounds (PAHs), but due to the limited ecological habitat, the Site is not expected to support appreciable populations of higher level predators.

Because the vast majority of COPCs found in the various Site areas are not volatile chemicals (see Section 2.6), 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 animals. This is because groundwater levels are too deep (greater than 8 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.

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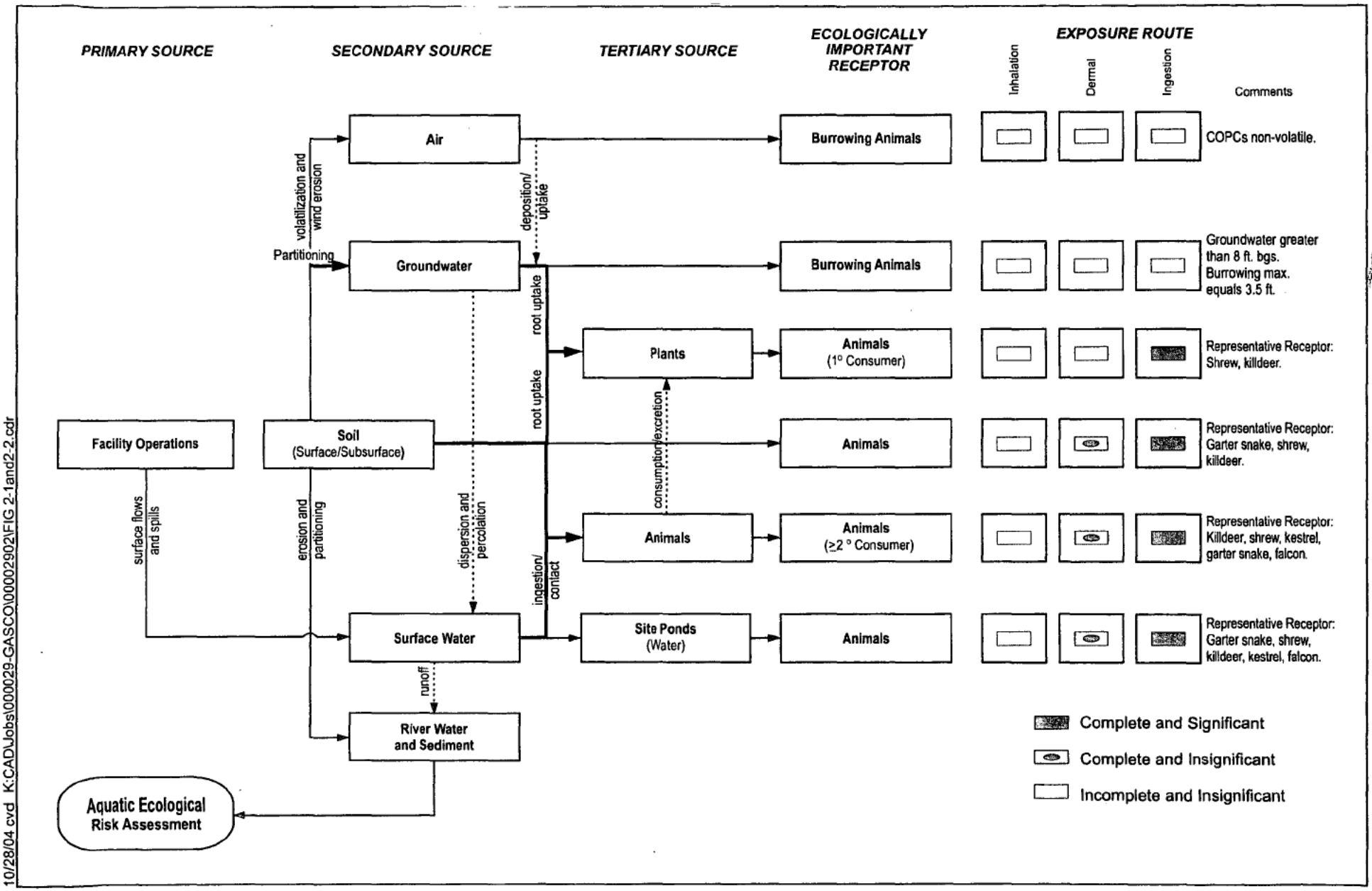

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Figure 2-2
Ecological Conceptual Site Model
NW Natural "Gasco" Site

2.5 Candidate Assessment Endpoints

Based on the information presented in the previous sections, the following candidate assessment endpoints are proposed:

- Protection of mammalian and avian primary consumers (herbivores) from population level effects due to COPCs.
- Protection of endangered avian secondary consumers (predators of soil invertebrates) from individual level effects due to COPCs.

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.

2.6 Contaminants of Potential Ecological Concern

The soil COPCs for the Site were identified in the Level II Risk Screening Report completed in February 2001 (Anchor 2001a). Because new Screening Levels Values (SLVs) have been promulgated since the initial Risk Screening Report was completed, and because additional results have been included in the Site database, chemistry at the Site was re-screened per DEQ 2002 guidance (DEQ 2002a). Both soil chemistry and surface water chemistry results were used in the screening. Consistent with the initial Risk Screening Report, groundwater was not expected to provide relevant and complete pathways for chemicals to the candidate ecological receptors; therefore, this media was not included in the evaluation (see Section 2.4 for more details).

2.6.1 Soil

For this evaluation it was assumed that chemicals in soil were evenly distributed across the ecological receptors' habitat and that foraging occurs randomly within this area. Only soil samples from the upper 3.5 feet bgs were included in this evaluation, consistent with Anchor (2001b). Using subsurface data to a depth of 3.5 feet is considered a conservative approach (more likely to find risks) because potential exposure to contaminants at this depth would only be anticipated for receptors that burrow extensively (DEQ 2004). Other receptors would not be expected to contact subsurface soils extensively. Exposure concentrations (ECs) for terrestrial and avian species exposed to soil within the Site were calculated based on the upper 90th

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percentile confidence level on the mean, which is consistent with DEQ (2002a) methods. If the 90th percentile confidence level on the mean was greater than the maximum concentration, then the maximum concentration was used for the EC.

2.6.2 Surface Water

Because surface waters in different locations move relatively rapidly (as compared to soils or groundwater) and mix over time, it was assumed that all surface water samples represent the range of exposure that would be present from surface waters regardless of receptor location. Consequently, ECs for terrestrial and avian species exposed to surface water within the Site were calculated based on the upper 90th percentile confidence level on the mean, which is consistent with DEQ (2002a) methods. If the 90th percentile confidence level on the mean was greater than the maximum concentration, then the maximum concentration was used for the EC. Because the levels of chemicals in transitory surface waters is mainly determined by the concentrations in surface soils they contact (e.g., rain/runoff), only chemicals listed as soil COPCs were used in the surface water screening assessment.

2.6.3 Screening Methodology

Exposure concentrations were compared to DEQ SLVs (2002a) for surface water and soil receptor groups. If an SLV was not available for a particular chemical, a surrogate chemical SLV from the same receptor group was used (noted in Table 2-1). CPAHs that did not have an SLV available were assigned the SLV for benzo(a)pyrene for both soils and surface water. Non-carcinogenic PAHs that did not have an SLV available were assigned the SLV for fluorene for soil and naphthalene for surface water. Because no plant, invertebrate, or aquatic receptors were identified as Site-specific ecological receptors of concern (ROCs) (Section 2.2), SLVs for these groups are compared to exposure concentrations for informational purposes only.

To quantitatively rank SLV exceedances, hazard quotients (HQs) were calculated. An HQ is the ratio of an EC to its respective SLV (HQ=EC/SLV). Therefore, HQs greater than 1 represent an SLV exceedance.

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2.6.4 Screening Results

The results of the screening evaluation are summarized in Table 2-1 and Table 2-2. Spatial presentation of the screening results by location is shown in Figure 2-3, Figure 2-4, and Figure 2-5. The value presented in these figures is the maximum HQ from the receptor groups. These figures are for informational purposes, an exceedance at a single location does not necessarily imply risk because the exposure point concentration is based on the 90th percentile upper confidence limit (UCL) on the mean of all the locations. The raw data used for these calculations is shown in Appendix A. Results are summarized in the following subsections based on chemical group.

2.6.4.1 Metals

Zinc was identified as a COPC in the Level II Risk Screening Report (Anchor 2001a). Zinc did not exceed the mammal or invertebrate SLVs for soil. Zinc was not analyzed in surface water and was therefore unavailable for screening. The concentration did exceed the bird and plant SLVs for soil, although it is important to note that the plant SLV is not considered relevant to this evaluation because plant ROCs were not identified in Section 2.2. As shown in Figure 2-3, zinc soil concentrations above SLV criteria were greatest near the Former Spent Oxide Area and at one location by the building in the Koppers area.

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Table 2-1
Ecological Screening Results for Soil

Chemical	Unit	EC (90th UCL)	SLV Receptor	SLV	HQ
Acenaphthene [a]	µg/kg	120864	30000	Invertebrates	
Acenaphthene	µg/kg	120864	20000	Plants	
Anthracene [a]	µg/kg	84890.6	30000	Invertebrates	
Benzo(a)anthracene [b]	µg/kg	66446.6	125000	Mammals	0.5
Benzo(a)pyrene	µg/kg	77361.6	125000	Mammals	0.6
Benzo(b)fluoranthene [b]	µg/kg	73165.1	125000	Mammals	0.6
Benzo(g,h,i)perylene [b]	µg/kg	63250.9	125000	Mammals	0.5
Benzo(k)fluoranthene [b]	µg/kg	42699.8	125000	Mammals	0.3
Chrysene [b]	µg/kg	84223.2	125000	Mammals	0.7
Dibenzo(a,h)anthracene [b]	µg/kg	12029.5	125000	Mammals	0.1
Fluoranthene [b]	µg/kg	227675	125000	Mammals	1.8
Fluorene	µg/kg	78046.7	30000	Invertebrates	
Indeno(1,2,3-cd)pyrene [b]	µg/kg	49746.2	125000	Mammals	0.4
Naphthalene [a]	µg/kg	585981	30000	Invertebrates	
Naphthalene	µg/kg	585981	10000	Plants	
Naphthalene	µg/kg	585981	3900000	Mammals	0.2
Phenanthrene [a]	µg/kg	387563	30000	Invertebrates	
Pyrene [b]	µg/kg	282185	125000	Mammals	2.3
Xylene	µg/kg	16214.4	100000	Plants	0.2
Xylene	µg/kg	16214.4	120000	Mammals	0.1
Zinc	mg/kg	144.298	50	Plants	
Zinc	mg/kg	144.298	60	Birds	2.4
Zinc	mg/kg	144.298	200	Invertebrates	0.7
Zinc	mg/kg	144.298	20000	Mammals	0

Notes:

Yellow = result exceeds SLV for receptor group of concern
= result exceeds SLV for receptor groups not identified as being of concern
90th UCL calculated per DEQ guidance - using ½ the reporting detection limit (RDL) for non detects
SLVs derived from DEQ guidance for ecological risk assessment - Level II SLV
HQ - Hazard quotient (EC/SLV)
a Fluorene used as surrogate for non-carcinogenic PAHs, no SLV available
b Benzo(a)pyrene used as surrogate for cPAHs, no SLV available

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Table 2-2
Ecological Screening Results for Surface Water

Chemical	Unit	EC (90th UCL)	SLV Receptor	SLV	HQ
Acenaphthene [a]	mg/l	1.61E-03	Mammals	284	0.0
Acenaphthylene [a]	mg/l	3.83E-04	Mammals	284	0.0
Anthracene	mg/l	4.04E-04	Aquatic	1.30E-02	0.0
Anthracene [a]	mg/l	4.04E-04	Mammals	284	0.0
Benzo(a)anthracene	mg/l	2.37E-04	Aquatic	2.7E-05	
Benzo(a)anthracene	mg/l	2.37E-04	Mammals	8	0.0
Benzo(a)pyrene	mg/l	3.32E-04	Aquatic	1.4E-05	
Benzo(a)pyrene	mg/l	3.32E-04	Mammals	8	0.0
Benzo(b)fluoranthene [b]	mg/l	6.47E-04	Mammals	8	0.0
Benzo(g,h,i)perylene [b]	mg/l	5.52E-04	Mammals	8	0.0
Benzo(k)fluoranthene [b]	mg/l	2.15E-04	Mammals	8	0.0
Chrysene [b]	mg/l	3.77E-04	Mammals	8	0.0
Dibenzo(a,h)anthracene [b]	mg/l	7.46E-05	Mammals	8	0.0
Fluoranthene	mg/l	6.77E-04	Aquatic	6.16E-03	0.1
Fluoranthene [b]	mg/l	6.77E-04	Mammals	8	0.0
Fluorene	mg/l	7.00E-04	Aquatic	3.90E-03	0.2
Fluorene [a]	mg/l	7.00E-04	Mammals	284	0.0
Indeno(1,2,3-cd)pyrene [b]	mg/l	3.67E-04	Mammals	8	0.0
Naphthalene	mg/l	1.11E-02	Aquatic	6.20E-01	0.0
Naphthalene	mg/l	1.11E-02	Mammals	284	0.0
Phenanthrene	mg/l	8.04E-04	Aquatic	6.30E-03	0.1
Phenanthrene [a]	mg/l	8.04E-04	Mammals	284	0.0
Pyrene [b]	mg/l	6.88E-04	Mammals	8	0.0

Notes:

= result exceeds SLV for receptor groups not identified as being of concern
90th UCL calculated per DEQ guidance - using ½ the RDL for non detects
SLVs derived from DEQ guidance for ecological risk assessment - Level II screening level values
HQ - Hazard quotient (EC/SLV)
a Naphthalene used as surrogate for non-carcinogenic PAHs, no SLV available
b Benzo(a)pyrene used as surrogate for cPAHs, no SLV available

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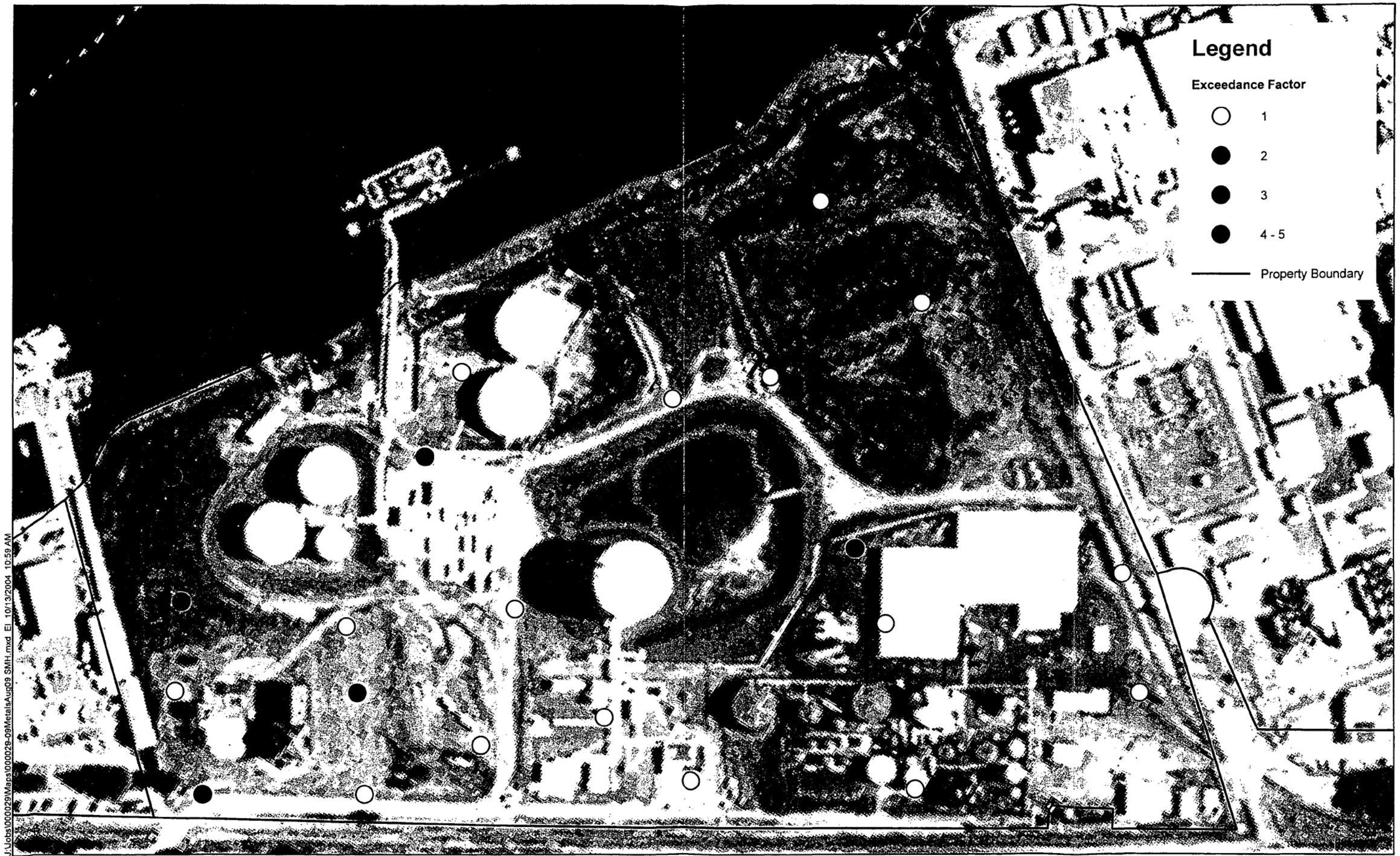

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0 250 500 1,000
Scale in Feet

SLV from DEQ guidance for ecological risk assessment - Level II screening level values
Receptor group with lowest SLV for given contaminant used in this evaluation

Figure 2-3
Zinc Exceedance Factor of SLV Criteria
Soil Upper 3.5 ft bgs
NW Natural Gasco Site

2.6.4.2 *Monocyclic Aromatic Hydrocarbons*

Of the monocyclic aromatic hydrocarbons, only xylene was identified as a COPC in the Level II Risk Screening Report (Anchor 2001a). Xylene did not exceed any of the soil SLVs, and it was not analyzed in surface water.

2.6.4.3 *Polycyclic Aromatic Hydrocarbons*

The PAH group had the largest number of concentrations that exceeded soil and surface water SLVs. The majority of the SLV exceedances for both surface water and soils were from receptor groups not identified in Section 2.2 (i.e., not ROCs). Mammal SLVs for soil were exceeded for both fluoranthene and pyrene. In both cases, the surrogate SLV for benzo(a)pyrene was used because no chemical-specific SLVs were available. Because benzo(a)pyrene is considered more carcinogenic than fluoranthene and pyrene, risks were likely overestimated by using it as a surrogate. Plant and invertebrate SLVs for soil were exceeded for six other PAHs, the highest exceedance was the plant SLV for naphthalene. Aquatic SLVs for surface water were exceeded for benzo(a)pyrene and benzo(a)anthracene, although the aquatic life receptor group was not identified in Section 2.2 as being of concern, these screening values were provided for informational purposes only.

Figures 2-4 and 2-5 show individual locations that did exceed soil SLV criteria for PAHs, the majority of which are in the tar pond area. Figure 2-4 spatially presents the HQ by location for the LPAH compounds. Figure 2-5 spatially presents the HQ by location for the HPAH compounds. These figures are for informational purposes, an exceedance at a single location does not necessarily imply risk because the exposure point concentration is based on the 90th percentile UCL of all the locations.

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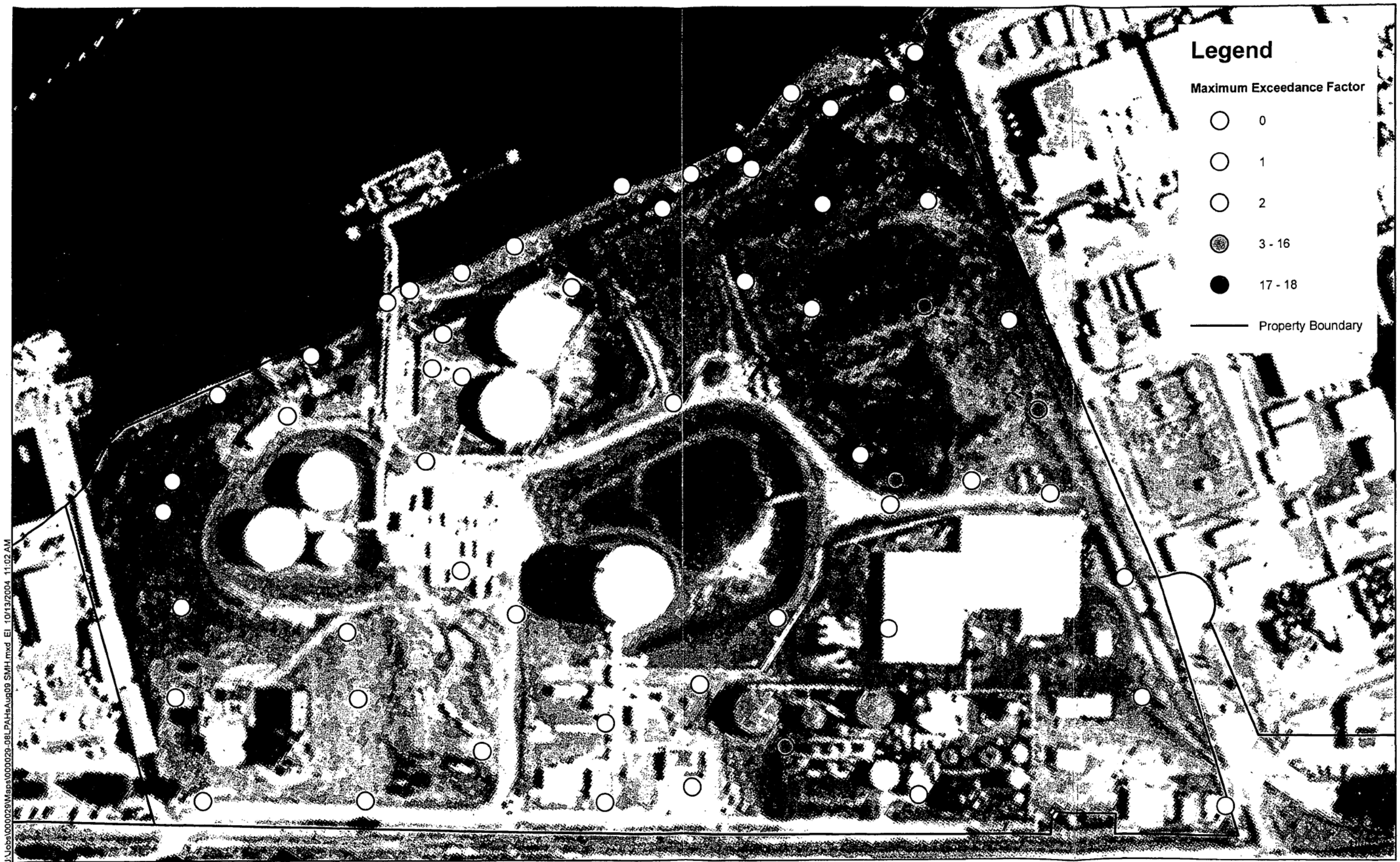

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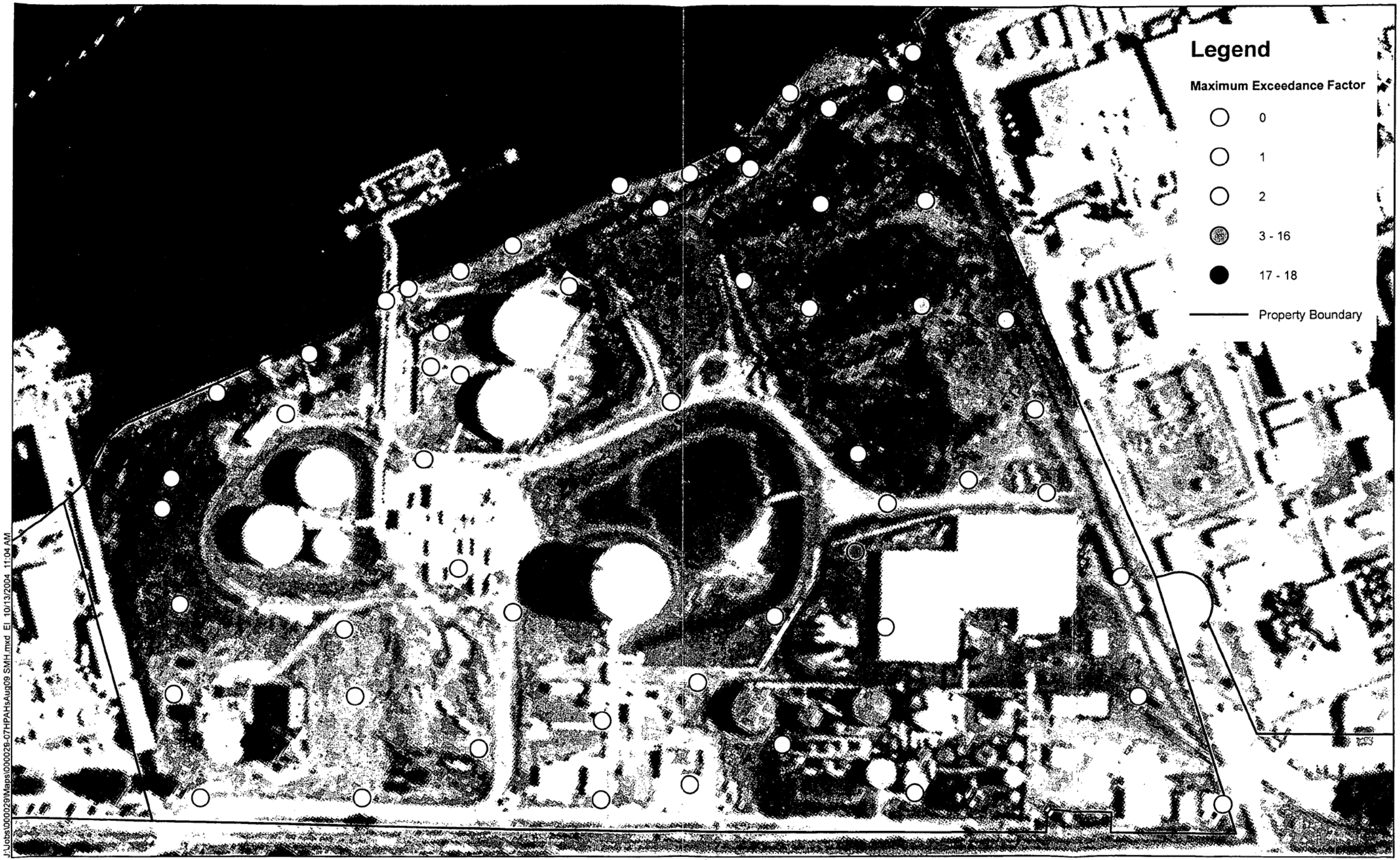
0 250 500 1,000
Scale in Feet

SLV from DEQ guidance for ecological risk assessment - Level II screening level values
Receptor group with lowest SLV for given contaminant used in this evaluation

Figure 2-4
LPAH Maximum Exceedance Factor of SLV Criteria
Soil Upper 3.5 ft bgs
NW Natural Gasco Site



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0 250 500 1,000
Scale in Feet

SLV from DEQ guidance for ecological risk assessment - Level II screening level values
Receptor group with lowest SLV for given contaminant used in this evaluation

Figure 2-5
HPAH Maximum Exceedance Factor of SLV Criteria
Soil Upper 3.5 ft bgs
NW Natural Gasco Site

DEQ guidance (2002a) recommends a discussion of any COPCs that have the potential to bioaccumulate in the food chain. Of the contaminants screened in this report, only the PAHs have the potential for bioaccumulation. One indicator of the propensity for a chemical to bioaccumulate is based on the log octanol/water (K_{ow}) partition coefficient (EPA 1991). 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 (EPA 1991 and Sample et al. 1997). PAHs have K_{ow} numbers in the 3 to 7 range, which may suggests that some of the Site PAHs may bioaccumulate in the food chain. Bioconcentration factors (BCFs) are also used to evaluate the propensity for a chemical to bioaccumulate and are typically used in Level III risk assessments to calculate uptake rates. Because the BCF is based on the ratio of concentration in media to concentration in organism, BCFs of 1 or less suggests that bioaccumulation is not occurring. All PAH compounds have dietary mammal BCFs that are less than 1, often less than ½ (EPA 2000). Therefore, for the purposes of this report, the propensity for PAHs to bioaccumulate was considered unlikely.

2.7 Known Ecological Effects

The known ecological and toxicological effects of the COPCs are discussed in this section. This section provides potentially important physiochemical and toxicity information for each of the COPCs. COPCs 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.

2.7.1 Metals

As discussed in Section 2.3.1, for metals only zinc was consistently detected at levels significantly above its respective SLV. 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

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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.

2.7.2 Polycyclic Aromatic Hydrocarbons

As discussed in Section 2.3.3, only fluoranthene and pyrene were detected at levels significantly above respective SLVs. A variety of toxic effects have been observed for the various PAHs. Although a large body of literature exists on the toxicity and carcinogenicity of PAHs, toxicity data for fluoranthene are very limited. No human data were available that addressed the toxicity of fluoranthene. Toxicity studies in animals have shown that fluoranthene exposure can cause eye irritation, nephropathy, increased liver weights, and increased liver enzyme levels. Pyrene has been determined through laboratory testing of terrestrial animals to cause nephropathy (ORNL 2000). Nephropathy is the disease of the kidney most likely via the ingestion pathway.

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3 HUMAN HEALTH RISK ASSESSMENT

This section contains the methods and results of the Human Health Risk Assessment (HHRA) conducted for the Site. The purpose of the HHRA is to determine risks to people related to chemicals in upland matrices under existing Site conditions. Note that the sections presented in this HHRA generally follow DEQ Guidance (2000), and differ somewhat from the section headings presented for the ERA presented above.

3.1 Problem Formulation

The basis of the problem formulation has been presented in previous documents submitted to DEQ including the Level II Risk Screening (Anchor 2001a) and the Receptor/Pathway Selection Interim Technical Memorandum (Anchor 2001b). This section summarizes that previous work and presents the most recent version of the problem formulation based on DEQ comments on the previous documents (in particular DEQ 2002). It should be noted that the LOF and the extent of contamination that was used in this problem formulation are summarized in Section 1.3.4.

3.1.1 Contaminants of Potential Concern

The COPCs for the Site were identified in the Level II Risk Screening Report completed in February 2001 (Anchor 2001a). Based on this initial screening level assessment chromium VI, benzene, xylene, and PAHs were carried through to the Level III HHRA.

3.1.2 Potentially Exposed Populations, Exposure Scenarios, and Exposure Routes

Potentially exposed populations were determined during the Level II Risk Screening (Anchor 2001a) and the Receptor Pathway Selection Interim Technical Memorandum (Anchor 2001b) and were modified based on DEQ comments on these documents. This information is summarized here.

The 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

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- 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 near the Site (not a current use)

No commercial, residential, or types of uses other than industrial exist 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.

On-Site Worker Population

On-site workers have the potential to be exposed on a regular basis. A previous human exposure pathway 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
- Koppers workers
- Pacific Northern Oil workers

These occupations all have moderate levels of exposures to Site media (e.g., soils and air). 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 to soils, and potentially groundwater, 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 Visitor Population

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

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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. Illegal entry to the site is highly unlikely. Utilities are federally recognized as potential terrorist targets, and federally required site security measures include security fencing around the entire property and regular security guard visual inspections of the property. 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 apply 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 Portland Harbor 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, and is further supported by the enhanced security protocols at the site. That is, the smaller averaging time and body weight for children would be outweighed by the greater assumed exposure duration and frequency (i.e., five days a week for eight hours a day).

Nearby Residential Population

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

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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 to do so in the future. Potential risks associated with this exposure will be evaluated in the Superfund aquatic risk assessment for Portland Harbor.

Current groundwater conditions at the Site are described in Section 1. In summary, groundwater contamination is limited to within the Site boundaries (except the Siltronic site which is being assessed separately – see Section 1) 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, both from a beneficial use and from a fate and transport perspective.

Exposure Scenarios

The above indicates the most representative exposure scenarios for this Site are:

- Occupational (on-site workers and visitors)
- Excavation workers involved in temporary excavation activities such as trenches or pits

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 EPA default scenario descriptions (DEQ 2000). Exposure assumptions in the Level III baseline risk assessment have been set to those defined in DEQ (2000) guidance for "Occupational Adult" and "Excavation Worker."

Exposure Routes

Based on the discussion of likely exposed populations, the following exposure routes were selected:

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1. Occupational (covers worker, visitor, and trespasser exposures)
   a. Incidental ingestion of soil
   b. Dermal contact with soil
   c. Outdoor inhalation of airborne chemicals (dust and volatiles) from soils and groundwater
   d. Indoor inhalation of airborne volatile chemicals from groundwater
2. Excavation Worker
   a. Incidental ingestion of soil
   b. Dermal contact with soil
   c. Inhalation of airborne chemicals (dust and volatiles) from soils and groundwater
   d. Dermal contact with groundwater (where present at shallower than 12 feet bgs).

The most likely exposure routes are from soils or airborne chemicals from soils. Groundwater is not and will not be used on-site for any purpose. Thus, the groundwater route to industrial workers is incomplete, with the exception of volatilization of chemicals from groundwater through soils to the soil surface. DEQ has indicated that excavation workers would be expected to have exposures up to 12 feet bgs. Consequently, where groundwater frequently occurs above this level, excavation workers' exposure to groundwater via dermal contact is conceivable.

Surface waters are transitory on-site, so any exposures to either type of worker would be of very short duration and frequency, and are expected to be insignificant in comparison to soils exposures. There are no occupations on the Site that routinely bring workers in contact with these transitory surface waters. Further, the concentrations of chemicals in transitory surface waters would be primarily determined by the soils they contact.

3.1.3 Conceptual Site Model

The conceptual Site model is shown in Figure 3-1. The model is based on the exposure populations, scenarios, and routes discussed in the previous sections.

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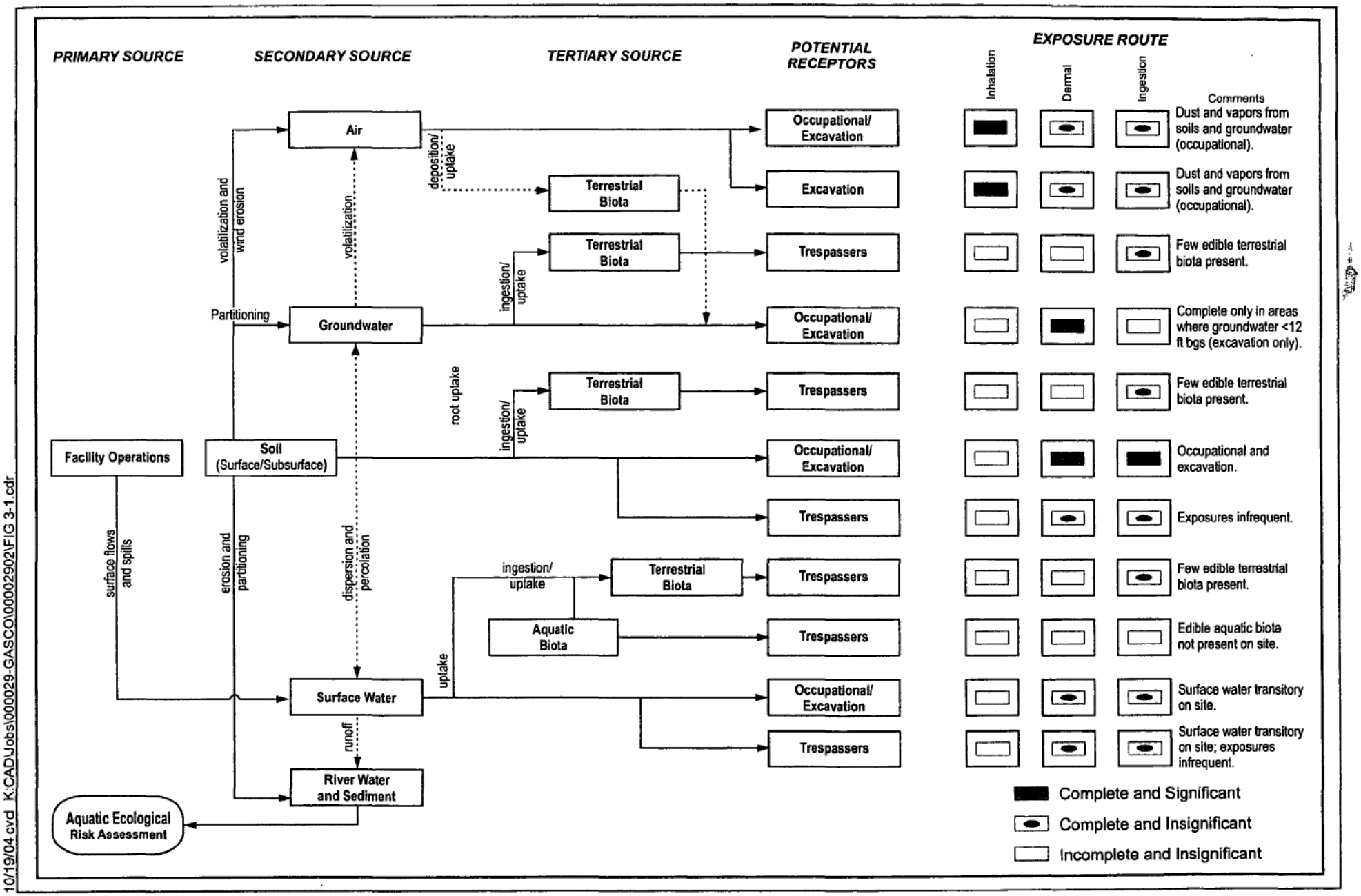

10/19/04 cvd K:CAD\Jobs\000029-GASCO\00002902\FIG 3-1.cdr

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Figure 3-1
Human Health Conceptual Site Model
NW Natural "Gasco" Site

3.2 Exposure Analysis

Exposure analysis quantifies the level of exposure for each of the significant and complete scenarios defined in the previous section. For this Site, the occupations involved generally require workers to be in specific areas of the Site. At the same time, the concentrations of chemicals vary considerably over various portions of the Site. For both of these reasons, the human health exposure analysis (and subsequent risk characterization) was conducted for five sub-areas of the Site shown in Figure 1-2. Using this approach, it can be determined whether certain areas of the Site and/or certain occupations that work within these areas would likely pose risk.

3.2.1 Exposure Point Concentrations

Consistent with the significant and complete pathways shown in Figure 3-1, exposure point concentrations were determined for soils and groundwater. Concentrations were determined for each sub-area shown in Figure 1-2. Sub-areas were further differentiated based on the potential for re-development activities. Areas where re-development may occur are identified in Figure 3-2. It is important to note that for most of these areas no specific re-development plans have been identified by NW Natural. Rather, these areas were primarily identified by the absence of ongoing activities at the request of DEQ. Soils data were vertically segregated within each area into occupational exposures—down to 3.5 feet bgs; and excavation exposures—down to 12 feet bgs in re-development areas and down to 3.5 feet in areas that will not likely be re-developed. Groundwater data from the fill unit were used to determine reasonable maximum estimates (RME) and central tendency estimates (CTE) estimates for each sub-area. If no data were available for particular chemicals from wells screened in the fill unit, data from the alluvial unit were used for those chemicals only. If no relevant groundwater data for particular chemicals was available for that sub-area in either the fill or alluvial unit, then the groundwater concentration was set to zero for that sub-area. Appendix A contains all data used in the determination of exposure point concentrations. Appendix D contains the resulting RME and CTE estimates used for each sub-area and exposure pathway.

Following DEQ guidance (2002a and 2000), the upper 90th confidence limit on the mean was used for the RME, and the mean was used for the CTE within each sub-area. It

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should be noted that DEQ guidance (2000) discusses methods of calculating these statistics for both normal and non-normally distributed data. During the Level II Risk Screening, all data sets were summarized using methods that assumed both normal and non-normal distributions. It was found that, in almost all cases, calculations based on assumed normality yielded higher exposure point concentrations. Consequently, both RME and CTE estimates were made using methods that assume normal distributions of data. This is a conservative assumption that would tend to overestimate risks if the data are not-normally distributed in any particular case.

3.2.2 Exposure Estimation

Exposure estimates (or doses) were made for each pathway and each exposure route following the equations in DEQ guidance (2000) wherever applicable. The methods for exposure estimation for each pathway are summarized in Table 3-1. All equation numbers are references to DEQ (2000).

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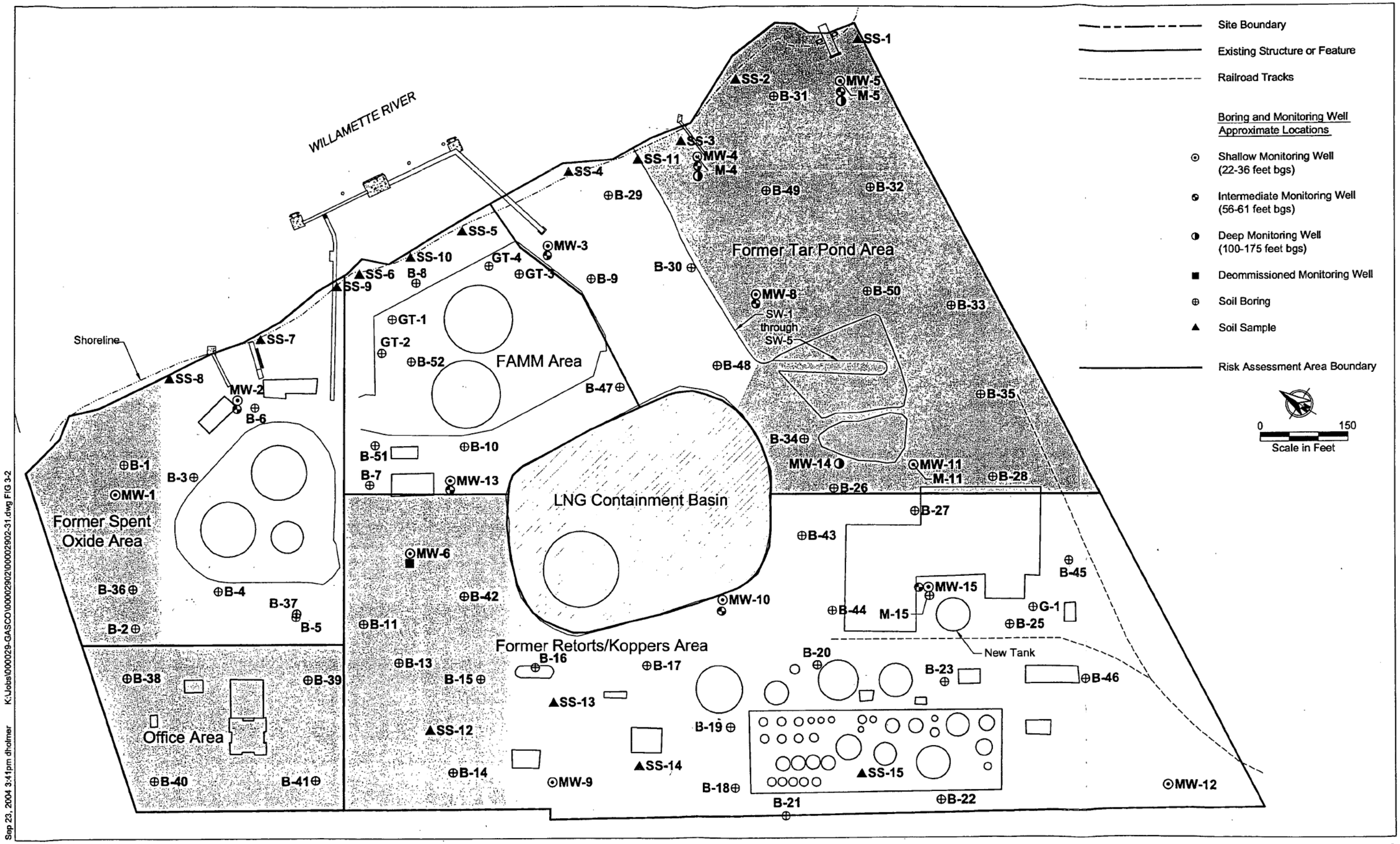

Sep 23, 2004 3:41pm dholmer K:\Jobs\000029-GASCO\00002902\00002902-31.dwg FIG 3-2

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Figure 3-2
Potential Redevelopment Areas
NW Natural "Gasco" Site

Table 3-1
Human Health Exposure Estimate Methods Summary

Scenario	Pathway	Carcinogens	Non-Carcinogens
Occupational	Incidental Ingestion of Soils	Equation A.9	Equation A.10
	Dermal Contact with Soils	Equations A.30, A.32	Equations A.31, A.32
	Inhalation from Soil Vapors	Equations A.41, A.43, A.44, A.45, A.46,.A.47, A.48	Equations A.42, A.43, A.44, A.45, A.46,.A.47, A.48
	Inhalation of Soil Particulates	A.50, A.52, A.53, A.54, A.55	A.51, A.52, A.53, A.54, A.55
	Inhalation from Groundwater Vapors	A.41, A.43, ASTM E1739-95	A.42, A.43, ASTM E1739-95
Excavation Worker	Incidental Ingestion of Soils	Equation A.9	Equation A.10
	Incidental Ingestion of Groundwater	Equation A.12	Equation A.13
	Dermal Contact with Soils	Equations A.30, A.32	Equations A.31, A.32
	Dermal Contact with Groundwater	Equations A.34, A.36, A.37, A.38, A.39	Equations A.35, A.36, A.37, A.38, A.39
	Inhalation from Soil Vapors	Equations A.41, A.43, A.44, A.45, A.46,.A.47, A.48	Equations A.42, A.43, A.44, A.45, A.46,.A.47, A.48
	Inhalation of Soil Particulates	A.50, A.52, A.53, A.54, A.55	A.51, A.52, A.53, A.54, A.55
	Inhalation from Groundwater Vapors	A.41, A.43	A.42, A.43

For the volatilization of groundwater under the occupational scenario, ASTM Method E1739-95 (ASTM 1995) for determination of vapor concentrations in enclosed spaces was used to determine the volatilization factor for groundwater in DEQ Equation A.43. For exposure to vapors from groundwater for excavation workers, a value of 0.5 L/m^3 was used for the water volatilization factor following EPA guidance for residential uses of water (EPA 1991). Although this value is not intended directly for use with excavation workers, it appears to be a reasonable estimate given the close contact with groundwater in an enclosed space that would occur with an excavation worker in a pit or trench. As noted above, excavation worker exposures to groundwater were only considered in sub-areas that have a groundwater levels commonly higher than 12 feet bgs. These areas are the Tar Pond Area, Koppers/Former Retorts Area, and Spent Oxide Area. Appendix A contains Site groundwater level data used to make this determination.

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3.2.3 Exposure Factor Values

Where available, exposure factors used were generally consistent with the exposure factor default values contained within Appendix B of DEQ guidance (2000), or updated values in DEQs Risk Based Decision Making for the Remediation of Petroleum-Contaminated Sites (DEQ 2003b). The specific values used for each exposure scenario and pathway are detailed in Appendix B. In addition, some sub-area specific exposure parameters for inhalation (e.g., source area size, percent vegetation coverage, soil organic carbon content, etc.) are shown at the top of risk characterization tables in Appendix D. In most cases, the only times DEQ default values were not used is when they were not provided by DEQ (2000). Parameters where DEQ default values were not available include:

- Height of indoor air space for enclosed vapor exposures was set at 7.5 feet as a general estimate of Site-specific conditions
- Incidental ingestion rate of groundwater for excavation workers was set equal to the EPA (2001) guidance for incidental ingestion of water while swimming
- Groundwater vapor exposure factor for excavation workers was set equal to EPA (1991) guidance on vapor factors for residential exposures to household water (see previous section for explanation)

3.3 Toxicity Analysis

The toxicity analysis generally followed the procedures in DEQ (2000) guidance such that EPA's Integrated Risk Information System (IRIS; EPA 2003) and Health Effects Assessment Summary Tables (HEAST; EPA 1997) values were the preferred sources of toxicity data.

Because three routes of exposure are assessed (ingestion, dermal, and inhalation), toxicity values specific to each exposure route were always selected when they were available. For many chemicals, exposure-route-specific toxicity values are not available. In these cases, extrapolations were made as follows:

- Dermal toxicity values were derived per the EPA Risk Assessment Guidance for Superfund Part E (EPA 2001). GI trac-absorption factors were used to extrapolate oral toxicity slope factors and/or reference doses for chemicals identified as requiring adjustment (Exhibit 4-1, EPA 2001). Chemicals that were identified as not requiring adjustment used available oral toxicity values directly.

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- Where inhalation toxicity values were not available, ingestion toxicity values were used consistent with EPA (1996) soils screening methods.

The specific human health toxicity values used for each exposure route are presented in Appendix C.

3.3.1 Toxicity Profiles

Toxicity profiles for all COPCs (chemicals passing through the Level II Risk Screening) are provided in Appendix C.

3.3.2 Toxicity Reference Values

As noted above, the toxicity values used in the risk assessment are provided in Appendix C. Two specific issues should be noted including:

- Slope factors for cPAHs were extrapolated from benzo(a)pyrene consistent with EPA 2003 and EPA 1993.
- Inhalation unit risks provided by EPA (2003) were converted to reference doses and slope factors based on a 20 L/day inhalation rate and a 70 kg body weight per EPA (2001) guidance.

3.4 Risk Characterization

3.4.1 Risk Estimation Methodology

Both occupational and excavation worker risks were characterized by sub-areas shown in Figure 1-2. For each sub-area, both an RME and CTE estimate was made. Risks for non-carcinogenic effects are presented as HQs, which are the calculated exposure dose divided by the toxicity reference value. HQs greater than 1 for any individual chemical indicate a potential risk. Risks for carcinogenic effects are presented as a probability of lifetime cancer risk. Per Oregon regulations (OAR 340-122-0115 and OAR 340-122-0084), cancer risks greater than 1×10^{-6} (or one in 1 million chance of cancer in a lifetime) indicate a potential risk for individual chemicals.

In addition, cumulative risks from multiple chemicals and pathways (exposure routes) were determined per Oregon regulations (OAR 340-122-0084) whereby all risks for each exposure route and each chemical are summed to yield an overall risk (carcinogenic and

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non-carcinogenic) for each exposure scenario. That is, the total chemical risks are presented for both the occupational and worker excavation scenarios. Per Oregon regulations, cumulative non-carcinogenic risks with an HQ greater than 1 indicate a potential unacceptable risk for the scenario assessed. Cumulative carcinogenic risks greater than 1×10^{-5} (one in 100,000) indicate potential unacceptable risk for the scenario assessed.

3.4.2 Risk Estimate Results

The risks by sub-area and chemical are shown in Tables 3-2 through 3-5. Tables 3-2 and 3-3 show the occupational scenario risks for the RME and CTE estimates, respectively. Tables 3-4 and 3-5 show the excavation worker scenario risks. All these tables show the total risks for all pathways considered in each of the scenarios. For example, occupational risks for a particular chemical include the summed risks from incidental soil ingestion, dermal contact with soils, inhalation of vapors from soils and groundwater, and inhalation of particulates from soils. The individual risks for each pathway are presented in Appendix D tables. In addition, Tables 3-2 through 3-5 show the total cumulative risks all COPCs for each sub-area at the bottom of each column.

Several of the results presented in the tables are noteworthy. Under the CTE estimates for the occupational scenario, the Spent Oxide, Former Office, and FAMM areas have risks that are confined to one or two chemicals that are just above the acceptable risk levels (Table 3-3).

For the excavation scenario, both the RME and CTE risk estimates are below Oregon risk requirements in the Former Office Area and the FAMM Area. The Spent Oxide and Koppers areas have risks under the CTE estimate that are confined to one or two chemicals that are just above the acceptable risk levels (Table 3-5).

In general, risks are highest in the Koppers and Tar Pond areas for the occupational scenario. It is noteworthy that there are no occupations on the Site that currently require people to access the Tar Pond area on a regular basis. For the excavation scenario, risks tend to be slightly higher in the Koppers Area, and this reflects the relatively high

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concentrations of some chemicals at depth in the eastern corner of this area, closest to the Tar Pond Area.

Appendix D tables present risks broken down by exposure route. The cumulative exposure route results are summarized in Table 3-6 for non-carcinogenic risks and Table 3-7 for carcinogenic risks. Only risks above Oregon requirements are presented for the particular pathways. For the occupational scenario, most of the risks are through the vapor inhalation and soil dermal contact pathways, with the exception of soil particulate inhalation in the Koppers area. For the excavation worker scenario, the risks are primarily through the vapor inhalation, groundwater dermal contact, and groundwater ingestion pathways.

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Table 3-2
Cumulative Risks for Occupational Exposure - Reasonable Maximum Estimate

	Spent Oxide Area		Former Office Area		Koppers Area		FAMM Area		Tar Pond Area	
	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk
Metals										
Chromium	9.89E-03	1.93E-07	6.68E-03	1.15E-07	6.94E-03	1.91E-07	1.56E-02	3.58E-07	3.53E-03	5.07E-08
Monocyclic Aromatic Compounds										
Benzene	1.16E-02	9.65E-07	1.88E-05	1.57E-09	**8.93E+01**	**7.46E-03**	**5.60E+00**	**4.68E-04**	**7.13E+00**	**5.96E-04**
Xylenes	1.34E-02	0.00E+00	1.64E-05	0.00E+00	**1.25E+00**	0.00E+00	5.72E-02	0.00E+00	3.44E-01	0.00E+00
Polyaromatic Compounds										
Acenaphthene	7.24E-05	0.00E+00	3.14E-05	0.00E+00	2.29E-03	0.00E+00	4.60E-05	0.00E+00	2.16E-03	0.00E+00
Acenaphthylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	7.87E-06	0.00E+00	2.33E-06	0.00E+00	3.27E-04	0.00E+00	4.76E-06	0.00E+00	6.06E-05	0.00E+00
Benzo(a)anthracene	0.00E+00	**2.83E-06**	0.00E+00	**1.35E-06**	0.00E+00	**9.90E-05**	0.00E+00	**3.53E-06**	0.00E+00	**2.90E-05**
Benzo(a)pyrene	0.00E+00	**4.49E-05**	0.00E+00	**1.82E-05**	0.00E+00	**1.34E-03**	0.00E+00	**1.04E-04**	0.00E+00	**4.34E-04**
Benzo(b)fluoranthene	0.00E+00	**4.77E-06**	0.00E+00	**1.56E-06**	0.00E+00	**1.17E-04**	0.00E+00	**9.43E-06**	0.00E+00	**4.31E-05**
Benzo(g,h,i)perylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	0.00E+00	**1.41E-06**	0.00E+00	**1.10E-06**	0.00E+00	**9.62E-05**	0.00E+00	**3.20E-06**	0.00E+00	**1.34E-05**
Chrysene	0.00E+00	3.15E-08	0.00E+00	1.46E-08	0.00E+00	**1.10E-06**	0.00E+00	4.73E-08	0.00E+00	3.15E-07
Dibenzo(a,h)anthracene	0.00E+00	**5.53E-06**	0.00E+00	**4.00E-06**	0.00E+00	**3.25E-04**	0.00E+00	**1.43E-05**	0.00E+00	**4.37E-05**
Fluoranthene	2.16E-05	0.00E+00	1.08E-05	0.00E+00	7.44E-04	0.00E+00	1.74E-05	0.00E+00	4.88E-04	0.00E+00
Fluorene	2.57E-05	0.00E+00	1.62E-05	0.00E+00	8.19E-04	0.00E+00	1.81E-05	0.00E+00	1.14E-03	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	**3.88E-06**	0.00E+00	**1.28E-06**	0.00E+00	**9.56E-05**	0.00E+00	**7.23E-06**	0.00E+00	**2.08E-05**
Naphthalene	6.33E-02	0.00E+00	6.12E-03	0.00E+00	**2.59E+00**	0.00E+00	1.29E-01	0.00E+00	7.91E-01	0.00E+00
Phenanthrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	3.84E-05	0.00E+00	1.56E-05	0.00E+00	9.28E-04	0.00E+00	4.13E-05	0.00E+00	1.02E-03	0.00E+00
Total Occupational Risks	5.41E-03	**6.31E-05**	1.29E-02	**2.77E-05**	**9.47E+01**	**9.54E-03**	**5.83E+00**	**6.10E-04**	**8.50E+00**	**1.18E-03**

Bold values highlight non-cancer HQs greater than 1 or cancer risk greater than 1E-06

Table 3-3
Cumulative Risks for Occupational Exposure - Central Tendency Estimate

	Spent Oxide Area		Former Office Area		Koppers Area		FAMM Area		Tar Pond Area	
	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk
Metals										
Chromium	6.43E-03	3.38E-08	5.20E-03	2.44E-08	5.12E-03	3.63E-08	6.81E-03	4.13E-08	2.54E-03	1.01E-08
Monocyclic Aromatic Compounds										
Benzene	8.21E-03	1.65E-07	1.82E-05	3.65E-10	**6.74E+01**	**1.35E-03**	**3.48E+00**	**6.98E-05**	**4.65E+00**	**9.33E-05**
Xylenes	9.44E-03	0.00E+00	1.59E-05	0.00E+00	9.16E-01	0.00E+00	4.43E-02	0.00E+00	2.22E-01	0.00E+00
Polyaromatic Compounds										
Acenaphthene	4.71E-05	0.00E+00	2.07E-05	0.00E+00	9.60E-04	0.00E+00	3.16E-05	0.00E+00	1.12E-03	0.00E+00
Acenaphthylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	4.98E-06	0.00E+00	1.42E-06	0.00E+00	1.63E-04	0.00E+00	2.33E-06	0.00E+00	3.01E-05	0.00E+00
Benzo(a)anthracene	0.00E+00	3.41E-07	0.00E+00	1.68E-07	0.00E+00	**7.92E-06**	0.00E+00	3.13E-07	0.00E+00	**3.01E-06**
Benzo(a)pyrene	0.00E+00	**5.18E-06**	0.00E+00	**2.22E-06**	0.00E+00	**1.06E-04**	0.00E+00	**8.21E-06**	0.00E+00	**5.21E-05**
Benzo(b)fluoranthene	0.00E+00	5.55E-07	0.00E+00	1.95E-07	0.00E+00	**9.45E-06**	0.00E+00	7.85E-07	0.00E+00	**5.05E-06**
Benzo(g,h,i)perylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	0.00E+00	1.64E-07	0.00E+00	1.30E-07	0.00E+00	**7.59E-06**	0.00E+00	3.13E-07	0.00E+00	**1.72E-06**
Chrysene	0.00E+00	3.90E-09	0.00E+00	1.80E-09	0.00E+00	8.91E-08	0.00E+00	4.12E-09	0.00E+00	3.56E-08
Dibenzo(a,h)anthracene	0.00E+00	6.99E-07	0.00E+00	4.97E-07	0.00E+00	**2.52E-05**	0.00E+00	**1.16E-06**	0.00E+00	**5.51E-06**
Fluoranthene	1.13E-05	0.00E+00	5.61E-06	0.00E+00	2.64E-04	0.00E+00	7.90E-06	0.00E+00	1.78E-04	0.00E+00
Fluorene	1.80E-05	0.00E+00	9.38E-06	0.00E+00	3.92E-04	0.00E+00	1.02E-05	0.00E+00	6.07E-04	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	4.16E-07	0.00E+00	1.53E-07	0.00E+00	**7.48E-06**	0.00E+00	5.91E-07	0.00E+00	**2.64E-06**
Naphthalene	4.07E-02	0.00E+00	3.60E-03	0.00E+00	**1.83E+00**	0.00E+00	8.37E-02	0.00E+00	5.23E-01	0.00E+00
Phenanthrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	1.97E-05	0.00E+00	8.30E-06	0.00E+00	3.29E-04	0.00E+00	1.69E-05	0.00E+00	3.76E-04	0.00E+00
Total Occupational Risks	3.17E-03	7.33E-06	8.89E-03	3.39E-06	**7.12E+01**	**1.52E-03**	**3.63E+00**	**8.12E-05**	**5.55E+00**	**1.63E-04**

Bold values highlight non-cancer HQs greater than 1 or cancer risk greater than 1E-06

Table 3-4
Cumulative Risks for Excavation Workers - Reasonable Maximum Estimate

	Spent Oxide Area		Former Office Area		Koppers Area		FAMM Area		Tar Pond Area	
	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk
Metals										
Chromium	1.21E-02	1.26E-10	1.72E-03	8.05E-11	6.12E-02	1.37E-10	3.18E-03	2.58E-10	4.85E-02	3.57E-11
Monocyclic Aromatic Compounds										
Benzene	2.45E-03	7.78E-09	3.98E-07	1.32E-12	**2.02E+01**	**6.39E-05**	3.53E-06	1.17E-11	**6.37E+00**	**2.02E-05**
Xylenes	7.88E-04	0.00E+00	3.10E-07	0.00E+00	7.90E-02	0.00E+00	2.76E-06	0.00E+00	1.03E-02	0.00E+00
Polyaromatic Compounds										
Acenaphthene	2.44E-02	0.00E+00	4.07E-06	0.00E+00	8.31E-02	0.00E+00	3.64E-06	0.00E+00	1.20E-01	0.00E+00
Acenaphthylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	4.70E-03	0.00E+00	9.48E-07	0.00E+00	3.38E-03	0.00E+00	1.72E-06	0.00E+00	6.38E-03	0.00E+00
Benzo(a)anthracene	0.00E+00	**1.40E-06**	0.00E+00	1.94E-09	0.00E+00	**1.27E-06**	0.00E+00	5.06E-09	0.00E+00	**2.85E-06**
Benzo(a)pyrene	0.00E+00	**2.98E-05**	0.00E+00	2.62E-08	0.00E+00	**2.30E-05**	0.00E+00	1.49E-07	0.00E+00	**5.43E-05**
Benzo(b)fluoranthene	0.00E+00	**3.31E-06**	0.00E+00	2.24E-09	0.00E+00	**2.47E-06**	0.00E+00	1.35E-08	0.00E+00	**4.85E-06**
Benzo(g,h,i)perylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	0.00E+00	4.47E-07	0.00E+00	8.68E-10	0.00E+00	3.01E-07	0.00E+00	2.53E-09	0.00E+00	7.68E-07
Chrysene	0.00E+00	2.34E-08	0.00E+00	2.10E-11	0.00E+00	1.13E-08	0.00E+00	6.79E-11	0.00E+00	3.00E-08
Dibenzo(a,h)anthracene	0.00E+00	2.05E-07	0.00E+00	2.91E-09	0.00E+00	3.24E-07	0.00E+00	1.04E-08	0.00E+00	3.69E-07
Fluoranthene	7.49E-02	0.00E+00	7.59E-05	0.00E+00	9.59E-02	0.00E+00	1.20E-04	0.00E+00	1.97E-01	0.00E+00
Fluorene	5.17E-02	0.00E+00	4.47E-06	0.00E+00	7.88E-02	0.00E+00	4.36E-06	0.00E+00	1.33E-01	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	**3.47E-06**	0.00E+00	1.84E-09	0.00E+00	**2.40E-06**	0.00E+00	1.04E-08	0.00E+00	**5.59E-06**
Naphthalene	1.28E-01	0.00E+00	8.32E-05	0.00E+00	**3.59E+00**	0.00E+00	7.82E-04	0.00E+00	**6.38E+00**	0.00E+00
Phenanthrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	8.17E-02	0.00E+00	1.09E-04	0.00E+00	9.46E-02	0.00E+00	2.83E-04	0.00E+00	2.44E-01	0.00E+00
Total Excavation Risks	3.82E-01	**3.87E-05**	1.99E-03	3.61E-08	**2.53E+01**	**9.37E-05**	4.38E-03	1.91E-07	**1.39E+01**	**8.90E-05**

Bold values highlight non-cancer HQs greater than 1 or cancer risk greater than 1E-06

Table 3-5
Cumulative Risks for Excavation Workers - Central Tendency Estimate

	Spent Oxide Area		Former Office Area		Koppers Area		FAMM Area		Tar Pond Area	
	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ	Cancer Risk
Metals										
Chromium	8.31E-03	4.51E-11	1.10E-03	3.57E-11	4.64E-02	5.44E-11	1.12E-03	6.19E-11	2.90E-02	1.53E-11
Monocyclic Aromatic Compounds										
Benzene	1.87E-03	2.96E-09	3.59E-07	5.98E-13	**1.25E+01**	**1.98E-05**	3.31E-06	5.51E-12	**4.66E+00**	**7.40E-06**
Xylenes	5.72E-04	0.00E00	2.97E-07	0.00E00	5.43E-02	0.00E00	2.75E-06	0.00E00	7.49E-03	0.00E00
Polyaromatic Compounds										
Acenaphthene	1.71E-02	0.00E00	2.15E-06	0.00E00	6.25E-02	0.00E00	1.78E-06	0.00E00	7.75E-02	0.00E00
Acenaphthylene	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00
Anthracene	3.16E-03	0.00E00	4.57E-07	0.00E00	2.42E-03	0.00E00	6.71E-07	0.00E00	4.30E-03	0.00E00
Benzo(a)anthracene	0.00E00	4.30E-07	0.00E00	3.16E-10	0.00E00	3.69E-07	0.00E00	5.89E-10	0.00E00	9.21E-07
Benzo(a)pyrene	0.00E00	**9.10E-06**	0.00E00	4.18E-09	0.00E00	**6.75E-06**	0.00E00	1.55E-08	0.00E00	**1.69E-05**
Benzo(b)fluoranthene	0.00E00	9.84E-07	0.00E00	3.68E-10	0.00E00	7.60E-07	0.00E00	1.48E-09	0.00E00	**1.52E-06**
Benzo(g,h,i)perylene	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00
Benzo(k)fluoranthene	0.00E00	1.41E-07	0.00E00	7.02E-11	0.00E00	8.27E-08	0.00E00	1.70E-10	0.00E00	2.42E-07
Chrysene	0.00E00	7.28E-09	0.00E00	3.39E-12	0.00E00	3.20E-09	0.00E00	7.76E-12	0.00E00	9.56E-09
Dibenzo(a,h)anthracene	0.00E00	6.74E-08	0.00E00	2.01E-10	0.00E00	4.54E-08	0.00E00	4.71E-10	0.00E00	9.90E-08
Fluoranthene	4.79E-02	0.00E00	3.82E-05	0.00E00	6.71E-02	0.00E00	5.22E-05	0.00E00	1.31E-01	0.00E00
Fluorene	3.62E-02	0.00E00	2.06E-06	0.00E00	6.15E-02	0.00E00	1.92E-06	0.00E00	8.94E-02	0.00E00
Indeno(1,2,3-cd)pyrene	0.00E00	**1.10E-06**	0.00E00	2.89E-10	0.00E00	7.73E-07	0.00E00	1.11E-09	0.00E00	**1.69E-06**
Naphthalene	8.66E-02	0.00E00	5.15E-05	0.00E00	**2.24E+00**	0.00E00	3.42E-04	0.00E00	**4.15E+00**	0.00E00
Phenanthrene	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00
Pyrene	5.24E-02	0.00E00	5.66E-05	0.00E00	6.16E-02	0.00E00	1.11E-04	0.00E00	1.61E-01	0.00E00
Total Excavation Risks	2.55E-01	**1.18E-05**	1.25E-03	5.47E-09	**1.58E+01**	**2.86E-05**	1.63E-03	1.94E-08	**9.59E+00**	**2.88E-05**

Bold values highlight non-cancer HQs greater than 1 or cancer risk greater than 1E-06

Table 3-6
Non-Cancer Cumulative (Hazard Quotients) Risks By Pathway for Occupational and Excavation Worker Exposures

	Indoor Inhalation (GW Vapors)	Outdoor Inhalation (GW + Soil Vapors)	Inhalation Vapors Soil Only	Inhalation Soil Particulates	Soil Dermal Contact	Soil Ingestion	Groundwater Dermal Contact	Groundwater Ingestion
Occupation RME								
Spent Oxide								
Former Office								
Koppers	93.1	94.7						
FAMM	5.7	5.8						
Tar Pond	7.9	8.5						
Occupation CTE								
Spent Oxide								
Former Office								
Koppers	70.1	71.1						
FAMM	3.6	3.6						
Tar Pond	5.2	5.6						
Excavation RME								
Spent Oxide								
Former Office								
Koppers	5.6	6.5					17.7	1.1
FAMM								
Tar Pond	6.3	6.9					6.6	
Excavation CTE								
Spent Oxide								
Former Office								
Koppers	3.7	4.1					11.1	
FAMM								
Tar Pond	4.2	4.6					4.7	

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Table 3-7
Cancer Risks By Pathway for Occupational and Excavation Worker Exposures

	Indoor Inhalation (GW Vapors)	Outdoor Inhalation (GW + Soil Vapors)	Inhalation Vapors Soil Only	Inhalation Soil Particulates	Soil Dermal Contact	Soil Ingestion	Groundwater Dermal Contact	Groundwater Ingestion
Occupation RME								
Spent Oxide					6.3E-05			
Former Office					2.7E-05			
Koppers	7.5E-03	7.5E-03		1.1E-05	2.1E-03			
FAMM	4.7E-04	5.8E-00			1.4E-04			
Tar Pond	5.9E-04	6.0E-04			5.8E-04			
Occupation CTE								
Spent Oxide					1.3E-05			
Former Office								
Koppers	1.4E-03	1.4E-03			1.6E-04			
FAMM	7.0E-05	7.0E-05			1.1E-05			
Tar Pond	9.3E-05	9.3E-05			7.0E-05			
Excavation RME								
Spent Oxide							3.9E-05	
Former Office								
Koppers	1.0E-05	1.0E-05					7.8E-05	
FAMM								
Tar Pond							8.3E-05	
Excavation CTE								
Spent Oxide							1.2E-05	
Former Office								
Koppers								
FAMM								
Tar Pond							2.7E-05	

3.5 Uncertainty Analysis

This section discusses the uncertainties associated with the HHRA presented above. Uncertainties associated with the various steps of the assessment are discussed below.

3.5.1 Pathway and Receptor Selection

The uncertainties associated with pathway and receptor selection are primarily a result of selecting pathways and receptors that are intended to be representative of the most likely risks. In some cases, the receptor scenarios are intended to provide information that would be protective of several potentially more specific receptor scenarios. These types of uncertainties can be summarized below at four different levels:

- Occupational Site Uncertainty
- Non-Occupational Site Uncertainty
- Off-site Uncertainty
- Exposure Route Uncertainties

Occupational Site Uncertainty

All Site occupations are represented by two scenarios: general occupational and excavation worker. Some existing Site occupations may have more or less exposure to certain matrices at the Site. In terms of exposure, there are not a wide variety of occupations at the Site (DMA 1997). Most occupations involve some time spent indoors and outdoors, and have periodic direct exposures to soils in various forms. Consequently, a general occupational scenario would appear to cover this potential range. In addition, inclusion of the excavation worker scenario allows for infrequent but more direct contact with soils and even groundwater than would be unlikely to occur for most occupations at the Site. Overall the uncertainty at this level:

- Is relatively low
- Could over- or underestimate risks

Non-Occupational Site Uncertainty

The occupational scenario is assumed to be representative of visitors to the Site, potential trespassers, and similar irregular exposures. The uncertainty associated with this assumption is probably relatively high. However, because the exposure durations and frequencies for visitors and trespassers would be much lower than the occupational

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scenario, it is unlikely that this uncertainty would result in underestimating risks to these types of populations. Overall uncertainty at this level:

- Is relatively high
- Likely overestimates risks to non-occupational Site exposures

Off-Site Uncertainty

There are currently no current residential areas near the Site that are measurably affected by chemicals from the Site, and residential land uses are not likely in the foreseeable future. Consequently, not including residential type exposures in this assessment appears appropriate. Overall, the uncertainty at this level:

- Is relatively low
- Is unlikely to underestimate risks

Exposure Route Uncertainties

In general, for each exposure scenario all likely substantial contributors to risk appear to be considered (Figure 3-1). For example, consumption of groundwater does not occur at the Site. Surface waters are transitory, and no Site occupation routinely requires contact with this surface water when they are present. Consumption of biota (plants or animals) is either impossible or highly unlikely. Further, some of the routes that were quantitatively assessed appear to pose little if any risk in any scenario including inhalation of particulates and incidental groundwater ingestion. Consequently, it appears that unlikely sources of risk have been quantitatively assessed and ruled out as reasonable possibilities. Overall, the uncertainty at this level:

- Is moderate
- Is not likely to underestimate overall Site risks

3.5.2 Exposure Analysis

The exposure analysis uses DEQ default parameters in most cases. These default values are generally intended to result in a conservative (overestimated) assessment of risks for most Sites. The uncertainties associated with the exposure analysis are discussed below for each exposure scenario.

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Occupational Soils Exposures

The important exposure parameters for occupational soils and their estimated relative uncertainty are:

- Skin surface area – high uncertainty
- Frequency of soil contact – moderate uncertainty
- Exposure frequency days per year – low uncertainty
- Exposure duration – moderate uncertainty
- Ingestion rate of soil – high uncertainty

The exposed ***skin surface area*** to soils is assumed to be between 16 percent and 21 percent of an adult body surface area (EPA 2001). However, actual exposures are likely to vary widely across potential events and occupations. For some occupations, it is reasonably likely that occasional exposures might greatly exceed this surface area. Occupations such as groundskeeper or gardener might fall into this category. However, it appears that skin area exposures for the occupations common on this Site (DMA 1997) would range considerably lower than this parameter in the vast majority of contact cases. Consequently, the likelihood of overestimating risk in this case is estimated to be high.

Frequency of contact is also a value that could range widely over potential occupations. The default value of one contact event per day likely overestimates the exposure for most occupations present at the Site.

Similarly, the ***soil ingestion rate*** could vary widely, but the range used is relatively narrow (between 50 and 100 mg/day). Again, the types of occupations present at the Site probably tend to have lower ingestion rates due to low level contacts with soils. Consequently, risk is potentially overestimated here.

Occupational Inhalation Exposures

Relative to soil contact, the uncertainty associated with estimates of inhalation exposures are estimated to be much higher for almost every parameter. When combined together, this results in a very high cumulative uncertainty. The majority of this uncertainty is primarily due to the estimation of airborne concentrations of chemicals, either vapor or soil particulates. The standard equations used rely on many assumptions regarding the

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ability of chemicals to be transported from soils or groundwater to the air. All of these assumptions are highly dependent on myriad site-specific conditions such as soil exposure, soil characteristics, wind conditions, building construction and location, rates of vaporization through complex physical pathways, etc. Therefore, inhalation estimates should be regarded as only broad approximations of the potential exposures likely at the Site. Many of the default values used to estimate airborne concentrations are based on conservative methods from EPA for developing soil screening numbers (EPA 1996). Because the intent of these methods was to identify sites for further risk assessment, use of these methods would be expected to overestimate risks in a large number of site-specific cases.

In addition, default factors specific to some exposures being considered for this Site (e.g., frequency of soil contact for occupational exposures) were not available, and substitute values developed for alternative purposes were used. Again, these substitute values should be regarded as broad approximations, and generally conservative (likely to overestimate risks) estimates were used in selection of these parameters.

Excavation Soils/Groundwater Exposures

The uncertainty issues for estimation of soils/groundwater exposures for excavation workers are similar to those discussed for occupational soil exposures. However, because excavation scenario is very specific to a certain type of work with less broadly defined coverage of multiple occupations, the overall level of uncertainty associated with these estimates is considered lower and includes:

- Skin surface area – moderate uncertainty
- Frequency of soil contact – low uncertainty
- Exposure frequency days per year – low uncertainty
- Exposure duration – moderate uncertainty
- Ingestion rate of soil – moderate uncertainty
- Groundwater ingestion – high uncertainty

Groundwater ingestion rates were based on swimming exposures, because DEQ scenario-specific default values were not available. Because excavation work would rarely require immersion of the head and mouth in groundwater (unlike swimming), the

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use of this ingestion rate is expected to considerably overestimate risks for this pathway. However, because groundwater ingestion was generally a very low at-risk pathway (Table 3-6 and Table 3-7), the effect on the overall risk assessment of this assumption appears minimal.

The ***skin surface area*** for both soil and dermal contact could also range relatively widely in the excavation worker scenario. However, as with the soil adherence factor, it is reasonable to assume relatively high rates of exposure for this type of occupation.

Excavation Inhalation Exposures

The uncertainties associated with inhalation exposures for excavation workers are similar to that discussed for the occupational scenario above. In addition, the groundwater volatilization factor used was derived from EPA (1991) estimates of exposures due to indoor domestic water use. The uncertainty here is probably high. However, given the close contact in enclosed spaces typical of indoor domestic water use, it is likely that this assumption overestimates the risks to excavation workers from groundwater.

3.5.3 Toxicity Analysis

The toxicity analysis used values from IRIS and HEAST databases. In general, these values are considered to be of the highest certainty available and considerable evaluation goes into these toxicity values before they are placed in these databases. Consequently, for chemicals that have toxicity values, the uncertainty is expected to be relatively low.

Chemicals Without Toxicity Values

The greatest uncertainty in the toxicity analysis is the absence of adequate toxicity values for some chemicals. In the absence of such values, the quantitative risk assessment assumes zero risk for these chemicals. However, with the exception of chromium VI (for which there is considerable toxicity data), all the COPCs at the Site fall within two broad categories of compounds with similar structures and bioaccumulative properties, namely BTEX and PAH compounds. The individual chemicals within these compound groups are highly co-located in samples at the Site (HAI 1998). It is unlikely

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that a substantial area of soils or groundwater exists at the Site where one of the compounds without toxicity information would be found by itself. Consequently, the compounds with adequate toxicity information appear to provide coverage and/or surrogate determination of risk in these circumstances. Because Oregon rules determine unacceptable risk based on individual compounds (as well as cumulative effects) it is unlikely that substantial areas would be designated as "clean" based on the absence of toxicity values for some compounds in this risk assessment.

Estimated Toxicity Values

Where dermal toxicity values were not available (EPA 2001), the oral toxicity value was used following EPA Rags Part E (2001) guidance. For most compounds, this assumption appears to overestimate potential risks. For example, information from Risk Assessment Information System (RAIS 2003) indicates alternative dermal adsorption factors for the following example chemicals:

- Chromium IV – 0.02
- Benzene – 0.97
- Anthracene – 0.76
- Benzo(a)pyrene – 0.31
- Napthalene – 0.80

In every case, except chromium IV these absorption factors would result in higher toxicity values than the default assumption used. This could overestimate uncertainty from several-fold to close to two orders of magnitude.

Where inhalation toxicity values were not available, ingestion toxicity values were used consistent with EPA (1996) soils screening methods. Examination of those chemicals that have both oral and inhalation toxicity values (Appendix B), indicates these values can differ considerably in terms of dose taken into the body. This implies that the uncertainty with the use of oral doses for inhalation route is relatively high. It appears that risks could be either over- or underestimated due to this uncertainty.

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Slope factors for cPAHs were extrapolated from benzo(a)pyrene consistent with EPA 2003 and EPA 1993. The uncertainty with the assumption is considered moderate, and could under- or overestimate risks for these compounds.

3.5.4 Risk Estimation

The risk estimation methodology itself (e.g., use of HQs and cancer risk estimates) is well established and the potential uncertainties with such approaches are discussed in standard texts (EPA 2001). Other than this, the primary source of uncertainty associated with the risk estimate derives from the uncertainties in the exposure and toxicity analyses discussed above. In general, the calculations involved are multiplicative. Thus, as these inputs vary, the change in the risk estimate is proportionally changed.

To provide an indication of the effect of the various assumptions in the exposure and toxicity assessments, the uncertainties discussed above were reviewed and the list of moderate to highly uncertain parameters, shown in Table 3-8, was compiled to calculate an uncertainty estimate. These parameters were varied, and the differences in the RME and the uncertainty cumulative risk estimate results are shown in Figures 3-3 and 3-4. Consistent with the above uncertainty discussions, most of these parameters have been varied so that lesser exposure would result. This is consistent with the nature of most of these default type estimates, which in most cases, appear more likely to overestimate rather than underestimate risks at the Site.

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Table 3-8
Variance in Exposure Factors and Toxicity Assumptions Used in Quantitative Uncertainty Analysis

Pathway	Factor	RME or Point Estimate	Uncertainty Reasonable Variance	Units
Occupational				
Soil Dermal Contact	Skin Surface Area	4100	3200	cm^2
Soil Ingestion	Ingestion Rate Soil	100	50	mg/day
Inhalation	Fraction of Floor Area with Cracks	1.00E-04	1.00E-05	unitless
	Source Area	various	0.2 of RME	unitless
	Fraction Contaminated Soil/Groundwater	1	0.5	unitless
All	Exposure Duration	25	15	years
Excavation Worker				
Soil Dermal Contact	Skin Surface Area	4100	3200	cm^2
Soil Ingestion	Ingestion Rate Soil	480	250	mg/day
Groundwater Contact	Skin Surface Area	5700	5200	cm^2
Inhalation	Fraction Contaminated Soil/Groundwater	1	0.5	unitless
	Groundwater Vapor Factor	0.5	0.2	L/m^3
	Source Area	various	0.2 of RME	unitless

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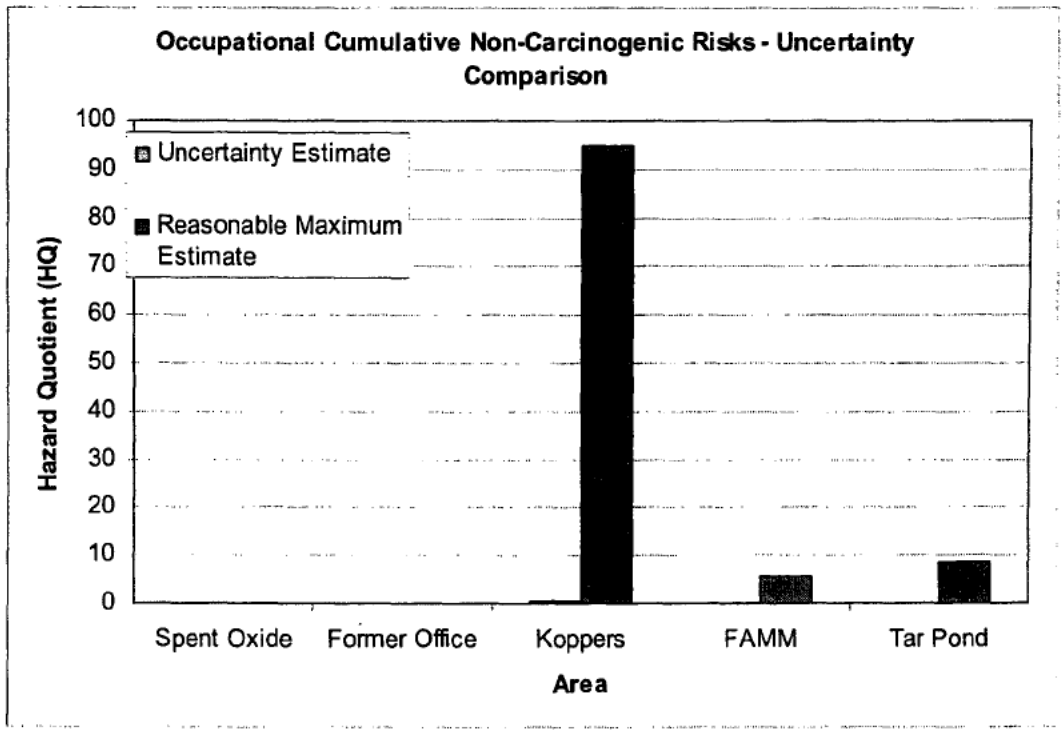

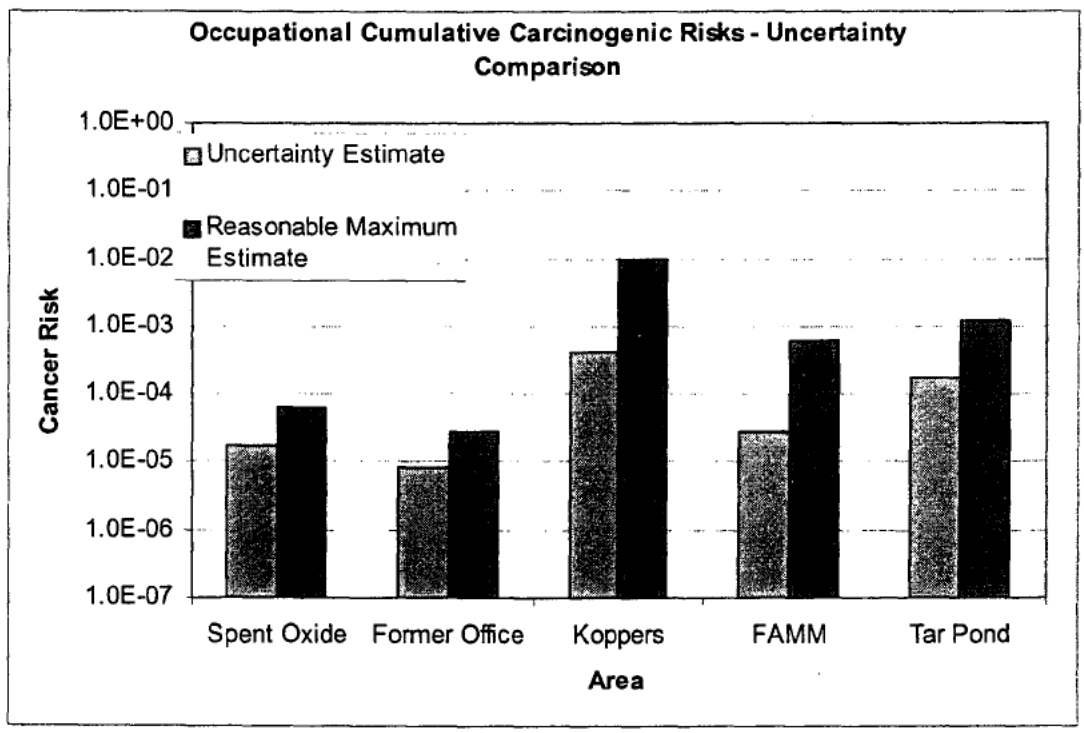

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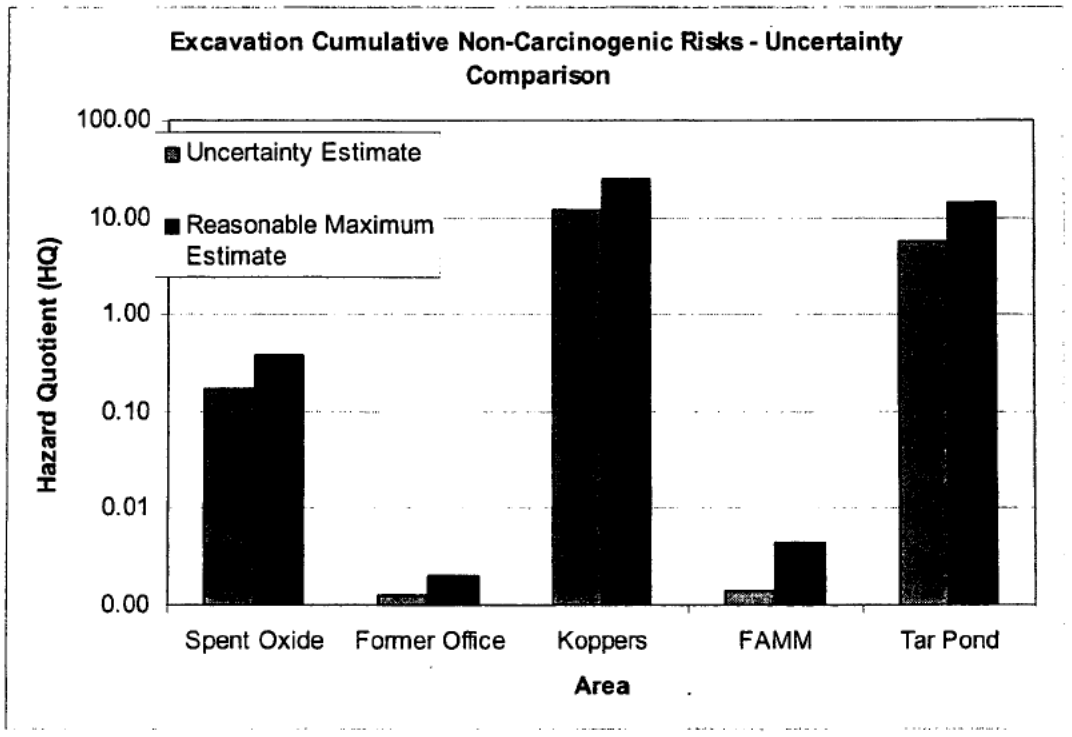
Figure 3-3
Uncertainty Comparison Occupational Exposure
Northwest Natural "Gasco" Site



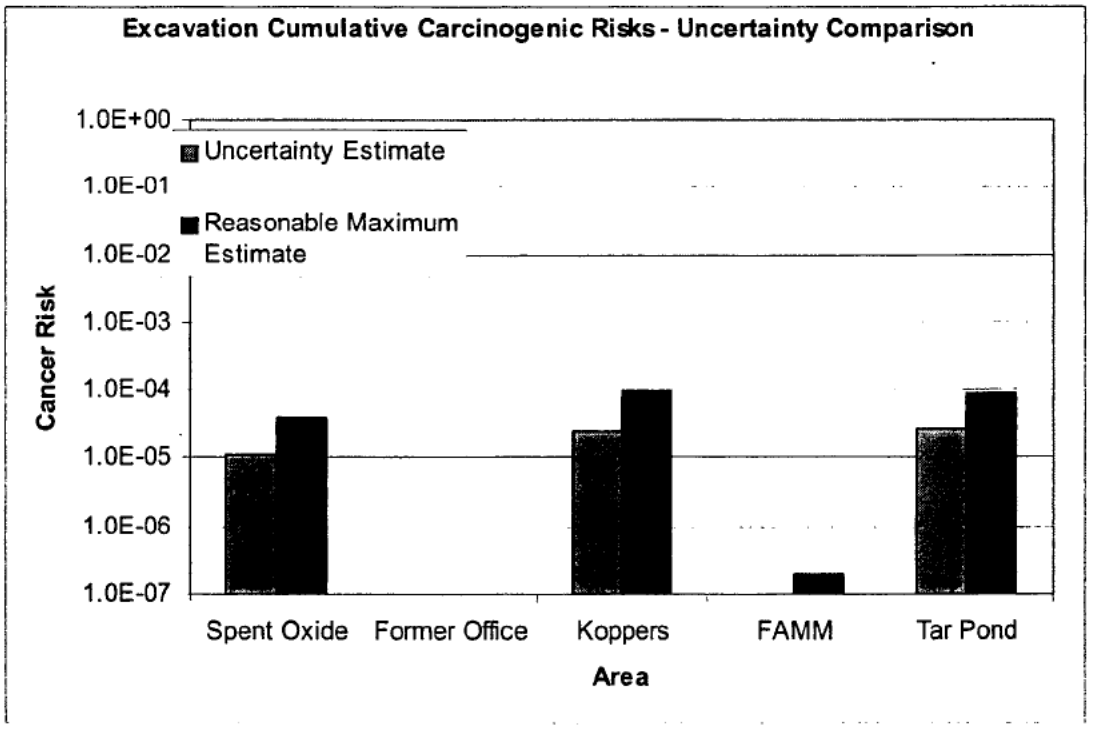


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Figure 3-4
Uncertainty Comparison Excavation Exposure
Northwest Natural "Gasco" Site

As shown in Figure 3-3, when the exposure and toxicity factors are varied over a reasonable range within the uncertainty associated for each parameter, the resulting HQs for occupational risk could be substantially lower. For occupational non-carcinogenic risks, the conclusion of the risk assessment would change from "substantial risk" to "minimal risk" for the Site, because all of the cumulative HQs fall below a value of 1. Similarly, the results for occupational carcinogenic risks fall below 1×10^{-5} at the Former Office Area, and below 1×10^{-4} at the Spent Oxide and FAMM Areas, thus changing the conclusion to "minimal and moderate risk" for these areas. The conclusion for occupational cumulative carcinogenic risks at the Koppers and Tar Pond Areas would not change.

Figure 3-4 shows that using the uncertainty estimates, the conclusions regarding excavation worker both non-carcinogenic and carcinogenic risks of the risk assessment would not greatly change.

Overall, these uncertainties could contribute to changes in both areas and volumes of soils that would be cleaned up. This uncertainty should be addressed in the development of reasonable cleanup levels for the FS.

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4 CONCLUSIONS

Overall the results of the risk assessment indicate there are potential risks to ecology and human health from chemicals in the upland portions of the Site. Because exposures to groundwater is minimal in both risk assessments (except for the vapor pathway in the HHRA), the vast majority of the risks come from chemicals in Site soils. For both types of risk assessment, the considerable uncertainties associated with the conservative assumptions used in the risk assessment should be considered when developing cleanup levels during the FS.

4.1 Ecological Risk

The results of the screening level risk assessment identified potential risks to mammalian and avian consumers. Soils exceedances of the SLVs were identified for zinc in birds, and fluoranthene and pyrene for mammals. Although plant and invertebrate groups were not identified as ROCs, soil exceedances for these groups were also identified. Exceedances for bird and mammal SLVs were less than a factor of 3 for the 90th percentile UCL of these chemicals, suggesting that ecological risks are minimal from a Site-wide perspective. Surface water exceedances of the SLVs were only found for aquatic organisms, which were not identified as a receptor group of concern. It should be noted that the areas posing potential risk on the southern side of the property are planned for development that will remove current vegetation and convert this area to full industrial use in the near future.

4.2 Human Health Risk

Benzene and several PAHs pose risks under general occupational and excavation worker exposure scenarios. In general, risks from at least one of these chemicals occurs in all five of the sub-areas of the Site investigated. However, risks were relatively low in the Spent Oxide, FAMM and Former Office Areas, with no risks shown for the excavation scenario in the FAMM or Former Office Areas. Under the CTE, risks were minimal for the Former Office and Spent Oxide Area. General occupational risks were higher than risks for the excavation worker scenario.

There were numerous sources of uncertainty in the human health risk assessment that, taken together, appear to substantially over-predict risks. When reasonable alternate assumptions are made, there are no predicted occupational or excavation risks for the Former Office and FAMM Areas, and minimal risks in the Spent Oxide Area. These

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uncertainties could have considerable effect on the cleanup areas and volumes designated for the FS. Again, it should be noted that the areas posing potential risk on the southern side of the property are planned for development that will remove current vegetation and convert this area to full industrial use in the near future.

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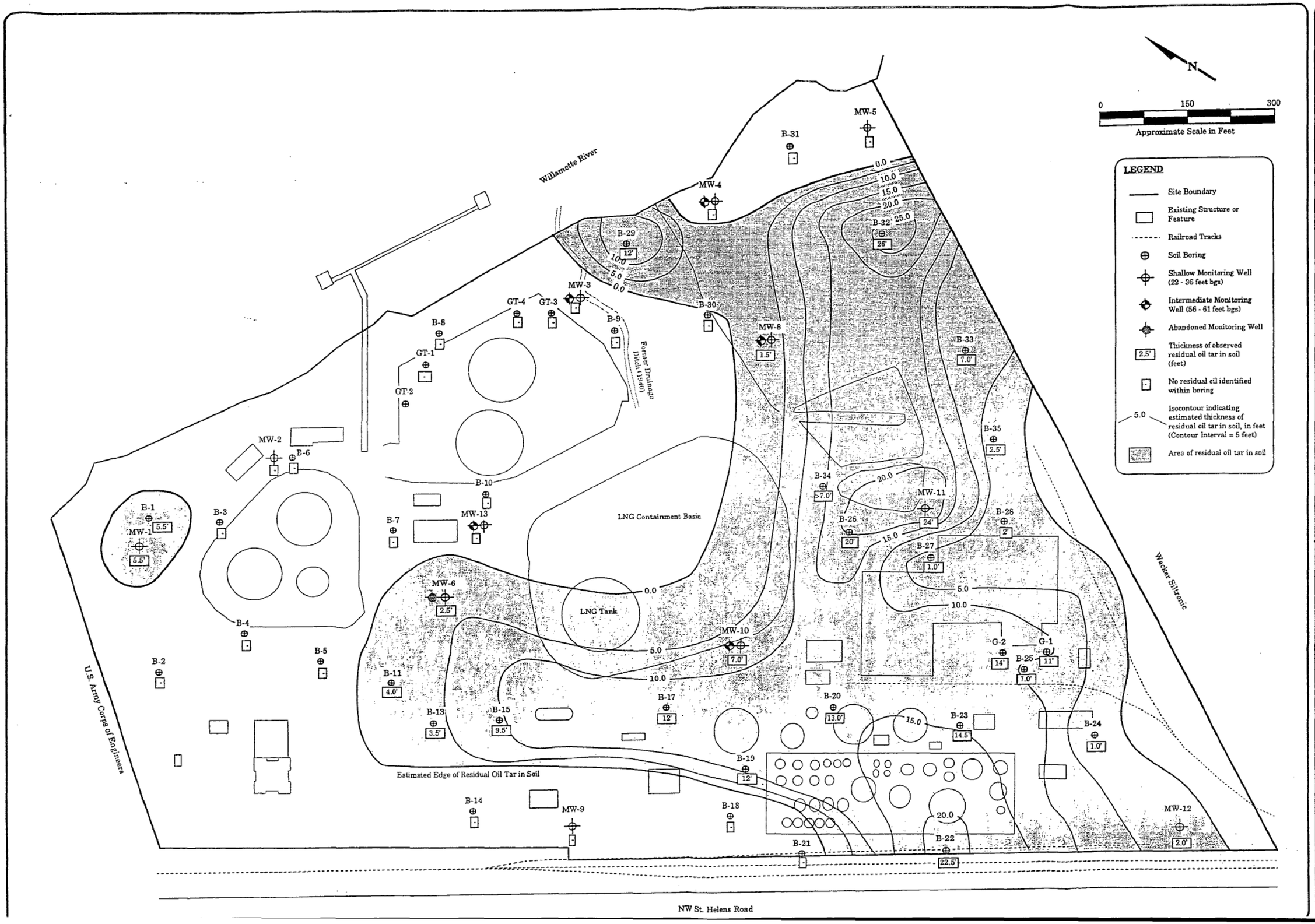

Figure F-2

Residual Oil Tar/ DNAPL in Soil: Thickness and Isopach Map

Remedial Investigation
Northwest Natural - 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

September 1998

Project #2708

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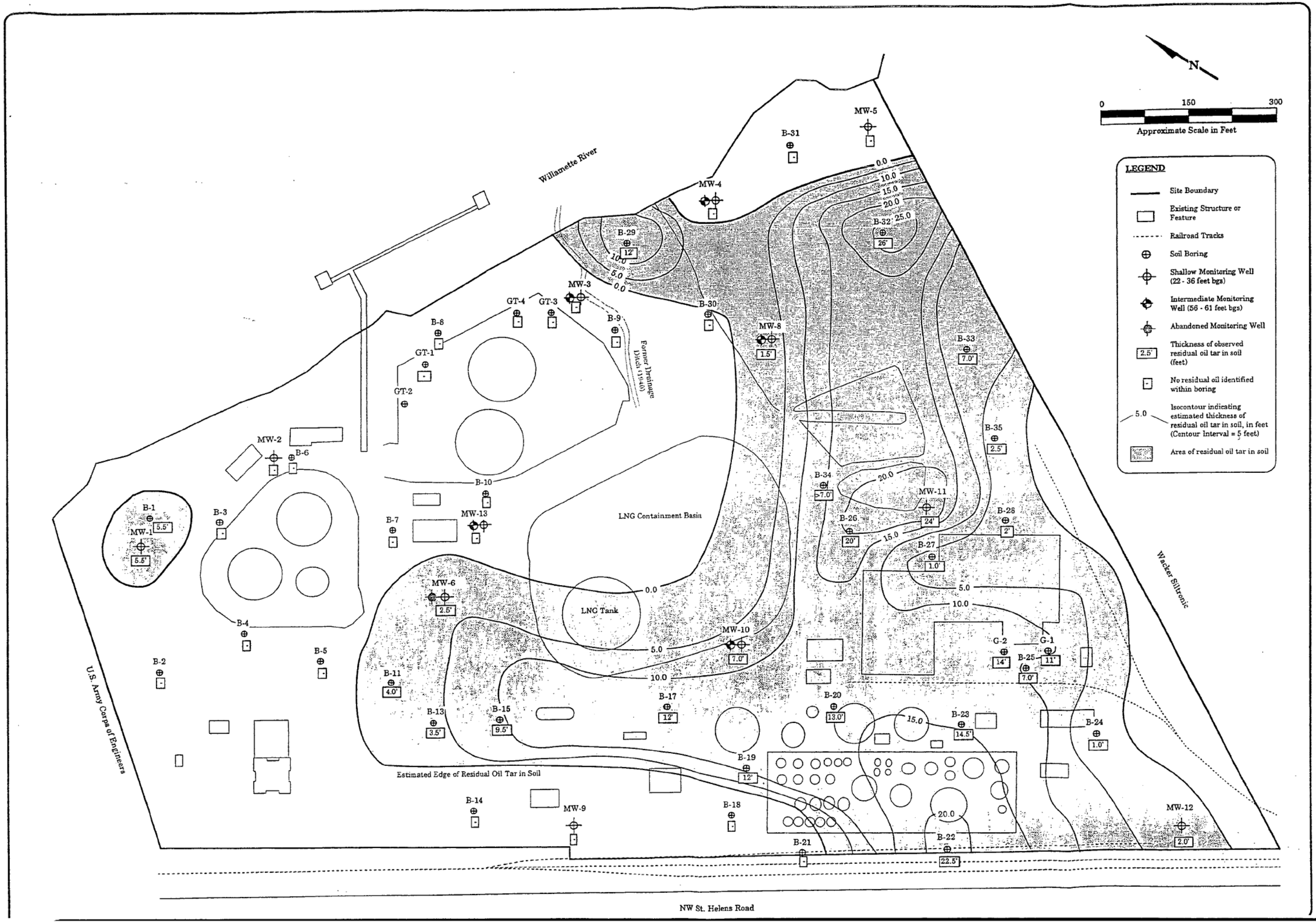

Figure
F-2

Residual Oil Tar/ DNAPL in Soil: Thickness and Isopach Map

Remedial Investigation
Northwest Natural - 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

September 1998

Project #2708

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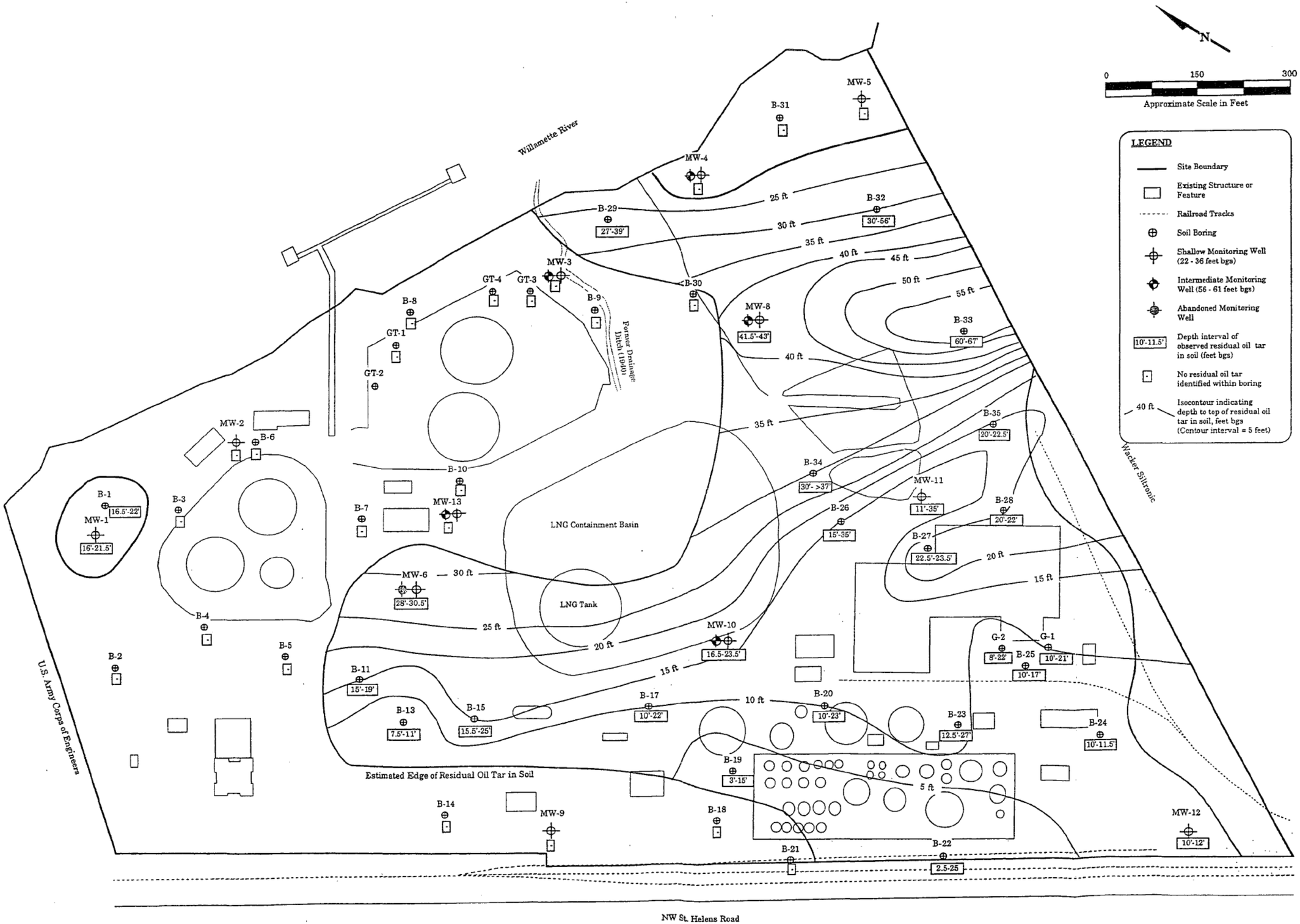

Figure
F-1

Residual Oil Tar/ DNAPL in Soil: Depth to Top (feet bgs)

Remedial Investigation
Northwest Natural - 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

September 1998

Project #2708

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Oregon DEQ Facility Profiler 2.0

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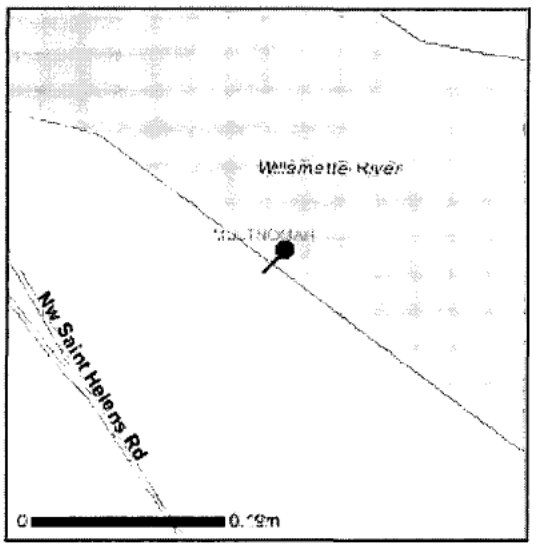
Facility Summary Report

Facility Profiler Print Report

Maps



Facility / Site Information

Location ID:	947	**Latitude:**	45° 34' 44.76"
Facility/Site Name:	KOPPERS INDUSTRIES INC	**Longitude:**	-122° 45' 29.88"
Address:	7540 NW ST HELENS RD	**Location Accuracy:**	HIGH
City State Zip:	PORTLAND OR 97210	**Last Updated:**	9/27/1999

Aliases

GASCO	ECSI	Koppers Co. - Portland	ECSI
KOPPERS INDUSTRIES INC	HWMS	Koppers Industries Inc.	ECSI
NW Natural Gas Co.	ECSI	Pacific Northern Oil Co.	ECSI
Pittsburgh Acquisition Corporation, Inc.	ECSI		

Geographic Features

Township:	T1N-R1W-S12	**Congress Dist:**	3	**Forest Type:**	N/A
County:	MULTNOMAH	**OR Senate Dist:**	17	**Vegetation:**	Urban and industrial
Watershed:	LOWER WILLAMETTE	**OR House Dist:**	33	**Agricultural Land:**	N/A

Oregon DEQ Program Information

Environmental Cleanup (ECSI)

Operation ID	Start Date	Issue Date	Expiration Date	Permit Type	Permit SubType	Status	Detail Information[1]	EPA Number
2348	07/01/1979			Contaminated Site		Suspect site requiring further investigation	ECSI Site Report	027734359
84	07/01/1979			Contaminated Site		Listed on CRL or Inventory	ECSI Site Report	027734359

SIC CODE	SIC Description	PRIMARY
2819	INDUSTRIAL INORGANIC CHEMICALS	Y
2865	CYCLIC CRUDES & INTERMEDIATES	Y
4923	GAS TRANSMISSION/DISTRIBUTION	Y
4925	GAS PRODUCTION/DISTRIBUTION	Y

Hazardous Waste (HWMS)

Identifier	Start Date	Effective Date	Review Date	NFA Date	Type	Sub Type	Detail Information[1]	EPA Number
7388453	08/18/1980	08/18/1980			Generator	CEG	HW Site Report	ORD027734359
7388453	08/18/1980	08/18/1980			Generator	LQG	HW Site Report	ORD027734359

SIC CODE	SIC Description	PRIMARY
2865	CYCLIC CRUDES & INTERMEDIATES	Y

[1] Linked reports may be unavailable from 9:00pm to 7:00am PST due to system maintenance.
[2] DEQ does not maintain air discharge permit information for Lane County.

More Information on this location

Oregon DEQ Neighborhood Info (by region/county)
See wells in the same Township Range Section from the Oregon Water Resources Department Well logs Application
See county's scanned assessor maps through ORMAP

[DEQ's Privacy Notice] [Contact DEQ] [Application Feedback]

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Oregon DEQ

Environmental Cleanup Site Information (ECSI) Database
Site Summary Report - Details for Site ID 84

This report shows data entered as of September 8, 2003 at 2:14:36 PM

See the bottom of this page for a key to certain acronyms and terms used in the report below

Note that other DEQ programs may be active at this site; to check, see DEQ's Facility Profiler.

General Site Information

Site ID: 84	Site Name: GASCO		CERCLIS No: 027734359	
Address:	7900 NW St. Helens RD Portland 97210			
	County: Multnomah		Region: Northwest	
Other location information:	Koppers is located at 7540 NW St. Helens RD			
	Investigation Status: Listed on CRL or Inventory	NPL Site: No	Orphan Site: No	Study Area: No
Property:	Twnshp/Range/Sect: 1N , 1W , 12		Tax Lots: 42,111,123,113,129,131,112,130	
	Latitude: 45.5774 deg.	Longitude: -122.7563 deg.	Site Size: 35 acres	
Other Site Names:	Koppers Co. - Portland NW Natural Gas Co. Pacific Northern Oil Co.			

Site Characteristics

General Site Description:	
Site History:	
Contamination Information:	(10/15/1999 ELB/VCP) Portland Gas and Coke Company (GASCO) apparently purchased the site in the 1880s, and built a gasification plant by 1913. All waste products from the gasification operations were discharged directly to the Willamette River until 1925. After 1925, tars were separated from the wastewater in settling ponds. When the plant was shut down in 1956 by GASCO's successor company, Northwest Natural Gas (NWNG), an estimated 30,000 cubic yards of coal tar had accumulated in the ponds. The ponds were buried under 10 feet of fill in 1973. Part of the site was then sold to Wacker Siltronic Corporation (see ECSI #183). Koppers Company leased an 8-acre portion of the site from NWNG in 1965 and built a coal-tar distillation plant. Waste streams of creosote and pitch were cooled and solidified in storage tanks, and apparently dumped into an on-site disposal pit. (The plant shut down in 1973 and has only been used for the bulk transfer of creosote oil and coal tar pitch since 1977). In December 1993, NWNG signed up for DEQ's Voluntary Cleanup Program. In August 1994, NWNG signed an agreement with DEQ to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the site. An RI/FS workplan was submitted to DEQ in January 1995 and approved in August 1995.
Manner and Time of Release:	Wastewater from tar stills and unusable petroleum by-products were discharged to the Willamette River, farmed on portion of site, or disposed of in settling ponds on-site. Lampblack and spent iron oxide waste stored in large on-site waste piles. Time of release: 1913 to 1977.
Hazardous	Oil gasification wastes including: tars, oil, creosote, phenols, polynuclear

Substances/Waste Types:	aromatic hydrocarbons, BTEX and lead.
Pathways:	
Environmental/Health Threats:	Contamination at the site may represent a threat to human health and the environment by migrating to the Willamette River. Evidence suggests near-shore Willamette River sediments may be contaminated due to past operating practices.
Status of Investigative or Remedial Action:	(10/15/1999 ELB/VCP) During the first phase of the Remedial Investigation, widespread petroleum contamination was identified in site soils, groundwater, and Willamette River sediments. Tars were identified to depths of 70 feet in the vicinity of the former tar disposal area. In the former plant site area, dense non-aqueous-phase liquids (DNAPLs) were identified at three distinct locations. Monitoring wells installed adjacent to the Willamette River detected elevated levels of benzene and naphthalene. Sediment samples were found to contain high concentrations of polynuclear aromatic hydrocarbons (PAHs) and tars. Phase I of the RI was completed in March 1996. Conceptual site models for human health and ecological risk assessments were submitted to DEQ in the fall of 1996. A Land and Water Use report and a series of technical memoranda were submitted during the summer of 1997. Phase II of the RI was completed during the fall of 1998. Groundwater contamination was detected up to 100 feet below the surface along the riverbank. A significant zone of tar contamination extending from the site to the river was also confirmed. (4/17/00 ELB/SRP) In March 2000, two cathodic protection wells that extended 400 feet into the basalt aquifer were abandoned. (9/15/00 ELB/SRP) In August 2000, a product recovery system was installed and soil sampling to support support the upland risk assessment was completed. (4/30/01 ELB/SRP) In March 2001, a source control evaluation was initiated.
Data Sources:	Doane Lake Study Area file (ECSI #36), and NWR project manager files for this site.

Substance Contamination Information

Substance	Media Contaminated	Concentration Level	Date Recorded
BENZENE	Groundwater	16 ppm	
BENZENE	Sediment	22 ppm	
BENZENE	Soil	360 ppm	
CYANIDE (AS ION)	Groundwater	11 ppm	
CYANIDE (AS ION)	Soil	50.7 ppm	
NAPHTHALENE	Groundwater	30 ppm	
NAPHTHALENE	Sediment	5,100 ppm	
NAPHTHALENE	Soil	11,000 ppm	
POLYAROMATIC HYDROCARBONS (PAH)	Groundwater	0.36 ppm	
POLYAROMATIC HYDROCARBONS (PAH)	Sediment	5,048 ppm	
POLYAROMATIC HYDROCARBONS (PAH)	Soil	3,156 ppm	

Investigative, Remedial and Administrative Actions

Action	Start Date	Compl. Date	Resp. Staff	Lead Pgm
Site added to CERCLIS	07/01/1979			
EPA Basic Preliminary Assessment	12/23/1987	12/28/1987		
Site added to database	05/03/1988		Michael Rosen	SRS
Responsible party notified re 11/88 Inventory listing	11/30/1988			SAS
EPA Screening Site Inspection 1	12/15/1988	12/15/1988		
SITE EVALUATION	03/16/1993	03/16/1993	Kevin Dana	SAS

PRELIMINARY ASSESSMENT EQUIVALENT	03/17/1993	03/17/1993	Kevin Dana	SAS
Listing Review completed	03/18/1993	03/18/1993	Kevin Dana	SAS
Proposal for Confirmed Release List recommended	03/19/1993	03/19/1993	Kevin Dana	SAS
Proposal for Inventory recommended	03/22/1993	03/22/1993	Kevin Dana	SAS
Other remedial or investigative action recommended	03/23/1993	03/23/1993	Kevin Dana	SAS
VCS Waiting List	08/13/1993	12/16/1993	Michael Rosen	VCS
NEGOTIATIONS	12/16/1993	08/08/1994	Eric Blischke	VCS
Facility proposed for Confirmed Release List	02/10/1994	02/10/1994	Eric Blischke	VCS
Facility proposed for Inventory	02/10/1994	02/10/1994	Eric Blischke	VCS
Owner/operator comments received on listing notification	02/22/1994	02/22/1994		
Beneficial Water Use Assessment	03/21/1994	08/18/1997	Eric Blischke	VCS
REMEDIAL INVESTIGATION	03/21/1994		Eric Blischke	VCS
Land-Use Assessment	03/21/1994	08/18/1997	Eric Blischke	VCS
Ecological Risk Assessment	03/21/1994	10/21/1996	Eric Blischke	VCS
Review for final listing	04/04/1994	04/04/1994	Eric Blischke	VCS
Listing on Confirmed Release List recommended	04/05/1994	04/05/1994	Eric Blischke	VCS
Listing on Inventory recommended	04/05/1994	04/05/1994	Eric Blischke	VCS
Facility placed on Confirmed Release List	04/06/1994	04/06/1994	Heather Schijf	SAS
Facility placed on Inventory	04/06/1994	04/06/1994	Heather Schijf	SAS
Letter Agreement	08/08/1994	08/08/1994	Eric Blischke	VCS
EPA Site Inspection Prioritization	02/15/1995	02/16/1995		
No Further Remedial Action Planned under Federal program	02/16/1995	02/16/1995		

Key to certain acronyms and terms in this report:
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Lead Pgm: This column refers to the Cleanup Program affiliation of the DEQ employee responsible for the action shown. SAS or SAP = Site Assessment; VCS or VCP = Voluntary Cleanup; ICP = Independent Cleanup; SRS or SRP = Site Response (enforcement cleanup); ORP = Orphan Program.

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Oregon DEQ Facility Profiler 2.0

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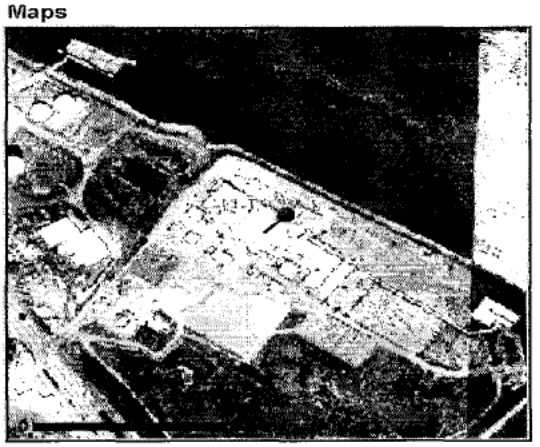
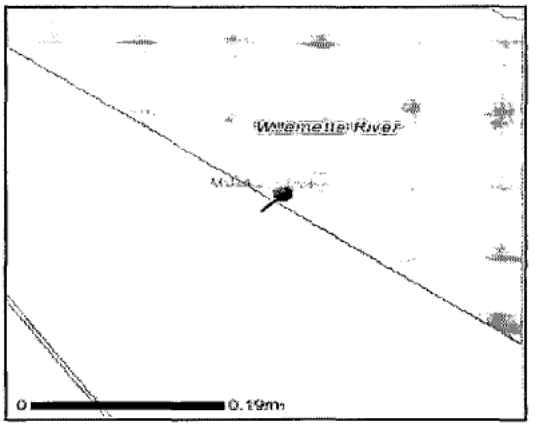
Facility Summary Report

Facility Profiler Print Report

Maps





Facility / Site Information

Location ID:	432	**Latitude:**	45° 34' 39"
Facility/Site Name:	WACKER SILTRONIC CORPORATION	**Longitude:**	-122° 45' 18.7"
Address:	7200 NW FRONT AVE	**Location Accuracy:**	HIGH
City State Zip:	PORTLAND OR 97210	**Last Updated:**	1/23/2003

Aliases

Wacker Siltronic Corp.	ECSI	WACKER SILTRONIC CORPORATION	ACSIS
WACKER SILTRONIC CORPORATION	HWMS	WACKER SILTRONIC CORPORATION	SIS

Geographic Features

Township:	T1N-R1W-S13	**Congress Dist:**	3	**Forest Type:**	N/A
County:	MULTNOMAH	**OR Senate Dist:**	17	**Vegetation:**	Urban and industrial
Watershed:	LOWER WILLAMETTE	**OR House Dist:**	33	**Agricultural Land:**	N/A

Oregon DEQ Program Information

Water Quality Permits (SIS)

FilePermit Number	Start Date	Issue Date	Expiration Date	Permit Type	Permit Subtype	Description	Status	Detail Information[1]
93450-101128	01/01/1901	07/14/1993	05/31/1998	INDUSTRIAL MAJOR	Individual NPDES - Industrial wastewater discharges	NPDES-IW-N All facilities not elsewhere classfied with disposal of process waste water	Active Admin extended	SIS Detail Report
93450-10894	01/01/1901	12/23/1997	06/30/2007	STORMWATER MINOR	NPDES General Permit - Industrial storm water discharges	GEN12Z Industrial storm water	Active Renew no eff mod	SIS Detail Report
93450-17438	01/01/1901	09/28/2000	12/31/2005	STORMWATER MINOR	NPDES General Permit - Industrial storm water discharges	GEN12C Construction that disturbs 1 or more acres	Active Renew no eff mod	SIS Detail Report
						NPDES-IW-N All		

http://deq12.deq.state.or.us/FP20/Fpdetail.aspx?SiteID=432 9/8/03

93450-100286	01/01/1901	02/18/1987	01/31/1992	INDUSTRIAL MINOR	Individual NPDES - Industrial wastewater discharges	facilities not elsewhere classfied with disposal of process waste water	Inactive Renew with eff mod	
93450-10895	01/01/1901	02/22/1993	09/30/1996	STORMWATER MINOR	NPDES General Permit - Industrial storm water discharges	GEN12L Industrial storm water - Light manufacturing	Inactive Renew no eff mod	
93450-10896	01/01/1901	11/08/1994	12/31/2000	STORMWATER MINOR	NPDES General Permit - Industrial storm water discharges	GEN12C Construction that disturbs 1 or more acres	Inactive Terminated	
93450-3847	01/01/1901	06/06/1984	09/30/1986	INDUSTRIAL MINOR	Individual NPDES - Industrial wastewater discharges	NPDES-IW-N All facilities not elsewhere classfied with disposal of process waste water	Inactive Renew with eff mod	

SIC CODE	SIC Description	PRIMARY
1541	INDUSTRIAL BLDGS AND WAREHOUSE	N
2819	INDUSTRIAL INORGANIC CHEMICALS	N
3674	SEMICONDUCTORS	Y

Environmental Cleanup (ECSI)

Operation ID	Start Date	Issue Date	Expiration Date	Permit Type	Permit SubType	Status	Detail Information[1]	EPA Number
183	06/14/1985			Contaminated Site		Listed on CRL or Inventory	ECSI Site Report	096253737

SIC CODE	SIC Description	PRIMARY
3674	SEMICONDUCTORS	Y

Air Quality Permits (ACSIS)

Air Quality Permit	Start Date	Effective Date	Review Date	Closed Date	Status	Type	Sub Type	Detail Information[1]	EPA Number
263002	09/01/2000	03/15/1984	01/24/1997		OPERATING	ACDP	Regular	AQ Report	OR05103002

SIC CODE	SIC Description	PRIMARY
3674	SEMICONDUCTORS	Y
4961	STEAM SUPPLY	N

Hazardous Waste (HWMS)

Identifier	Start Date	Effective Date	Review Date	NFA Date	Type	Sub Type	Detail Information[1]	EPA Number
7610132	08/07/1980	08/07/1980			Generator	LQG	HW Site Report	ORD096253737
7610132	08/07/1980	08/07/1980			Generator	SQG	HW Site Report	ORD096253737

SIC CODE	SIC Description	PRIMARY
3674	SEMICONDUCTORS	Y

[1] Linked reports may be unavailable from 9:00pm to 7:00am PST due to system maintenance.
[2] DEQ does not maintain air discharge permit information for Lane County.

More Information on this location

Oregon DEQ Neighborhood Info (by region/county)
See wells in the same Township Range Section from the Oregon Water Resources Department Well logs Application
See county's scanned assessor maps through ORMAP

[DEQ's Privacy Notice] [Contact DEQ] [Application Feedback]

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Oregon DEQ

Home > Programs> Cleanup & Spills > ECSI Query > ECSI Site Details

Environmental Cleanup Site Information (ECSI) Database
Site Summary Report - Details for Site ID 183

This report shows data entered as of September 8, 2003 at 2:15:57 PM

See the bottom of this page for a key to certain acronyms and terms used in the report below

Note that other DEQ programs may be active at this site; to check, see DEQ's Facility Profiler.

General Site Information

Site ID: 183	Site Name: Wacker Siltronic Corp.		CERCLIS No: 096253737	
Address:	7200 NW Front AVE Portland 97210			
	County: Multnomah		Region: Northwest	
Other location information:	Between Front Ave and Hwy 30 (St. Helens Rd) at the NW 7200 Block			
	Investigation Status: Listed on CRL or Inventory	NPL Site: No	Orphan Site: No	Study Area: No
Property:	Twnshp/Range/Sect: 1N , 1W , 13		Tax Lots: 1	
	Latitude: 45.5775 deg.	Longitude: -122.7552 deg.	Site Size: 84.6 acres	
Other Site Names:				

Site Characteristics

General Site Description:	
Site History:	
Contamination Information:	(5/20/93 KPD/SAS) Predecessor company of Northwest Natural Gas accumulated 30,000 cubic yards of coal tar in on-site pits. Coal tar pits were buried under 10 feet of overburden and spent oxide in 1973. Wacker purchased part of the property in 1978. Subsurface soil sampling on the vacant southern half of the site in 1985 found high levels of PAHs, plus lesser amounts of herbicides. Similar contamination was found in subsurface soil sampling on another portion of the site in 1990. The same year groundwater contaminated with TPH and BTEX compounds was found near a fuel line corridor. In addition, there has been occasional releases of solvents from Wacker's operations. (1/19/00 JMW/SAP) In September and October 1997, EPA's contractor, Roy F. Weston Inc., collected sediment samples within the Portland Harbor (RM 3.5 to RM 9.5). Beryllium, cobalt, iron, manganese, selenium, silver, titanium, vanadium, zinc, carbazole, 2-methylnaphthalene, bis(2-Ethylhexyl)phthalate, dibenzofuran, Di-N-Butylphthalate, pentachlorophenol, PAHs, DDTs, 2,4-D, and 2,4-DB were detected in river sediments.
Manner and Time of Release:	Past practices; time of release unknown.
Hazardous Substances/Waste Types:	PAHs, BTEX, phenols, 2,4-D. In adjacent Willamette River sediments: beryllium, cobalt, iron, manganese, selenium, silver, titanium, vanadium, zinc, 2-methylnaphthalene, bis(2-ethyhexyl)phthalate, carbazole, pentachlorophenol, di-n-butylphthalate, dibenzofuran, PAHs, DDTs, 2,4-D, 2,4-DB
Pathways:	The site is located in a heavily industrialized part of NW Portland. The Willamette River is adjacent to the site on the northeast, and Forest Park is less than a quarter mile to the southwest. Past solvent releases and

suspected leaks from an underground fuel line may have helped to mobilize the coal tar contamination.

Environmental/Health Threats: Site is located in heavy industrial area. Significant soil and groundwater contamination, but contaminated soil is under surface and groundwater not used. Greatest threat may be to Willamette River and to on-site workers who dig into contaminated soil without adequate personal safety equipment.

Status of Investigative or Remedial Action: (5/20/93 KPD/SAS) Contaminated soil is 10-20 feet below ground surface, and groundwater in the area is not used. Contaminants may pose a threat to the environment, particularly the adjacent Willamette River. Similar contamination at the adjacent Northwest Natural Gas Company Site (ECSI #84) has been referred to Voluntary Cleanup and Site Response for further action. Site Assessment recommends that this site be included in those investigations. (1/19/00 JMW/SAP) Based on initial sampling results from a river sediment quality study, the Wacker Siltronic site has been identified as a potential source of contamination to the Portland Harbor. A Strategy Recommendation was completed on October 8, 1999. Contamination in sediments and the high potential for groundwater contamination prompted DEQ to require an RI/FS for the facility (high priority). (3/1/00 JMW/SAP) Voluntary Agreement for Remedial Investigation and Source Control Measures forwarded to Wacker Siltronic Corporation on February 29, 2000. (2/6/01 ELB/VCP) Following Wacker Siltronic Corp's refusal to sign the voluntary agreement, a Unilateral Order was issued jointly to Wacker and Northwest Natural on October 4, 2000. Both parties agreed to comply. An RI proposal was received on November 20, 2000. (11/21/01 ELB/VCP) A Remedial Investigation work plan was approved in June 2001. The Phase I Remedial Investigation was initiated in August 2001; investigative efforts are ongoing.

Data Sources: 1) "Preliminary Report: Soil Investigation for Proposed Polysilicon Plant" by CH2M Hill, June 1985. 2) EPA CERCLA Preliminary Assessment report, by Ecology and Environment, October 1987. 3) Laboratory data from Pacific Environmental Laboratory, July 25, 1990. 4) "Findings Report: Groundwater and Soil Gas Investigation" by CH2M Hill, December 1990. 5) GASCO files (ECSI #84)(see VCS Project Manager files). 6) Doane Lake Study Area files (ECSI #36). 7) Portland Harbor Sediment Investigation Report, Roy F. Weston, Inc. for USEPA, May 1997.

Substance Contamination Information

Substance	Media Contaminated	Concentration Level	Date Recorded
BENZENE	Groundwater	23,300 ppb	12/1/1990
BENZENE	Soil	29 ppm	7/25/1990
BENZO(a)ANTHRACENE	Soil	210 ppm	7/25/1990
BENZO(a)PYRENE	Groundwater	760 ppb	
BENZO(a)PYRENE	Soil	120 ppm	6/1/1985
BENZO(a)PYRENE	Soil	240 ppm	7/25/1990
BENZO(b)FLUORANTHENE	Soil	180 ppm	7/25/1990
BENZO(b)FLUORANTHENE	Soil	up to 120 ppm	6/1/1985
BENZO(k)FLUORANTHENE	Soil	up to 120 ppm	6/1/1985
BENZO(k)FLUORANTHENE	Soil	120 ppm	7/25/1990
BERYLLIUM	Sediment	0.9 ppm	9/1/1997
BIS(2-ETHYLHEXYL)PHTHALATE	Sediment	210 - 700 ppb	9/1/1997
CARBAZOLE	Sediment	170 - 3600 ppb	9/1/1997
CHLOROPHENOL	Soil	17.5 ppm	
CHRYSENE	Soil	92 ppm	6/1/1985
CHRYSENE	Soil	280 ppm	7/25/1990
COBALT	Sediment	20.3 - 24.6 ppm	9/1/1997
D,2,4-	Sediment	9 - 93 ppb	9/1/1997
DB,2,4-	Sediment	13 - 130 ppb	9/1/1997
DDT,p,p'-	Sediment	570 - 380 ppb	9/1/1997

DIBENZOFURAN	Sediment	160 - 3600 ppb	9/1/1997
DIMETHYLPHENOL,2,4-	Groundwater	27 ppb	
DIMETHYLPHENOL,2,4-	Soil	3.1 ppm	
DI-n-BUTYL PHTHALATE	Sediment	21 ppb	9/1/1997
ETHYLBENZENE	Groundwater	4,680 ppb	12/1/1990
INDENO(1,2,3-cd)PYRENE	Soil	160 ppm	7/25/1990
INDENO(1,2,3-cd)PYRENE	Soil	up to 270 ppm	6/1/1985
IRON	Sediment	51900 - 64500 ppm	9/1/1997
MANGANESE	Sediment	863 - 909 ppm	9/1/1997
METHYLNAPHTHALENE,2-	Sediment	180 - 11000 ppb	9/1/1997
PENTACHLOROPHENOL	Sediment	4.6 - 11 ppb	9/1/1997
PETROLEUM HYDROCARBONS	Groundwater	89,000 ppb	12/1/1990
POLYAROMATIC HYDROCARBONS (PAH)	Sediment	LPAHs 6860 - 165600 ppb	9/1/1997
POLYAROMATIC HYDROCARBONS (PAH)	Sediment	HPAHs 3034 - 268800 ppb	9/1/1997
SELENIUM	Sediment	16 - 17 ppm	9/1/1997
SILVER	Sediment	1.5 - 1.7 ppm	9/1/1997
TETRACHLOROETHYLENE	Soil	11 ppm	
TITANIUM	Sediment	2740 - 3200 ppm	9/1/1997
TOLUENE	Groundwater	5,960 ppb	12/1/1990
TOLUENEDIAMINE,2,4-	Soil	160 ppm	6/1/1985
VANADIUM	Sediment	113 - 152 ppm	9/1/1997
ZINC	Sediment	120 - 150 ppm	9/1/1997

Investigative, Remedial and Administrative Actions

Action	Start Date	Compl. Date	Resp. Staff	Lead Pgm
Site added to CERCLIS	06/14/1985			
EPA Basic Preliminary Assessment	11/09/1987	11/09/1987		
Site added to database	05/02/1988		Michael Zollitsch	SAS
Responsible party notified re 11/88 Inventory listing	11/30/1988			SAS
EPA Screening Site Inspection 1	12/15/1988	12/15/1988		
NEGOTIATIONS	05/11/1990	08/05/1991		SRS
SITE EVALUATION	08/04/1991	08/04/1991		SRS
Preliminary Assessment Equivalent recommended (PAE)	08/04/1991	08/04/1991		SRS
PRELIMINARY ASSESSMENT EQUIVALENT	08/05/1991	08/05/1991		SRS
Listing Review completed	08/06/1991	08/06/1991		SRS
Proposal for Confirmed Release List recommended	08/07/1991	08/07/1991		SRS
Proposal for Inventory recommended	08/07/1991	08/07/1991		SRS
Facility proposed for Confirmed Release List	11/15/1991	11/15/1991		SRS
Facility proposed for Inventory	11/15/1991	11/15/1991		SRS
Extension requested by owner/operator	12/20/1991	12/20/1991		
Petition or request granted	12/22/1991	12/22/1991	Loretta Pickerell	SAS
Owner/operator comments received on listing notification	02/13/1992	02/13/1992	Loretta Pickerell	SAS
Review for final listing	07/29/1992	07/29/1992	Loretta Pickerell	SAS
Listing on Confirmed Release List recommended	07/30/1992	07/30/1992	Loretta Pickerell	SAS

Listing on Inventory recommended	07/30/1992	07/30/1992	Loretta Pickerell	SAS
Facility placed on Confirmed Release List	10/22/1992	10/22/1992	Loretta Pickerell	SAS
Facility placed on Inventory	10/22/1992	10/22/1992	Loretta Pickerell	SAS
SITE PRIORITY EVALUATION FOR FURTHER ACTION	05/19/1993	05/19/1993	Kevin Dana	SAS
Other remedial or investigative action recommended	05/20/1993	05/20/1993	Kevin Dana	SAS
EPA Site Inspection Prioritization	03/07/1995	03/07/1995		
Remedial Investigation/Feasibility Study recommended	10/08/1999	10/08/1999	Eric Blischke	VCS
BASIC PRELIMINARY ASSESSEMENT	10/08/1999	10/08/1999	Eric Blischke	VCS
NEGOTIATIONS	02/29/2000	10/04/2000	Eric Blischke	VCS
Letter Agreement	02/29/2000	10/04/2000	Eric Blischke	VCS
REMEDIAL INVESTIGATION	10/04/2000		Eric Blischke	VCS
Unilateral Order	10/04/2000		Eric Blischke	SRS

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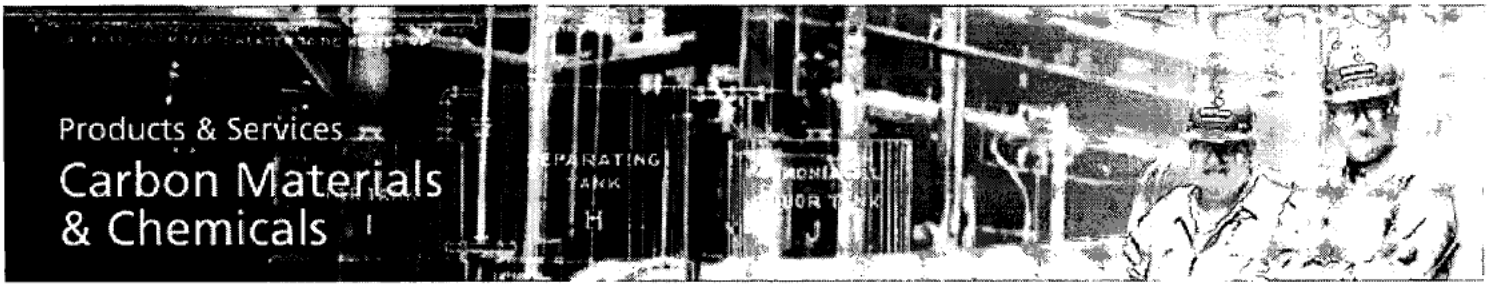

Koppers carbon materials and chemicals are used by many industries. They are essential to the production of aluminum, steel, plastics, resins, treated wood, and rubber products. They also increase the durability of many products including railroad ties, utility and transmission poles, and marine pilings.

Koppers experience and expertise make it the company that hundreds of manufacturers turn to for top quality carbon pitch, creosote, carbon black and phthalic anhydride.

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all related.
(learn how)

Products →

Koppers is a worldwide supplier of carbon pitch, coal tar distillates, industrial wood preservatives, phthalic anhydride, refined tars, specialty chemicals, and commercial grade roofing products.

- Carbon Pitch
- Coal Tar Distillates
- Coke
- Refined Tars
- Phthalic Anhydride
- Naphthalene

Services →

Our services are available to our customers in an effort to keep us the preferred supplier for your carbon material and chemical needs.

- Carbon Testing
- Logistics

Resources →

Information dealing with the production, usage and refinement of coal tar may change as new methods are found. Updates are available via our Technical Support group or through our published white papers.

- Technical Support
- Technology White Papers

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Headquarters Press Release

Washington, DC
For Release 01/16/2003

UNITED STATES REACHES SETTLEMENT WITH KOPPERS INDUSTRIES TO SETTLE SCORES OF ENVIRONMENTAL VIOLATIONS

Department of Justice

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FOR IMMEDIATE RELEASE ENRD (202) 514-2007
THURSDAY, JANUARY 16, 2003 EPA (202) 564-7873
WWW.USDOJ.GOV

WASHINGTON, D.C. – Koppers Industries, Inc. agreed to pay the United States $2.9 million to resolve allegations of numerous violations of several environmental regulations at many of the company's U.S. facilities and committed to carry out an environmental management system (EMS), the Justice Department and Environmental Protection Agency (EPA) announced today. The Pittsburgh-based company engages in coke making (a carbon-rich fuel used as a heat source to melt iron ore), coal tar production and wood preserving at facilities throughout the United States.

As a result of an investigation of Koppers facilities initiated in 1996, EPA found thousands of violations, mostly under the Clean Water Act (CWA). EPA investigations revealed that Koppers failed to submit monitoring data required by the National Pollutant Discharge Elimination System (NPDES) and pretreatment permits issued under the CWA. Without proper monitoring and reporting, regulatory agencies cannot adequately assess the potential for environmental harm that may be caused by a discharger of pollutants.

The company also violated discharge limits in its NPDES permits. These permit violations by Koppers

SCOEPA00003700

throughout the company resulted in the discharge of pollutants above the permitted amounts. Some of these pollutants are designated as hazardous chemicals and are toxic in fresh water in small quantities. The discharge of this industrial wastewater over the permit limits may endanger aquatic life and the environment.

"Today's settlement exemplifies the government's commitment to ensure compliance with all federal environmental laws," said Tom Sansonetti, Assistant Attorney General for the Department's Environment and Natural Resources Division. "Compliance with these laws is absolutely necessary to protect human health and the environment. Koppers' commitment to carry out an environmental management system is particularly significant, as it increases the likelihood that similar violations will not recur."

"This settlement resolves Koppers' past illegal practices and commits the company to a comprehensive environmental management program that will protect the public and the environment," said John Peter Suarez, EPA's Assistant Administrator for Enforcement and Compliance Assurance. "EPA will take actions necessary to enforce our environmental laws against companies that put the public at risk by not complying with the law."

Under the Clean Air Act (CAA), EPA found multiple violations of National Emission Standards for Hazardous Air Pollutants at the company's Woodward, Alabama coke plant, including violations of the standards that control benzene emissions from coke by-product recovery plants. In particular, the plant failed to operate a gas blanketing system, which is used to control benzene emissions from its storage tanks, between October 1996 and May 1997. The plant also failed to submit semi-annual reports from August 1994 to September 1997 for its benzene emissions control system.

In addition, the Woodward plant violated the standards for fugitive emission sources, which require a facility to identify, tag and monitor monthly potential fugitive emissions from equipment leaks. The plant also violated the regulation applicable to coke oven batteries. This regulation requires a facility to submit semiannual compliance reports. Koppers submitted a semiannual report in August of 1995, but failed to submit additional reports before July 1997. The United States also alleged that in March 1997, Koppers violated the Resource Conservation and Recovery Act (RCRA) regulation that requires a facility to store used oil in containers and tanks that are in good condition with no severe rusting, apparent structural defects or deterioration. In March 1997, Koppers violated the regulation by collecting used oil in an unmarked, severely crushed tank.

As a result of the consent decree entered into by Koppers and the United States, lodged today in the U.S. District Court, Northern District of Alabama, Koppers will implement an EPA-approved EMS that helps the company identify and monitor its compliance with federal and state environmental laws. During the first three years after entry, Koppers will hire qualified third-parties to audit each facility's performance under the EMS and will provide periodic reports on these audits to EPA. After these EMS audits are underway, Koppers will use independent auditors to evaluate the company's compliance with environmental laws. Should the compliance audits identify additional violations, Koppers will be required to install the necessary treatment upgrades, and operational and maintenance improvements to meet all environmental permit requirements and water quality standards.

Compliance audits also will address storm water, and may require Koppers to implement storm water pollution prevention plans. These efforts will reduce the instances of unreported and contaminated storm water discharges to the environment.

The consent decree requires Koppers to correct all violations identified in an audit report within 60 days. EPA may assess civil penalties for violations identified in an audit report using its audit policy.

In August 2002, Koppers was ordered to pay a fine of $2.1 million after pleading guilty to two felony violations of the CWA and one felony violation of the CAA. The convictions resulted from releases of hazardous air and water pollutants, which exceeded permitted limits at the company's Woodward plant. In addition, Koppers was ordered to pay restitution of $900,000 to the Black Warrior-Cahaba Rivers Land Trust and was placed on probation for three years.

R-016 ###

Last Revised: 01/16/2003

SCOEPA00003702

WACKER
Wacker Siltronic Corporation

FOR RELEASE: October 3, 2000

FOR MORE INFORMATION CONTACT: Cathryn Young, (503) 219-7406

WACKER FILES NOTICE OF INTENT TO SUE OVER CONTAMINATION

PORTLAND, OR... Wacker Siltronic Corporation has notified Northwest Natural that it will bring a lawsuit if Northwest Natural does not take responsibility for contamination it put on Wacker's property.

Wacker sent Northwest Natural a 90-day Notice of Intent to file a Citizen's Suit under the Federal Resource Conservation and Recovery Act (RCRA). "We believe that those who created the contamination should take responsibility for it," according to Cathryn Young, Wacker's Senior Manager for environment and engineering.

Under RCRA, a 90-day notice of intent to sue is required in the hope that issues of responsibility can be resolved before they reach the courts.

Ms. Young explained that Wacker and Northwest Natural have been negotiating over responsibility for the contamination. "We hope the negotiations will continue and that we can come to an agreement and avoid a lawsuit," she said. "We're very reluctant to take this step, but we need to preserve our legal options."

Between 1913 and 1956, Portland Gas and Coke Company, which later became Northwest Natural, operated an oil gasification plant next to Wacker's current site. In addition to producing gas from oil, the operation produced oil tar and a number of other waste products. Large amounts of this waste were deposited on Wacker's site.

In the 1960's and 70's, the mounds of waste were leveled, and oil tar settling ponds were filled. Fill material was added to low spots, and the entire site was covered with clean fill. Wacker purchased the property in 1978 without knowledge of the historical activities.

MORE...

Northwest Natural continues to own the property next to Wacker's site. According to DEQ records, Northwest Natural has been addressing the oil tars and other wastes on its property for over six years. "We're asking only that they address the oil tars and other wastes they created and put on our property as well," Ms. Young noted.

If Northwest Natural and Wacker do not come to an agreement and a lawsuit is filed, a judge would allocate responsibility.

Because the oil tars and other wastes on Wacker's site are covered with soil and vegetation, they do not pose a risk to anyone on site, according to Ms. Young.

However, she noted that questions have recently been raised about whether contamination under the site is reaching the river. "Someone needs to determine whether the contamination is moving, and we believe the responsibility rests with those who created the problem," according to Ms. Young.

Ms. Young noted that Wacker expects DEQ to also take action very soon. She said DEQ is expected to issue a unilateral order to both Wacker and Northwest Natural requiring that the contamination be addressed. "We expect to be included in the order because it is our property, and we expect Northwest Natural will be included because they are the source of the contamination."

###########

NEWS RELEASE

FOR IMMEDIATE RELEASE October 5, 2000

NW Natural commits to joint studies, cleanup on Wacker site

PORTLAND – NW Natural today emphasized its commitment to share responsibility for environmental studies and cleanup ordered by the Oregon Department of Environmental Quality on a Northwest Portland industrial site owned by Wacker Siltronic since 1978.

The DEQ this week issued an order directing Wacker and NW Natural to complete studies and undertake appropriate cleanup procedures on the property, previously owned by NW Natural until the early 1960s.

"We're willing to clean up any contaminants deposited by our former use of the property," said Gregg Kantor, NW Natural's Vice President for Public Affairs. "We would have preferred to do so through a voluntary agreement with DEQ, but Wacker was unwilling to participate." Kantor said NW Natural has offered to share half the costs of the initial studies and then "reallocate the costs of the studies and cleanup when we know who is responsible for what share of the contamination."

The Wacker property is adjacent to property owned by NW Natural. The two properties were at one time a single parcel owned by Portland Gas & Coke, the predecessor of NW Natural Gas. The property was the site of a plant that produced gas from oil. The process created byproducts such as oil, tar, wastewater, and other chemicals. The plant was closed in the late 1950s when natural gas was first transported into the Pacific Northwest by interstate pipeline. The property was later bought by a consortium of owners and used as a disposal site for construction and dredge materials.

(MORE)

Steve Sechrist
PRESS CONTACT
TEL
503.226.4211 EXT.**3517**

James Boehlke
INVESTOR CONTACT
TEL
503.226.4211 EXT.2451

NW Natural is currently working on studies and cleanup on the adjacent property it still owns under a voluntary agreement with DEQ, Kantor said. NW Natural officials were willing to enter into a similar agreement jointly with Wacker with respect to the Wacker property, but Wacker refused to go forward on that basis and instead gave notice of its intent to sue NW Natural.

"It is inappropriate for a company (Wacker) who has owned the site for 22 years, and who may have contributed to its contamination, to try to absolve themselves of nearly all responsibility," Kantor said. "We have reason to believe that Wacker may have contributed to the contamination on the property, and Wacker and other parties may have contributed to, or exacerbated, the extent of the contamination."

"We haven't owned the Wacker property since the 1960s," Kantor added. "But if we are responsible for any contamination on the site we will clean it up. We're a 141-year-old Oregon company with a strong commitment to the community and we're willing to do what's right."

# # #

WACKER SILTRONICS

General Permit Information

June 1978

INTRODUCTION

Wacker Siltronics proposes to build a high purity silicon manufacturing plant in Portland, Oregon. The following has been prepared to provide city/state/federal regulatory agencies with general background information to assist in their review of specific permit applications.

The major product, silicon, will be used mainly as a semi-conductor material by the electronics industry. The plant will be constructed in phases approximately as follows:

Initiate Site Work	August 1978
Initial Production	March 1980
Further Expansion	1980 - 1985
Additional Major Construction	June 1985
Full Production	January 1987

The estimated cost of the project is 55 million dollars. Employment, upon completion of the first major phase, will be approximately 700. Total employment upon completion, as presently projected, will be approximately 1200 people.

PROPOSED FACILITY DESCRIPTION

Brief descriptions of the plant site, manufacturing process and environmental aspects follow:

PLANT LOCATION

The plant location is shown in Figure 1. The site, located in the City of Portland, consists of approximately 84 acres on Northwest Front Avenue, bordering on the Willamette River. The property, which is presently vacant, was formerly low, wet land that has been filled over a number of years with river dredged fill (mostly sand) for future industrial development.

The proposed project is subject to provisions of the Urban Renewal Plan for the Northwest Front Avenue Industrial Renewal Project which was approved and adopted on 11 May 1978 by the City Council of the City of Portland by Resolution No. 32099. In adopting the urban renewal plan, the Council declared the redevelopment of this site and elimination of existing undesirable conditions to be in the public interest and of benefit to the public health, safety, and welfare.

An application for a Greenway Conditional Use Permit is necessary and has been submitted to the City of Portland, Planning Commission for their review and consideration.

PLANT LAYOUT

The overall plant layout showing building locations, roadways, rail line, parking area and other facilities is shown

In general, production will be 24 hours per day, 7 days per week, and 52 weeks per year.

PROCESS DESCRIPTION--PHASE 2

Major plant expansion or Phase 2 construction will include expansion of operations described in Phase 1 and additional facilities to produce polycrystalline material from ferrosilicon feed stock. The additional facilities to be constructed will primarily replace the polycrystalline material previously shipped from Germany. Ground raw ferrosilicon alloy will be delivered to the plant site by truck and/or railcar. The feedstock will be stored in enclosed bins on site. HC1 and H_2 used in the process will be piped to the plant from Pennwalt Corporation which is located adjacent to the plant site.

A process flow diagram for the production of the polycrystalline material is shown in Figure 4. These operations consist of reacting the raw silicon alloy feedstock with HC1 at a high temperature to form silicon tetrachloride ($SICl_4$) and trichlorosilane ($SiHCl_3$). The silicon tetrachloride and trichlorosilane are separated and purified by fractional distillation. Steam is provided to the distillation operation by a natural gas or distillate oil fired boiler. $SiCl_4$ is stored on site and sold for other uses. The purified $SiHCl_3$ is entrained in hydrogen gas and deposited into polycrystalline rods. The polycrystalline rods are stored and fed into the monosilcon facility constructed in Phase I. This process will also operate 24 hours per day, 7 days per week, 50 weeks per year.

ENVIRONMENTAL SYSTEMS

The plant's air, water, noise and solid waste discharges are subject to regulations of the Oregon Department of Environmental Quality, City of Portland, U.S. Army Corps of Engineers and Environmental Protection Agency (NPDES).

The plant will be designed to use the best available control technology to control its discharges in conformance with the regulatory requirements.

WATER AND WASTEWATER

The plant will obtain its water from the City of Portland. The majority of the plant process water needs are associated with process cooling. Other uses include scrubber water, washing and limited process needs.

Sanitary sewerage and organic process wastewater will be discharged for treatment to the City of Portland sewer system. Inorganic process wastewater will be treated onsite by neutralization and settling before being discharged to the Willamette River.

SOLID WASTE

Solid waste generated when in full production consists primarily of waste silicon, wastewater sludge, unclaimable in-process material and general plant solid waste (packing boxes, etc.).

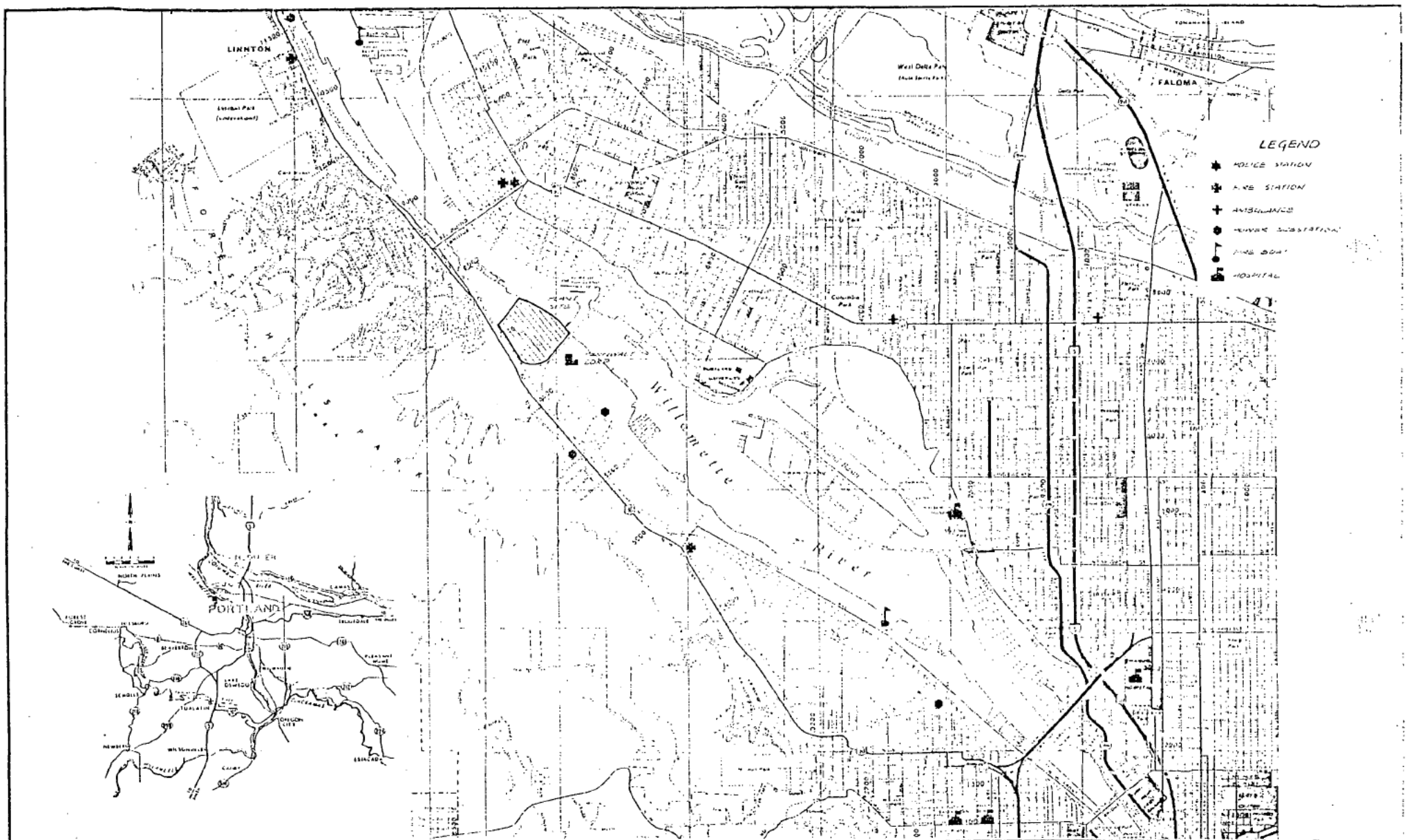
Solid waste generated at the plant that cannot be recycled or sold to others will be disposed of in an approved off-site landfill.

AIR EMISSIONS

Air contaminants generated by the facility primarily come from the natural gas/distillate fired boiler and the nitric acid etching operation. The boiler emissions are controlled by use of low sulfur fuels and NO_x emissions are reduced by passing them through a chemical absorption scrubber. Particulate emissions from material transfer operations are limited and controlled by fabric filters.

NOISE

Any ambient noise generated at the plant is primarily associated with fans used for air movement. The plant location is such that any noise generated will not exceed adopted regulations.



PRELIMINARY

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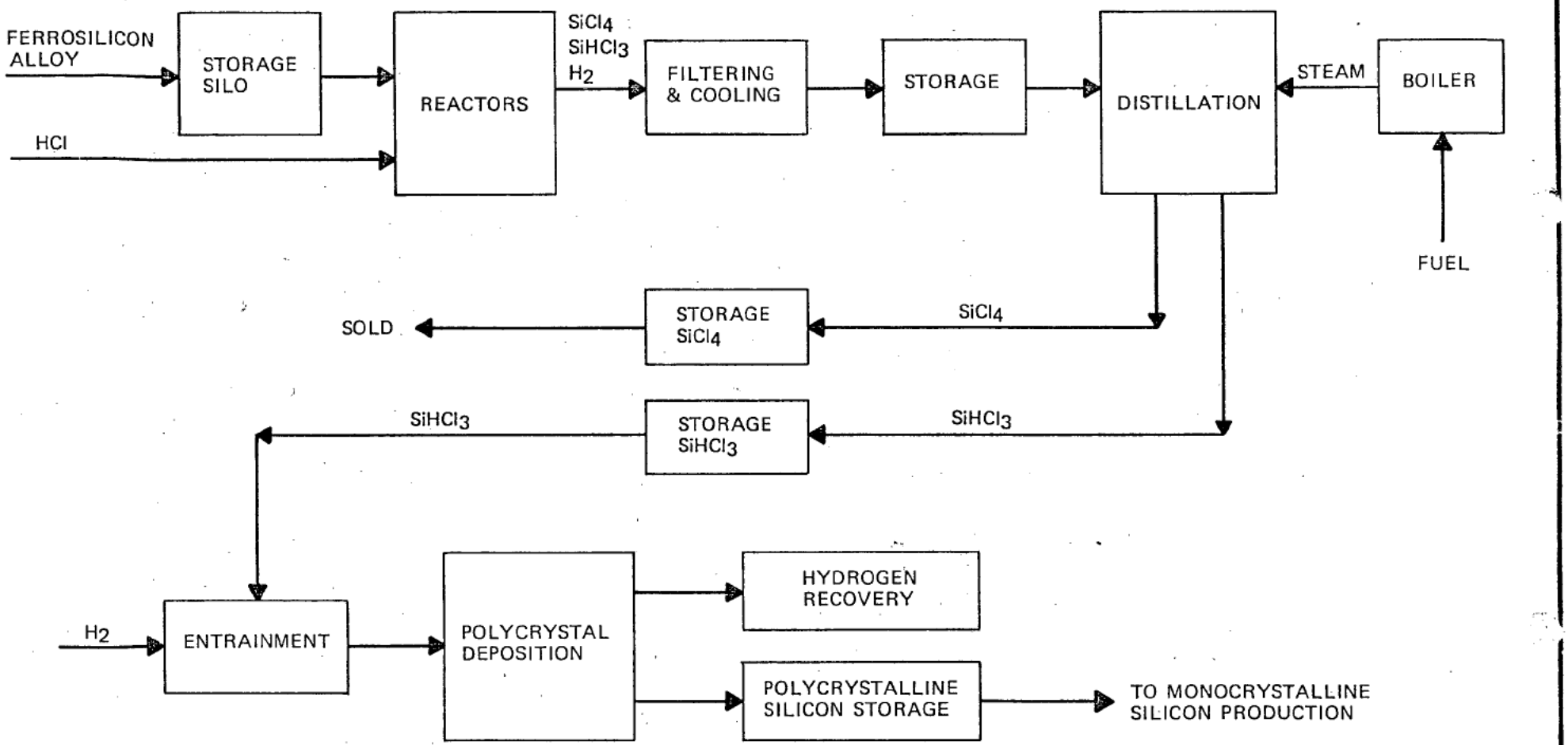

FIGURE 4 -- POLYCRYSTALLINE SILICON PRODUCTION

CH2M HILL

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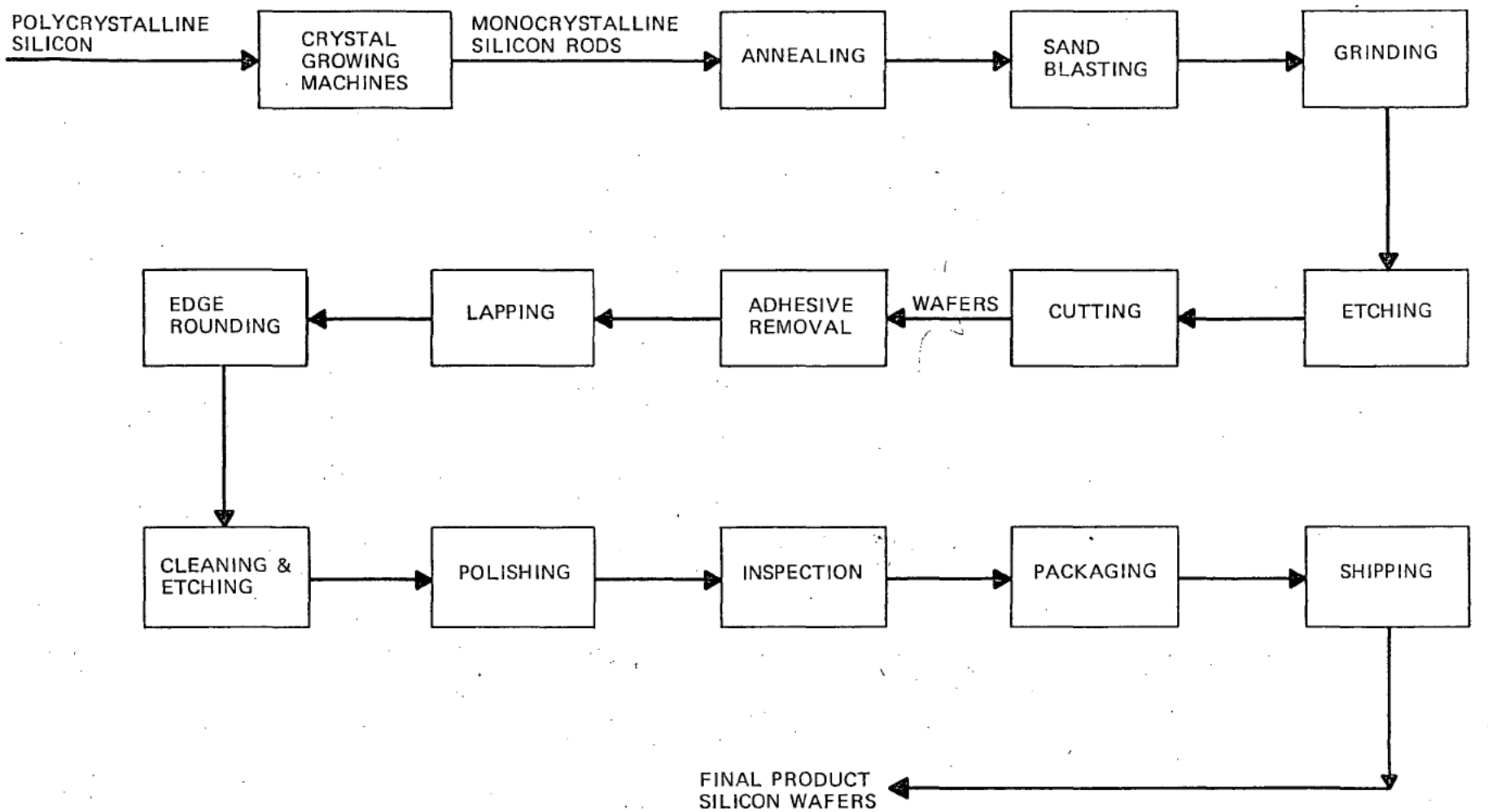

FIGURE 3 – MONOCRYSTALLINE SILICON PRODUCTION AND PROCESSING

CH2M HILL

Oregon
Theodore R. Kulongoski, Governor

Department of Environmental Quality
Northwest Region Portland Office
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987
(503) 229-5263
FAX (503) 229-6945
TTY (503) 229-5471

March 12, 2004

Mr. Bob Wyatt
Northwest Natural
220 NW Second Avenue
Portland, OR 97209

Re: Indoor Air Benzene Assessment/Completing Gasco RI
on Siltronic Property

Dear Mr. Wyatt,

During the recent remedial investigation (RI) work conducted by Siltronic Corporation, benzene concentrations associated with apparent manufactured gas plant waste were detected in soil and shallow groundwater exceeding the Department of Environmental Quality (DEQ) indoor air pathway screening levels for occupational exposure[1]. Benzene was detected up to 218,000 ug/kg in soil (e.g., GP-10) and up to 8,060 ug/L in groundwater (e.g., monitoring well WS-10-27). DEQ's benzene screening levels for vapor intrusion into buildings for occupational exposure are 1,200 ug/kg for soil and 2,700 ug/L for groundwater. Attached for your reference are data summary tables and a sample location figure from recent data reports[2].

Trichloroethene (TCE) concentrations in shallow groundwater in GP-9 (near GP-10) adjacent to the FAB 1 Building also exceed DEQ screening levels for vapor intrusion into buildings. Because of the potential for exposure from vapor phase migration into the FAB 1 Building, DEQ has requested that Siltronic Corporation conduct indoor testing for volatile organic compounds (VOCs) such as TCE and benzene inside the FAB 1 Building.

DEQ considers Siltronic Corporation responsible for the subject investigation of the TCE release and NW Natural responsible for the remedial work associated with the former Gasco manufactured gas plant wastes on the Siltronic Property. Given the potential for benzene exposure to occupants of existing structures on the Siltronic site from manufactured gas plant wastes, DEQ requests that NW Natural immediately coordinate with Siltronic Corporation to design and implement an assessment of the indoor air exposure pathway for VOCs associated with manufactured gas plant wastes at the Siltronic site. DEQ anticipates that indoor air monitoring will be an initial focus of this

[1] Oregon Department of Environmental Quality, September 22, 2003, Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites.

[2] Maul Foster Alngi, December 29, 2003, Groundwater Summary Report Wacker Siltronic Corporation Site 7200 NW Front Avenue Portland, Oregon

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Theodore R. Kulongoski, Governor

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[2] Maul Foster Alngi, December 29, 2003, Groundwater Summary Report Wacker Siltronic Corporation Site 7200 NW Front Avenue Portland, Oregon

assessment and requests that NW Natural provide a draft work plan for this assessment within the next 30 days. This work plan would not include the portion of the FAB 1 Building potentially impacted by the TCE release as Siltronic Corporation is already proceeding with this evaluation.

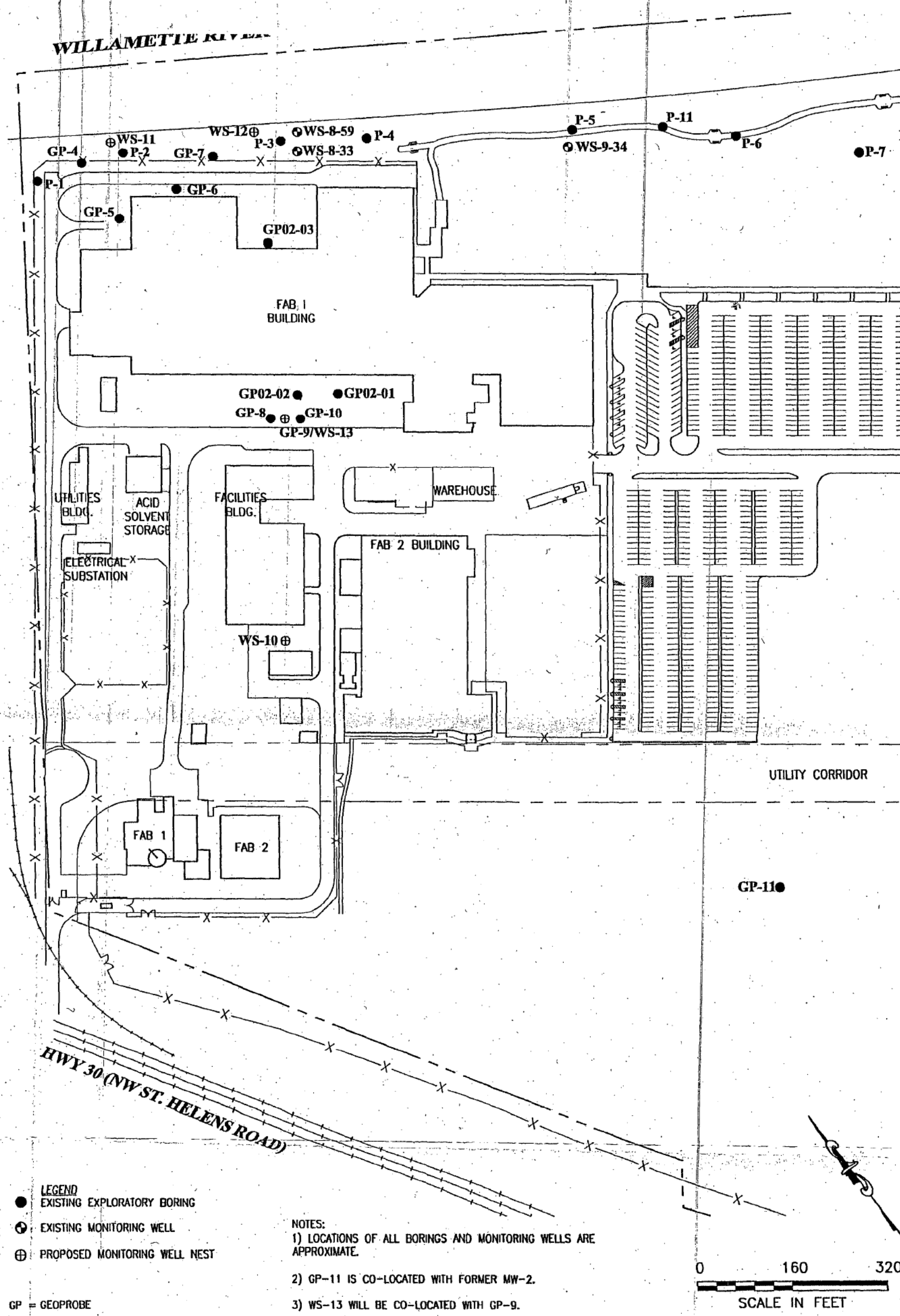
In addition, as we have discussed, the RI of manufactured gas plant wastes on the Siltronic site is outstanding and must be completed before the Gasco RI can be considered complete. Because of the differing property ownership and the fact that the RI work on the NW Natural property is nearing completion, DEQ intends to treat the NW Natural property and the Siltronic Corporation property as separate operable units. Given the potential for current exposure to manufactured gas plant wastes noted above, completing the RI work on the Siltronic site is a priority for DEQ. As such DEQ requests that NW Natural provide a proposal to complete the RI on the Siltronic Corporation property within the next 90 days. The proposal should build on the recently submitted *Phase I Site Characterization Summary Report* and include a conceptual site model, identification of RI data gaps, and a proposed phased RI scope of work and schedule.

Please let me know within 10 days of receipt of this letter, if NW Natural intends to conduct the indoor assessment and complete the RI work on the Siltronic Corporation property as requested. If you have any questions, please contact me at (503) 229-5538.

Sincerely,

Matt McClincy
Project Manager
Portland Harbor Section

Cc: Tom McCue, Siltronic Corporation
Jim Anderson, DEQ NWR
Kurt Burkholder, Department of Justice



Vancouver: (360) 694-2691
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Portland: (971) 544-2139

MAUL FOSTER ALONGI

DATE 03/04/03
DWN. JLN
APPR.
REVIS.
PROJECT NO.
8128.01.05

Figure 1
WACKER SILTRONIC CORPORATION
PORTLAND, OREGON

PROPOSED BORING AND MONITORING WELL LOCATIONS

File: G:\8000\8128-01_WACKER SILTRONIC\FINAL WORKPLAN MARCH 2003\SAMPLE LOCATIONS-REV091803.DWG Last edited: AUG. 18, 2003 @ 1:59 p.m. Xrefs: none Black/White

LAYOUT: Scenario 3

Table 1
Concentrations of Volatile Organic Compounds in Groundwater (ug/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	units	1,1-Dichloroethene	1,2,3-Trichloro-propane	1,2,4-Trimethyl-benzene	1,2-Dichloro-benzene	1,3,5-Trimethyl-benzene	1,3-Dichloro-benzene	4-Chlorotoluene	4-Isopropyl-toluene
GP8	GP8-W-24.0	0307095-10A	07/16/2003	24	ug/l	10.9	0.450 J	65.0	--	19.3	--	0.220 J	2.65
GP9	GP9-W-24.0	0307095-21A	07/17/2003	24	ug/l	26.8	--	48.1	--	20.5	--	--	1.92
GP9	GP-W-DUP	0307095-21A	07/17/2003	24	ug/l	30.6	--	58.6	--	24.7	--	--	2.62
GP10	GP10-W-24.0	0307095-05A	07/16/2003	24	ug/l	46.7	--	102	--	27.4	--	--	4.65
GP11	GP11-W-40.0	0307076-09A	07/14/2003	40	ug/l	--	--	--	--	--	--	--	--
GP11	GP11-W-70.0	0307087-10A	07/15/2003	70	ug/l	--	--	--	--	--	--	--	--
GP11	GP11-W-96.0	0307087-13A	07/15/2003	96	ug/l	--	--	--	105	--	37.7	--	--

Notes:
ft. bgs = Feet below ground surface.
ug/L = Micrograms per liter.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

SCOEPA00003720

Table 1
Concentrations of Volatile Organic Compounds in Groundwater (ug/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	units	Acetone	Benzene	Carbon Disulfide	Chlorobenzene	cis-1,2-Dichloroethene	Ethylbenzene	Isopropyl-benzene	m,p-Xylenes	Naphthalene	n-Butyl-benzene
GP8	GP8-W-24.0	0307095-10A	07/16/2003	24	ug/l	--	1,900	0.680 J	--	1,330	548	8.91	175	8,430	--
GP9	GP9-W-24.0	0307095-21A	07/17/2003	24	ug/l	1.73 J	1,270	--	--	6,360	181	11.6	64.1	6,990	0.610
GP9	GP-W-DUP	0307095-21A	07/17/2003	24	ug/l	--	1,020	--	--	5,530	185	13.9	67.6	8,290	0.680
GP10	GP10-W-24.0	0307095-05A	07/16/2003	24	ug/l	--	1,120	--	--	3,590	340	12.7	185	5,930	3.62
GP11	GP11-W-40.0	0307076-09A	07/14/2003	40	ug/l	--	--	0.160 J	--	--	--	--	--	--	--
GP11	GP11-W-70.0	0307087-10A	07/15/2003	70	ug/l	--	--	--	--	--	--	--	--	--	--
GP11	GP11-W-96.0	0307087-13A	07/15/2003	96	ug/l	8.45 J	0.410	0.130 J	63.9	--	--	--	--	0.770	--

Notes:
ft. bgs = Feet below ground surface.
ug/L = Micrograms per liter.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

SCOEPA00003721

Table 1
Concentrations of Volatile Organic Compounds in Groundwater (ug/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	units	n-Propyl-benzene	o-Xylene	Styrene	tert-Butyl-benzene	Toluene	trans-1,2-Dichloroethene	Trichloro-ethene	Vinyl chloride
GP8	GP8-W-24.0	0307095-10A	07/16/2003	24	ug/l	6.30	183	0.590 J	0.840 J	28.1	2.00	616	4.44
GP9	GP9-W-24.0	0307095-21A	07/17/2003	24	ug/l	4.79	42.8	--	--	26.4	11.7	273	9.23
GP9	GP-W-DUP	0307095-21A	07/17/2003	24	ug/l	6.27	45.4	--	--	28.2	13.3	287	8.49
GP10	GP10-W-24.0	0307095-05A	07/16/2003	24	ug/l	6.23	117	2.00	0.940 J	328	18.8	8.00	8.75
GP11	GP11-W-40.0	0307076-09A	07/14/2003	40	ug/l	--	--	--	--	--	--	--	--
GP11	GP11-W-70.0	0307087-10A	07/15/2003	70	ug/l	--	--	--	--	0.550	--	--	--
GP11	GP11-W-96.0	0307087-13A	07/15/2003	96	ug/l	--	--	--	--	0.590	--	0.620	0.460

Notes:
ft. bgs = Feet below ground surface.
ug/L = Micrograms per liter.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

SCOEPA00003722

Table 2
Concentrations of Volatile Organic Compounds in Soil (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	units	1,1,2,2-Tetra-chloroethane	1,1,2-Trichloro-ethane	1,1-Dichloro-ethene	1,2,3-Trichloro-benzene	1,2,3-Trichloro-propane	1,2,4-Trichloro-benzene	1,2,4-Trimethyl-benzene
GP8	GP8-S-22.0	0307095-08A	7/16/2003	22	ug/kg	--	--	--	1.88 J	4.10 J	1.43 J	7.74 J
GP8	GP8-S-25.0	0307095-09A	7/16/2003	25	ug/kg	--	0.390 J	0.820 J	--	4.06 J	--	6.09 J
GP9	GP9-S-20.0	0307095-20A	7/17/2003	20	ug/kg	--	1.30 J	--	--	--	--	37.9
GP9	GP9-S-25.0	0307095-18A	7/17/2003	25	ug/kg	1.29 J	0.530 J	17.3	--	5.95 J	--	231
GP9	GP9-S-DUP	0307095-18A	7/17/2003	25	ug/kg	--	--	12.7	--	5.32 J	--	150
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	ug/kg	--	--	--	--	--	--	178,000
GP11	GP11-S-17.0	0307076-05A	7/14/2003	17	ug/kg	--	--	--	--	--	--	11,400
GP11	GP11-S-27.0	0307076-07A	7/14/2003	27	ug/kg	--	--	--	--	--	--	--

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

SCOEPA00003723

Table 2
Concentrations of Volatile Organic Compounds in Soil (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	1,2-Dibromo-ethane	1,2-Dichloro-propane	1,3,5-Trimethyl-benzene	2-Hexanone	4-Isopropyl-toluene	Acetone	Benzene	Carbon Disulfide	Chlorobenzene	Chloroform
GP8	GP8-S-22.0	0307095-08A	7/16/2003	22	--	--	2.08 J	13.2 J	--	36.5 J	2.33 J	--	--	--
GP8	GP8-S-25.0	0307095-09A	7/16/2003	25	--	7.23 J	4.39 J	12.9 J	--	28.4 J	443	0.720 J	--	--
GP9	GP9-S-20.0	0307095-20A	7/17/2003	20	--	--	10.6	--	2.26 J	37.1 J	38.1	0.740 J	--	1.30 J
GP9	GP9-S-25.0	0307095-18A	7/17/2003	25	--	--	64.2	13.5 J	5.37 J	33.0 J	700	1.60 J	--	1.84 J
GP9	GP9-S-DUP	0307095-18A	7/17/2003	25	--	--	42.0	--	3.38 J	37.5 J	736	1.39 J	--	0.630 J
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	--	--	56,700	--	--	--	218,000	--	--	--
GP11	GP11-S-17.0	0307076-05A	7/14/2003	17	1.31 J	--	180	--	10.1	15.4 J	7,200	--	2.23 J	--
GP11	GP11-S-27.0	0307076-07A	7/14/2003	27	--	--	--	--	--	13.6 J	--	--	--	--

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

SCOEPA00003724

Table 2
Concentrations of Volatile Organic Compounds in Soil (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	cis-1,2-Dichloroethene	Dibromo-chloromethane	Dichloro-difluoromethane	Ethylbenzene	Isopropyl-benzene	m,p-Xylenes	Methyl chloride	Methyl ethyl ketone
GP8	GP8-S-22.0	0307095-08A	7/16/2003	22	0.740 J	--	--	5.28 J	3.64 J	2.55 J	--	10.6 J
GP8	GP8-S-25.0	0307095-09A	7/16/2003	25	675	--	--	51.1	5.18 J	4.54 J	--	10.8 J
GP9	GP9-S-20.0	0307095-20A	7/17/2003	20	71.3	--	--	29.5	8.58 J	11.6 J	2.73 J	--
GP9	GP9-S-25.0	0307095-18A	7/17/2003	25	855	7.21 J	2.94 J	289	21.8	393	--	--
GP9	GP9-S-DUP	0307095-18A	7/17/2003	25	971	6.30 J	--	331	14.9	255	--	10.5 J
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	208,000	--	--	162,000	--	236,000	--	--
GP11	GP11-S-17.0	0307076-05A	7/14/2003	17	--	--	--	32,800	177	13,600	--	7.63 J
GP11	GP11-S-27.0	0307076-07A	7/14/2003	27	--	--	--	--	--	--	--	--

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

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Table 2
Concentrations of Volatile Organic Compounds in Soil (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	Methyl isobutylketone (MIBK)	Methylenechloride	Naphthalene	n-Butyl-benzene	n-Propyl-benzene	o-Xylene	sec-Butyl-benzene	Styrene	tert-Butyl-benzene
GP8	GP8-S-22.0	0307095-08A	7/16/2003	22	--	5.66 J	4,580	1.54 J	0.750 J	3.16 J	4.97 J	--	--
GP8	GP8-S-25.0	0307095-09A	7/16/2003	25	--	--	3,890	--	1.77 J	7.61 J	4.80 J	--	--
GP9	GP9-S-20.0	0307095-20A	7/17/2003	20	--	--	1,610	--	4.90 J	15.0	5.35 J	--	--
GP9	GP9-S-25.0	0307095-18A	7/17/2003	25	11.2 J	--	11,800	4.35 J	15.7	228	5.54 J	7.63 J	--
GP9	GP9-S-DUP	0307095-18A	7/17/2003	25	--	--	7,410	1.19 J	10.0	146	5.29 J	--	--
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	--	--	6,450,000	--	--	122,000	--	66,500	--
GP11	GP11-S-17.0	0307076-05A	7/14/2003	17	--	--	3,270,000	19.4	37.6	6170	104	--	11.0
GP11	GP11-S-27.0	0307076-07A	7/14/2003	27	--	--	36.6	--	--	--	--	--	--

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

SCOEPA00003726

Table 2
Concentrations of Volatile Organic Compounds in Soil (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	Tetra-chloroethene	Toluene	trans-1,2-Dichloroethene	Trichloro-ethene	Vinyl chloride
GP8	GP8-S-22.0	0307095-08A	7/16/2003	22	--	0.770 J	--	1.75 J	--
GP8	GP8-S-25.0	0307095-09A	7/16/2003	25	--	4.08 J	--	9.72 J	105
GP9	GP9-S-20.0	0307095-20A	7/17/2003	20	--	2.28 J	--	37.5	--
GP9	GP9-S-25.0	0307095-18A	7/17/2003	25	2.30 J	25.9	11.0	211	--
GP9	GP9-S-DUP	0307095-18A	7/17/2003	25	1.53 J	17.3	7.80 J	859	--
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	--	223,000	--	557,000	--
GP11	GP11-S-17.0	0307076-05A	7/14/2003	17	--	155	--	--	--
GP11	GP11-S-27.0	0307076-07A	7/14/2003	27	--	--	--	--	--

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.
-- = Analyte not detected at or above method reporting limit.
J = Analyte concentration was detected above the method detection limit but below the method reporting limit. Reported concentration is an estimate.

SCOEPA00003727

Table 3
Concentrations of Polycyclic Aromatic Hydrocarbons in Soil (ug/kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	units	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	ug/kg	1,600	1,970	2,530	2,420	1,860	1,990
GP11	GP11-S-15.0	0307076-04A	7/14/2003	15	ug/kg	62,900	8,570	36,600	44,400	43,600	44,700

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.

SCOEPA00003728

Table 3
Concentrations of Polycyclic Aromatic Hydrocarbons in Soil (ug/kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)-pyrene
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	1,270	473	1,790	193	5,570	1,710	907
GP11	GP11-S-15.0	0307076-04A	7/14/2003	15	29,200	11,300	31,300	4,300	59,100	27,800	21,700

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.

SCOEPA00003729

Table 3
Concentrations of Polycyclic Aromatic Hydrocarbons in Soil (ug/kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft. bgs)	Naphthalene	Phenanthrene	Pyrene
GP10	GP10-S-20.0	0307095-03B	7/16/2003	20	10,200	7,680	7,000
GP11	GP11-S-15.0	0307076-04A	7/14/2003	15	114,000	66,700	123,000

Notes:
ft. bgs = Feet below ground surface.
ug/kg = Micrograms per kilogram.

SCOEPA00003730

Table 1
Boring and Well Completion Details
Wacker Siltronic Corporation
Portland, Oregon

Location	Top of Casing (MSL)	Northing	Easting	Total Depth (ft bgs)		Screen (ft bgs)		Screen Elevations (MSL)		Type
				Borehole	Well	Top	Bottom	Top	Bottom	
WS8-33	32.96	7624854.144	704987.857	40.0	33	22.5	32.5	10.46	0.46	Monitoring Well
WS8-59	32.84	7624858.335	704990.171	60.0	59	48.5	58.5	-15.66	-25.66	Monitoring Well
WS9-34	32.28	7625261.758	704714.064	40.0	34	23.5	33.5	8.78	-1.22	Monitoring Well
WS10-27	33.45	7624393.651	704307.087	106.0	27	11	26	22.45	7.45	Monitoring Well
WS11-125	31.83	7624628.253	705147.350	207.0	125	109	124	-77.17	-92.17	Monitoring Well
WS11-161	31.85	7624628.254	705147.030	207.0	161	145	160	-113.2	-128.15	Monitoring Well
WS12-125	32.76	7624836.715	704998.620	207.0	125	109	124	-76.24	-91.24	Monitoring Well
WS12-161	32.77	7624836.839	704998.848	207.0	161	145	160	-112.2	-127.23	Monitoring Well
WS13-69	33.19	7624574.863	704633.029	207.0	68.8	52.6	67.6	-19.41	-34.41	Monitoring Well
WS13-105	33.15	7624575.098	704633.270	207.0	105	89	104	-55.85	-70.85	Monitoring Well
P1-South(1)	32.29	7624510.619	705206.149	64.0	NA	NA	NA	NA	NA	Boring
P1-North(1)	32.11	7624514.369	705209.604	64.0	NA	NA	NA	NA	NA	Boring
P2-West(1)	32.22	7624638.519	705137.389	100.0	NA	NA	NA	NA	NA	Boring
P2-East(1)	32.81	7624655.869	705124.685	100.0	NA	NA	NA	NA	NA	Boring
P3	33.21	7624847.273	704992.942	90.0	NA	NA	NA	NA	NA	Boring
P4	32.81	7624979.862	704917.439	64.0	NA	NA	NA	NA	NA	Boring
P5	33.06	7625276.037	704727.810	100.0	NA	NA	NA	NA	NA	Boring
P6	34.11	7625477.293	704597.279	64.0	NA	NA	NA	NA	NA	Boring
P11	33.87	7625394.033	704639.904	20.0	NA	NA	NA	NA	NA	Boring
GP02-01	34.15	7624687.491	704599.809	100.0	NA	NA	NA	NA	NA	Boring
GP02-02-East	33.83	7624590.683	704658.309	100.0	NA	NA	NA	NA	NA	Boring
GP02-02-West	33.92	7624588.128	704660.220	100.0	NA	NA	NA	NA	NA	Boring
GP4	32.62	7624558.765	705179.296	100.0	NA	NA	NA	NA	NA	Boring
GP4-Refusal	32.56	7624570.677	705171.179	12.0	NA	NA	NA	NA	NA	Boring
GP5	33.88	7624557.683	705064.911	100.0	NA	NA	NA	NA	NA	Boring
GP6	34.19	7624666.535	705048.391	100.0	NA	NA	NA	NA	NA	Boring
GP7	32.75	7624748.867	705058.827	100.0	NA	NA	NA	NA	NA	Boring
GP8	33.10	7624560.484	704640.170	25.0	NA	NA	NA	NA	NA	Boring
GP9	33.46	7624569.399	704636.005	25.0	NA	NA	NA	NA	NA	Boring
GP10	33.44	7624580.141	704631.996	25.0	NA	NA	NA	NA	NA	Boring
GP11	31.66	7624834.116	703460.988	96.5	NA	NA	NA	NA	NA	Boring
WS2	31.20	7624822.962	703447.141	31.5	NA	NA	NA	NA	NA	Abandoned Monitoring Well

Notes:
MSL = mean sea level in feet above the National Geodetic Vertical Datum of 1929.
(1) = P-1 and P-2 unable to confirm locations due to ambiguous ground stakes in the field.
ft bgs = feet below ground surface.
NA = not applicable
GP02-03 could not be located during the survey.

Table 2
Volatile Organic Compounds Detected in Soil Samples (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	GP8	GP8	GP9	GP9	GP9	GP10	GP11	GP11	WS-10	WS-10
Sample	GP8-S-22.0	GP8-S-25.0	GP9-S-20.0	GP9-S-25.0	GP9-S-25.0-Dup	GP10-S-20.0	GP11-S-17.0	GP11-S-27.0	WS10-S-26.0	WS10-S-30.0
Lab Code	0307095-08A	0307095-09A	0307095-20A	0307095-18A	0307095-18A	0307095-03B	0307076-05A	0307076-07A	0309039-06A	0309039-07
Date	07/16/2003	07/16/2003	07/17/2003	07/17/2003	07/17/2003	07/16/2003	07/14/2003	07/14/2003	09/03/2003	09/03/2003
Depth (ft bgs)	22	25	20	25	25	20	17	27	26	30
units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,1-Dichloroethene	--	--	--	17.3	12.7	--	--	--	--	--
1,2,4-Trimethylbenzene	--	--	37.9	231	150	178,000	11,400	--	93,800	--
1,3,5-Trimethylbenzene	--	--	10.6	64.2	42.0	56,700	180	--	12,700	--
4-Isopropyltoluene	--	--	--	--	3.38	--	10.1	--	--	--
Benzene	--	443	38.1	700	736	218,000	7,200	--	137,000	--
cis-1,2-Dichloroethene	--	675	71.3	855	971	208,000	--	--	--	--
Ethylbenzene	--	51.1	29.5	289	331	162,000	32,800	--	161,000	--
Isopropylbenzene	--	--	--	21.8	14.9	27,900	177	--	13,000	--
m,p-Xylene	--	--	--	393	255	236,000	13,600	--	154,000	--
Naphthalene	4,580	3,890	1,610	11,800	7,410	6,450,000	3,270,000	36.6	3,540,000	--
n-Butylbenzene	--	--	--	--	1.19	--	19.4	--	--	--
n-Propylbenzene	--	--	--	15.7	10.0	--	37.6	--	5,540	--
o-Xylene	--	--	15.0	228	146	122,000	6,170	--	71,200	--
sec-Butylbenzene	--	--	--	--	5.29	--	104	--	--	--
Styrene	--	--	--	--	--	66,500	--	--	--	--
tert-Butylbenzene	--	--	--	--	--	--	11.0	--	--	--
Toluene	--	--	--	25.9	17.3	223,000	155	--	7,620	--
trans-1,2-Dichloroethene	--	--	--	11.0	7.80	--	--	--	--	--
Trichloroethene	--	--	37.5	211	859	557,000	--	--	--	--
Vinyl chloride	--	105	--	--	--	--	--	--	--	--

Notes:
ug/Kg = milligrams per kilogram.
-- = not detected at or above the method reporting limit.
See data validation memo for more details.

SCOEPA00003732

Table 2
Volatile Organic Compounds Detected in Soil Samples (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	WS-11	WS-12	WS-12	WS-12	WS-13	WS-13	WS-13
Sample	WS11-S-118.0	WS12-S-80.0	WS12-S-120.0	WS12-S-150.0	WS13-S-50.0	WS13-S-85.0	WS13-S-105.0
Lab Code	0309155-04A	0309063-01	0309073-01	0309073-07	0310051-07A	0310051-15A	0310052-01
Date	09/23/2003	09/08/2003	09/09/2003	09/09/2003	10/04/2003	10/04/2003	10/05/2003
Depth (ft bgs)	118	80	120	150	50	85	105
units	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
1,1-Dichloroethene	--	--	--	--	--	28.8	--
1,2,4-Trimethylbenzene	13.2 J	--	--	--	--	--	--
1,3,5-Trimethylbenzene	--	--	--	--	--	--	--
4-Isopropyltoluene	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	25.3	--
cis-1,2-Dichloroethene	--	--	--	--	108	105	--
Ethylbenzene	13.0 J	--	--	--	--	31.6	--
Isopropylbenzene	--	--	--	--	--	--	--
m,p-Xylene	--	--	--	--	--	29.1	--
Naphthalene	3,330 J	--	--	--	198	221	--
n-Butylbenzene	--	--	--	--	--	--	--
n-Propylbenzene	--	--	--	--	--	--	--
o-Xylene	--	--	--	--	--	15.7	--
sec-Butylbenzene	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--
tert-Butylbenzene	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	20.7	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	188	127,000	--
Vinyl chloride	--	--	--	--	--	--	--

Notes:
ug/Kg = milligrams per kilogram.
-- = not detected at or above the method reporting limit.
See data validation memo for more details.

SCOEPA00003733

Table 3
Semi Volatile Organic Compounds Detected in Soil Samples (ug/Kg)
Wacker Siltronic Corporation
Portland, Oregon

Location	GP10	GP11
Sample	GP10-S-20.0	GP11-S-15.0
Lab Code	0307095-03B	0307076-04A
Date	07/16/2003	07/14/2003
Depth (ft bgs)	20	15
units	ug/kg	ug/kg
1-Methylnaphthalene	2,010	30,900
2-Methyl-naphthalene	3,240	56,200
Acenaphthene	1,600	62,900
Acenaphthylene	1,970	8,570
Anthracene	2,530	36,600
Benzo(a)anthracene	2,420	44,400
Benzo(a)pyrene	1,860	43,600
Benzo(b)fluoranthene	1,990	44,700
Benzo(ghi)perylene	1,270	29,200
Benzo(k)fluoranthene	473	11,300
Chrysene	1,790	31,300
Dibenzo(a,h)anthracene	193	4,300
Fluoranthene	5,570	59,100
Fluorene	1,710	27,800
Indeno(1,2,3-cd)-pyrene	907	21,700
Naphthalene	10,200	114,000
Phenanthrene	7,680	66,700
Pyrene	7,000	123,000

Notes:

ug/kg = micrograms per kilogram.

ft bgs = feet below ground surface

Table 4
Volatile Organic Compounds Detected in Exploratory Groundwater Samples (ug/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft bgs)	units	1,1-Dichloro-ethane	1,1-Dichloro-ethene	1,2,4-Trimethyl-benzene	1,2-Dichloro-benzene	1,2-Dichloro-ethane	1,3,5-Trimethyl-benzene	1,4-Dichloro-benzene	4-Isopropyl-toluene	Benzene	Bromodichloro-methane
GP8	GP8-W-24.0	0307095-10A	07/16/2003	24	ug/l	--	10.9	65.0	--	--	19.3	--	2.65	1,900	--
GP9	GP9-W-24.0	0307095-21A	07/17/2003	24	ug/l	--	26.8	48.1	--	--	20.5	--	1.92	1,270	--
GP9	GP9-W-24.0-Dup	0307095-21A	07/17/2003	24	ug/l	--	30.6	58.6	--	--	24.7	--	2.62	1,020	--
GP10	GP10-W-24.0	0307095-05A	07/16/2003	24	ug/l	--	46.7	102	--	--	27.4	--	4.65	1,120	--
GP11	GP11-W-40.0	0307076-09	07/14/2003	40	ug/l	--	--	--	--	--	--	--	--	--	--
GP11	GP11-W-70.0	0307087-10	07/15/2003	70	ug/l	--	--	--	--	--	--	--	--	--	--
GP11	GP11-W-96.0	0307087-13A	07/15/2003	96	ug/l	--	--	--	105	--	--	--	--	0.410	--
RINSE BLANK	EQP-071403	0307076-10A	07/14/2003	0	ug/l	--	--	--	--	--	--	--	--	--	--
WS-11	WS11-W-72.0	0309145-07A	09/22/2003	72	ug/l	0.450	--	--	--	--	--	--	--	3.83	--
WS-11	WS11-W-87.0	0309145-08A	09/22/2003	87	ug/l	0.920	--	--	--	--	--	--	--	8.29	--
WS-11	WS11-W-102.0	0309145-09A	09/22/2003	102	ug/l	1.60	--	--	--	--	--	--	--	92.2	--
WS-11	WS11-W-117.0	0309155-10A	09/23/2003	117	ug/l	--	28.9	2.51	--	--	1.33	--	--	395	--
WS-11	WS11-W-DUP	0309155-12	09/23/2003	117	ug/l	--	41.0	3.29	--	--	1.84	--	--	281	--
WS-11	WS11-W-132.0	0309155-11	09/23/2003	132	ug/l	--	--	--	--	--	--	--	--	1.14	--
WS-11	WS11-W-147.0	0309166-10A	09/24/2003	147	ug/l	--	--	--	4.89	--	--	0.280	--	--	--
WS-11	WS11-W-167.0	0309166-11A	09/24/2003	167	ug/l	--	--	--	--	--	--	--	--	--	--
WS-11	WS11-W-182.0	0309166-12A	09/24/2003	182	ug/l	--	--	--	47.4	--	--	0.970	--	0.310	--
WS-11	WS11-W-197.0	0309171-06A	09/25/2003	197	ug/l	--	--	--	35.6	--	--	1.50	--	0.230	--
WS-11	WS11-W-206.0	0309171-07A	09/25/2003	206	ug/l	--	--	--	115	--	--	34.6	--	--	--
WS-12	WS12-W-100.0	0309063-09A	09/08/2003	100	ug/l	--	--	--	--	--	--	--	--	16.5	--
WS-12	WS12-W-117.0	0309073-09A	09/09/2003	117	ug/l	--	--	--	--	--	--	--	--	4.46	--
WS-12	WS12-W-132.0	0309073-10A	09/09/2003	132	ug/l	--	--	--	--	--	--	--	--	0.300	--
WS-12	WS12-W-147.0	0309084-03A	09/11/2003	147	ug/l	--	--	--	--	--	--	--	--	--	0.630
WS-12	WS12-W-166.0	0309084-04A	09/11/2003	166	ug/l	--	--	--	8.39	--	--	--	--	--	--
WS-12	WS12-W-182.0	0309093-04A	09/11/2003	182	ug/l	--	--	--	18.5	0.540	--	--	--	0.220	--
WS-12	WS12-W-197.0	0309097-09A	09/12/2003	197	ug/l	--	--	--	48.4	--	--	2.15	--	--	--
RINSE BLANK	Equip	0309097-11	09/12/2003	0	ug/l	--	--	--	--	--	--	--	--	--	--
WS-12	WS12-W-205.0	0309118-01D	09/17/2003	205	ug/l	--	--	--	114	--	--	2.44	--	--	--
WS-12	WS12-W-206.0	0309097-10A	09/12/2003	206	ug/l	--	--	--	79.0	--	--	2.11	--	--	--
WS-13	WS13-W-72.0	0310051-19A	10/04/2003	72	ug/l	--	3.44	--	--	--	--	--	--	3.19	--
WS-13	WS13-W-87.0	0310051-20A	10/04/2003	87	ug/l	--	39.6	16.0	--	--	4.93	1.84	--	24.3	--
WS-13	WS13-W-102.0	0310052-07A	10/05/2003	102	ug/l	--	--	--	--	--	--	--	--	0.560	--
WS-13	WS13-W-152.0	0310055-05A	10/05/2003	152	ug/l	--	--	--	12.0	--	--	7.30	--	0.850	--
WS-13	WS13-W-DUP	0310055-06	10/05/2003	152	ug/l	--	--	--	9.53	--	--	6.06	--	0.780	--
WS-13	WS13-W-169.0	0310055-12A	10/06/2003	169	ug/l	--	--	--	8.56	--	--	3.96	--	0.720	--
WS-13	WS13-W-207.0	0310060-08A	10/06/2003	207	ug/l	--	--	--	0.200	--	--	--	--	--	--

Notes:
ug/L = micrograms per liter.
ft bgs = feet below ground surface.
-- = not detected at or above the method reporting limit.
Detections in those analytes in the equipment blank were flagged as non-detected if they were less than five times the detected value in the equipment blank.
See data validation memo for more details.

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Table 4
Volatile Organic Compounds Detected in Exploratory Groundwater Samples (ug/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft bgs)	units	Chlorobenzene	Chloroform	cis-1,2-Dichloroethene	Ethylbenzene	Isopropyl-benzene	m,p-Xylene	m-Dichloro-benzene	Methyl tert-butyl ether	Naphthalene	n-Butyl-benzene
GP8	GP8-W-24.0	0307095-10A	07/16/2003	24	ug/l	--	--	1,330	548	8.91	175	--	--	8,430	--
GP9	GP9-W-24.0	0307095-21A	07/17/2003	24	ug/l	--	--	6,360	181	11.6	64.1	--	--	6,990	0.610
GP9	GP9-W-24.0-Dup	0307095-21A	07/17/2003	24	ug/l	--	--	5,530	185	13.9	67.6	--	--	8,290	0.680
GP10	GP10-W-24.0	0307095-05A	07/16/2003	24	ug/l	--	--	3,590	340	12.7	185	--	--	5,930	3.62
GP11	GP11-W-40.0	0307076-09	07/14/2003	40	ug/l	--	--	--	--	--	--	--	--	--	--
GP11	GP11-W-70.0	0307087-10	07/15/2003	70	ug/l	--	--	--	--	--	--	--	--	--	--
GP11	GP11-W-96.0	0307087-13A	07/15/2003	96	ug/l	63.9	--	--	--	--	--	37.7	--	0.770	--
RINSE BLANK	EQP-071403	0307076-10A	07/14/2003	0	ug/l	--	0.590	--	--	--	--	--	--	--	--
WS-11	WS11-W-72.0	0309145-07A	09/22/2003	72	ug/l	--	--	26.4	--	--	--	--	--	--	--
WS-11	WS11-W-87.0	0309145-08A	09/22/2003	87	ug/l	--	--	248	--	--	--	--	--	--	--
WS-11	WS11-W-102.0	0309145-09A	09/22/2003	102	ug/l	--	--	3,040	--	--	--	--	--	--	--
WS-11	WS11-W-117.0	0309155-10A	09/23/2003	117	ug/l	--	--	17,200	28.6	2.00	10.5	--	--	778	--
WS-11	WS11-W-DUP	0309155-12	09/23/2003	117	ug/l	--	--	13,800	37.7	2.11	14.2	--	--	783	--
WS-11	WS11-W-132.0	0309155-11	09/23/2003	132	ug/l	--	--	32.2	0.850	--	--	--	--	4.04	--
WS-11	WS11-W-147.0	0309166-10A	09/24/2003	147	ug/l	4.54	--	--	--	--	--	2.69	0.810	--	--
WS-11	WS11-W-167.0	0309166-11A	09/24/2003	167	ug/l	--	0.380	--	--	--	--	--	--	--	--
WS-11	WS11-W-182.0	0309166-12A	09/24/2003	182	ug/l	47.3	0.380	1.05	--	--	--	16.6	5.76	--	--
WS-11	WS11-W-197.0	0309171-06A	09/25/2003	197	ug/l	30.4	--	0.700	--	--	--	25.5	9.12	--	--
WS-11	WS11-W-206.0	0309171-07A	09/25/2003	206	ug/l	9.15	2.40	0.920	--	--	--	2.30	4.94	--	--
WS-12	WS12-W-100.0	0309063-09A	09/08/2003	100	ug/l	--	2.10	1.65	--	--	--	--	--	1.17	--
WS-12	WS12-W-117.0	0309073-09A	09/09/2003	117	ug/l	--	2.61	21.0	--	--	--	--	--	--	--
WS-12	WS12-W-132.0	0309073-10A	09/09/2003	132	ug/l	--	--	2.86	1.00	--	--	--	--	--	--
WS-12	WS12-W-147.0	0309084-03A	09/11/2003	147	ug/l	--	0.620	--	--	--	--	--	--	--	--
WS-12	WS12-W-166.0	0309084-04A	09/11/2003	166	ug/l	7.83	--	0.610	--	--	--	0.500	3.35	--	--
WS-12	WS12-W-182.0	0309093-04A	09/11/2003	182	ug/l	21.8	--	1.03	--	--	--	0.480	8.44	--	--
WS-12	WS12-W-197.0	0309097-09A	09/12/2003	197	ug/l	7.56	--	0.620	--	--	--	28.5	15.5	--	--
RINSE BLANK	Equip	0309097-11	09/12/2003	0	ug/l	--	--	--	--	--	--	--	--	--	--
WS-12	WS12-W-205.0	0309118-01D	09/17/2003	205	ug/l	8.00	--	--	--	--	--	2.44	12.9	--	--
WS-12	WS12-W-206.0	0309097-10A	09/12/2003	206	ug/l	6.48	--	0.880	--	--	--	28.5	15.3	--	--
WS-13	WS13-W-72.0	0310051-19A	10/04/2003	72	ug/l	--	--	923	2.45	--	2.02	--	--	44.0	--
WS-13	WS13-W-87.0	0310051-20A	10/04/2003	87	ug/l	--	2.00	559	62.7	1.75	51.7	--	--	478	--
WS-13	WS13-W-102.0	0310052-07A	10/05/2003	102	ug/l	--	1.70	3.93	--	--	--	--	--	10.9	--
WS-13	WS13-W-152.0	0310055-05A	10/05/2003	152	ug/l	4.36	1.18	0.640	--	--	--	0.720	8.87	--	--
WS-13	WS13-W-DUP	0310055-06	10/05/2003	152	ug/l	3.57	1.16	--	--	--	--	0.620	7.50	--	--
WS-13	WS13-W-169.0	0310055-12A	10/06/2003	169	ug/l	2.91	2.96	--	--	--	--	0.340	8.92	--	--
WS-13	WS13-W-207.0	0310060-08A	10/06/2003	207	ug/l	--	2.01	--	--	--	--	--	9.10	--	--

Notes:
ug/L = micrograms per liter.
ft bgs = feet below ground surface.
-- = not detected at or above the method reporting limit.
Detections in those analytes in the equipment blank were flagged as non-detected if they were less than five times the detected value in the equipment blank.
See data validation memo for more details.

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Table 4
Volatile Organic Compounds Detected in Exploratory Groundwater Samples (ug/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft bgs)	units	n-Propyl-benzene	o-Xylene	Styrene	Tetra-chloroethene	Toluene	trans-1,2-Dichloroethene	Trichloro-ethene	Vinyl chloride
GP8	GP8-W-24.0	0307095-10A	07/16/2003	24	ug/l	6.30	183	--	--	28.1	2.00	616	4.44
GP9	GP9-W-24.0	0307095-21A	07/17/2003	24	ug/l	4.79	42.8	--	--	26.4	11.7	273	9.23
GP9	GP9-W-24.0-Dup	0307095-21A	07/17/2003	24	ug/l	6.27	45.4	--	--	28.2	13.3	287	8.49
GP10	GP10-W-24.0	0307095-05A	07/16/2003	24	ug/l	6.23	117	2.00	--	328	18.8	8.00	8.75
GP11	GP11-W-40.0	0307076-09	07/14/2003	40	ug/l	--	--	--	--	--	--	--	--
GP11	GP11-W-70.0	0307087-10	07/15/2003	70	ug/l	--	--	--	--	--	--	--	--
GP11	GP11-W-96.0	0307087-13A	07/15/2003	96	ug/l	--	--	--	--	--	--	0.620	0.460
RINSE BLANK	EQP-071403	0307076-10A	07/14/2003	0	ug/l	--	--	--	--	0.710	--	--	--
WS-11	WS11-W-72.0	0309145-07A	09/22/2003	72	ug/l	--	--	--	--	--	--	--	4.34
WS-11	WS11-W-87.0	0309145-08A	09/22/2003	87	ug/l	--	--	--	--	--	0.530	0.400	33.1
WS-11	WS11-W-102.0	0309145-09A	09/22/2003	102	ug/l	--	--	--	3.90	2.10	5.00	841	196
WS-11	WS11-W-117.0	0309155-10A	09/23/2003	117	ug/l	--	11.2	--	--	21.0	25.8	2,990	3,200
WS-11	WS11-W-DUP	0309155-12	09/23/2003	117	ug/l	--	15.2	--	--	28.4	31.1	2,560	2,460
WS-11	WS11-W-132.0	0309155-11	09/23/2003	132	ug/l	--	--	--	--	--	--	8.66	6.40
WS-11	WS11-W-147.0	0309166-10A	09/24/2003	147	ug/l	--	--	--	--	--	--	--	--
WS-11	WS11-W-167.0	0309166-11A	09/24/2003	167	ug/l	--	--	--	--	--	--	--	--
WS-11	WS11-W-182.0	0309166-12A	09/24/2003	182	ug/l	--	--	--	--	--	0.500	1.59	--
WS-11	WS11-W-197.0	0309171-06A	09/25/2003	197	ug/l	--	--	--	--	--	--	0.650	--
WS-11	WS11-W-206.0	0309171-07A	09/25/2003	206	ug/l	--	--	--	--	0.410	--	2.63	--
WS-12	WS12-W-100.0	0309063-09A	09/08/2003	100	ug/l	--	0.810	--	--	1.30	--	0.580	5.75
WS-12	WS12-W-117.0	0309073-09A	09/09/2003	117	ug/l	--	--	--	--	--	--	1.63	66.1
WS-12	WS12-W-132.0	0309073-10A	09/09/2003	132	ug/l	--	--	4.64	--	11.9	--	0.500	4.33
WS-12	WS12-W-147.0	0309084-03A	09/11/2003	147	ug/l	--	--	--	--	--	--	--	--
WS-12	WS12-W-166.0	0309084-04A	09/11/2003	166	ug/l	--	--	--	--	--	--	--	--
WS-12	WS12-W-182.0	0309093-04A	09/11/2003	182	ug/l	0.290	--	--	--	0.380	0.470	0.850	--
WS-12	WS12-W-197.0	0309097-09A	09/12/2003	197	ug/l	0.250	--	--	--	0.360	--	0.860	--
RINSE BLANK	Equip	0309097-11	09/12/2003	0	ug/l	--	--	--	--	--	--	--	--
WS-12	WS12-W-205.0	0309118-01D	09/17/2003	205	ug/l	--	--	--	--	--	--	2.05	--
WS-12	WS12-W-206.0	0309097-10A	09/12/2003	206	ug/l	--	--	--	--	--	--	1.93	--
WS-13	WS13-W-72.0	0310051-19A	10/04/2003	72	ug/l	--	--	--	--	5.11	53.8	6,930	--
WS-13	WS13-W-87.0	0310051-20A	10/04/2003	87	ug/l	--	28.9	--	1.57	24.0	79.5	43,200	10.1
WS-13	WS13-W-102.0	0310052-07A	10/05/2003	102	ug/l	--	--	--	--	--	--	556	--
WS-13	WS13-W-152.0	0310055-05A	10/05/2003	152	ug/l	--	--	--	--	--	--	--	--
WS-13	WS13-W-DUP	0310055-06	10/05/2003	152	ug/l	--	--	--	--	--	--	--	--
WS-13	WS13-W-169.0	0310055-12A	10/06/2003	169	ug/l	--	--	--	--	--	--	--	--
WS-13	WS13-W-207.0	0310060-08A	10/06/2003	207	ug/l	--	--	--	--	--	--	--	--

Notes:
ug/L = micrograms per liter.
ft bgs = feet below ground surface.
-- = not detected at or above the method reporting limit.
Detections in those analytes in the equipment blank were flagged as non-detected if they were less than five times the detected value in the equipment blank.
See data validation memo for more details.

Table 5
Organochlorine Pesticides Detected in Exploratory Groundwater Samples (ug/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	Sample	Lab Code	Date	Depth (ft bgs)	units	2,4,5-TP (Silvex)
WS-11	WS11-W-206.0	0309171-07A	09/25/2003	206	ug/l	2.63
WS-12	WS12-W-205.0	0309118-01D	09/17/2003	205	ug/l	3.15
WS-13	WS13-W-207.0	0310060-08	10/06/2003	207	ug/l	--

Notes:
ug/l = micrograms per liter.
ft bgs = feet below ground surface.
-- = not detected at or above the reporting limit.

Table 6
Volatile Organic Compounds Detected in Quarterly Groundwater Samples
Wacker Siltronic Corporation
Portland, Oregon

Location	WS-10-27	WS-11-125	WS-11-161	WS-12-125	WS-12-161	WS-13-69	WS-13-105	WS-13-105	RINSE BLANK
Sample	WS10-27	WS11-125	WS11-161	WS12-125	WS12-161	WS13-69	WS13-105	WS13-105-Dup	Equip Blank
Lab Code	0310196-05A	0310196-07A	0310196-02E	0310196-06E	0310196-01E	0310196-09A	0310196-10E	0310196-10E	0310196-08A
Date	10/27/2003	10/28/2003	10/27/2003	10/28/2003	10/27/2003	10/29/2003	10/29/2003	10/29/2003	10/28/2003
Depth (ft bgs)	18.5	116.5	152.5	116.5	152.5	60.5	96.5	96.5	0
units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
1,1,2-Trichloroethane	--	--	--	--	--	12.2	--	--	--
1,1-Dichloroethene	--	14.2	--	--	--	29.0	1.61 J	0.570 J	--
1,2,4-Trimethylbenzene	136	12.6	--	--	--	8.07	2.78	--	--
1,2-Dichlorobenzene	--	--	--	0.260	1.76	--	--	--	--
1,3,5-Trimethylbenzene	47.5	3.67	--	--	--	2.13	0.500	--	--
4-Isopropyltoluene	7.28	--	--	--	--	--	0.220	--	--
Acetone	--	--	--	768	1,120	--	--	--	--
Benzene	8,060	252	0.560	8.53	0.550	129	2.14	1.09	0.680
Chlorobenzene	--	--	--	--	1.52	--	--	--	--
Chloroform	--	--	0.950	--	0.360	2.05	0.610	0.390	--
cis-1,2-Dichloroethene	--	5,340	1.00	28.0	0.900	7,040	360 J	61.9 J	4.59
trans-1,2-Dichloroethene	--	17.5	--	--	--	89.8	3.67 J	1.51 J	--
Ethylbenzene	716	87.6	--	--	--	60.1	--	1.29	1.51
Isopropylbenzene	33.3	--	--	0.520	--	1.31	0.460	0.200	--
m,p-Xylene	947	54.4	--	--	--	56.0	--	1.39	10.5
Methyl tert-butyl ether	--	--	--	--	1.45	--	--	--	--
Naphthalene	13,600	1,660	--	--	--	343	226 J	25.8 J	4.61
n-Butylbenzene	3.42	--	--	--	--	--	--	--	--
n-Propylbenzene	11.1	--	--	--	--	--	--	--	--
o-Xylene	525	38.5	--	--	--	31.3	--	0.810	3.55
Styrene	1.46	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	1.12	--	--	--
Toluene	150	56.1	--	--	--	46.9	1.34	--	--
Trichloroethene	--	2,020	--	--	--	55,200	10,600 J	1,390 J	5.11
Vinyl chloride	--	961	--	63.5	--	--	--	--	1.43

Notes:
ft bgs = feet below ground surface.
ug/l = micrograms per liter.
-- = not detected at or above the method reporting limit.
J = the result for this analyte is between the method detection limit and the practical quantitation limit and should be considered an estimated concentration.
Detections in those analytes in the equipment blank were flagged as non-detected if they were less than five times the detected value in the equipment blank.
See data validation memo for more details.

SCOEPA00003739

Table 7
Natural Attenuation Parameters in Groundwater Samples (mg/L)
Wacker Siltronic Corporation
Portland, Oregon

Location	WS-10-27	WS-11	WS-11-125	WS-11-161	WS-12	WS-12-125	WS-12-161	WS-13	WS-13-69	WS-13-105	WS-13-105
Sample	WS10-27	WS11-W-206.0	WS11-125	WS11-161	WS12-W-205.0	WS12-125	WS12-161	WS13-W-207.0	WS13-69	WS13-105	WS13-105-Dup
Lab Code	0310196-05A	0309171-07A	0310196-07A	0310196-02E	0309118-01D	0310196-06E	0310196-01E	0310060-08A	0310196-09A	0310196-10E	0310196-10E
Date	10/27/2003	09/25/2003	10/28/2003	10/27/2003	09/17/2003	10/28/2003	10/27/2003	10/06/2003	10/29/2003	10/29/2003	10/29/2003
Depth (ft bgs)	18.5	206	116.5	152.5	205	116.5	152.5	207	60.5	96.5	96.5
units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Alkalinity (as CaCO3)	493	199	302	217	206	366	209	240	379	283	280
Carbon Dioxide	338	2.23 U	136	66.9	2.23 U	135	77.5	2.23 U	290	98.7	224
Chloride	10.3	145	36.2	32.7	110	16.0	76.2	21.1	17.9	14.2	14.1
Ethane	0.613 U	1.53 U	0.613 U	0.613 U	1.53 U	0.613 U	0.613 U	1.53 U	0.613 U	0.613 U	0.613 U
Ethene	9.34	1.45 U	0.578 U	4.26	1.45 U	4.25	0.578 U	1.45 U	5.71	0.578 U	0.578 U
Iron	34.4	4.36	12.5	8.91	5.57	20.9	8.67	54.1	31.0	18.9	19.7
Manganese	2.41	0.746	1.45	1.76	0.411	1.87	1.35	1.71	6.44	2.28	2.40
Methane	17.8	3.26 U	9.40	18.1	3.26 U	9.52	14.0	3.26 U	22.5	23.4	35.0
Nitrate	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Nitrate + Nitrite Nitrogen	0.03 U	--	--	0.03 U	--	--	0.03 U	--	--	--	--
Nitrite (as Nitrogen)	0.025 U	0.025 U	0.0403	0.025 U	0.025 U	0.0530	0.025 U	0.0727	0.0732	0.0671	0.0648
Nitrogen	--	37.9	--	--	24.7	--	--	32.5	--	--	--
Sulfate	28.6	42.0	40.9	17.5	27.2	17.2	16.0	65.4	64.0	11.3	10.8
Sulfide	1 U	1 U	1 U	1 U	1 U	1.80	1 U	1 U	1 U	1 U	2.20
TOC	26.1	1 U	5.13	5.33	1.56	5.72	10.2	9.37	9.86	6.55	6.40
Total phosphorus	20.7	0.0744	2.50	1.16	0.145	2.41	3.67	0.701	1.64	2.22	2.21

Notes:
mg/l = milligrams per liter.
ft bgs = feet below ground surface.
U = not detected at or above the method reporting limit.
-- = not analyzed.

Table 8
Groundwater Elevations and Vertical Gradients
Wacker Siltronic Corporation
Portland, Oregon

Point ID	Top of Casing (MSL)	Depth to Water Measured 10/27/03 (FT-BTOC)	Water Level Elevation (MSL)	Depth to Midpoint of Screen (FT-BTOC)	Screen Midpoint Elevation (MSL)	Vertical Gradient	Direction
WS8-33	32.96	27.88	5.08	27.50	5.46	-0.0100	Up
WS8-59	32.84	27.50	5.34	53.50	-20.66		
WS9-34	32.28	25.20	7.08	28.50	3.78	NA	NA
WS10-27	33.45	15.51	17.94	18.50	14.95	NA	NA
WS11-125	31.83	26.50	5.33	116.50	-84.67	0.0006	Down
WS11-161	31.85	26.54	5.31	152.50	-120.65		
WS12-125	32.76	27.43	5.33	116.50	-83.74	-0.0025	Up
WS12-161	32.77	27.35	5.42	152.50	-119.73		
WS13-69	33.19	26.92	6.27	60.10	-26.91	-0.0030	Up
WS13-105	33.15	26.77	6.38	96.50	-63.35		
Willamette River Stage[1]	NA	NA	5.13[2]	NA	NA	NA	NA

Point ID	Top of Casing (MSL)	Depth to Water Measured 11/24/03 (FT-BTOC)	Water Level Elevation (MSL)	Depth to Midpoint of Screen (FT-BTOC)	Screen Midpoint Elevation (MSL)	Vertical Gradient	Direction
WS8-33	32.96	27.36	5.60	27.50	5.46	0.0092	Down
WS8-59	32.84	27.48	5.36	53.50	-20.66		
WS9-34	32.28	24.84	7.44	28.50	3.78	NA	NA
WS10-27	33.45	15.94	17.51	18.50	14.95	NA	NA
WS11-125	31.83	26.56	5.27	116.50	-84.67	0.0008	Down
WS11-161	31.85	26.61	5.24	152.50	-120.65		
WS12-125	32.76	27.48	5.28	116.50	-83.74	-0.0017	Up
WS12-161	32.77	27.43	5.34	152.50	-119.73		
WS13-69	33.19	26.43	6.76	60.10	-26.91	0.0058	Down
WS13-105	33.15	26.60	6.55	96.50	-63.35		
Willamette River Stage[1]	NA	NA	5.01[2]	NA	NA	NA	NA

Notes:
FT-BTOC = feet below top of casing.
MSL = Mean Sea Level National Geodetic Vertical Datum 1929.
NA = Not Applicable.
[1] = Measured at Morrison Bridge, Portland, Oregon.
[2] = Average of elevations recorded during water level measurements.

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Table 9
Soil Physical Testing Results (cm/sec)
Wacker Siltronic Corporation
Portland, Oregon

Sample	Hydraulic Conductivity (cm/sec)	ASTM Method
WS11-S-118	1.0×10^{-2}	D2434
WS11-S-153	6.9×10^{-3}	D2434
WS12-S-118	5.1×10^{-2}	D2434
WS12-S-153	5.0×10^{-3}	D2434
WS13-S-60.5	1.5×10^{-6}	D5084
WS13-S-96.5	2.2×10^{-6}	D5084

Notes:
cm/sec = centimeters per second.
ASTM = American Society for Testing and Materials.
ASTM D2434 = permeability of granular soils (constant head).
ASTM D5084 = A measurement of hydraulic conductivity of saturated porous materials using a flexible wall permeameter (appropriate for materials with high fines content).

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REPORT ON SUPPLEMENTAL UPLAND REMEDIAL INVESTIGATION ACTIVITIES

VOLUME 1

NW Natural – Gasco Facility
7900 NW St. Helens Road
Portland, Oregon

March 11, 2005

Project No. 2708

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REMEDIATION

REPORT ON SUPPLEMENTAL UPLAND REMEDIAL INVESTIGATION ACTIVITIES

NW Natural – Gasco Facility
7900 NW St. Helens Road
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Prepared for:

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1.0 INTRODUCTION

The investigation activities described herein have been conducted to provide supplemental information related to the nature, extent, and potential migration pathways of chemical impacts present in groundwater along the uplands portion of the Willamette River shoreline at the NW Natural Gasco facility, 7900 NW St. Helens Road, in Portland, Oregon (Figure 1). The need and scope for these additional upland-area investigatory activities was initially discussed during a January 27, 2004 meeting with representatives of NW Natural, the Oregon Department of Environmental Quality (DEQ), and the U.S. Environmental Protection Agency (EPA), and were outlined in a DEQ Memorandum prepared by Mr. Matt McClincy and Mr. Rod Struck, dated January 26, 2004. The investigation activities described herein were completed in accordance with an HAI Work Plan dated April 28, 2004 (HAI 2004), as conditionally approved in DEQ correspondence dated May 11, 2004 (Mr. Matt McClincy to Mr. Bob Wyatt).

1.1 Purpose and Project Objectives

The purpose of this report is to summarize results of the supplemental soil and groundwater quality investigation activities that were conducted at the site during the timeframe June through August 2004, to satisfy the objectives identified below.

- Describe the presence and distribution of tar and/or oil in the Surficial Fill Unit and Alluvial Unit in the vicinity of the buried historical drainage near boring B-29.

- Evaluate the potential that oil identified in the subsurface in the vicinity of the historical drainage adjacent to the Willamette River is a present oil migration threat to Willamette River sediments.

- Collect representative groundwater quality data to supplement the current interpretation of contaminant nature and extent, with emphasis on identifying unique plume characteristics in the area

of the historical discharge feature (e.g., boring B-29 area) that would be of significance to the upland source control evaluation.

- Collect representative groundwater quality data to supplement the current interpretation of contaminant nature and extent down-gradient of the former tar pond area, at a location mid-way between existing groundwater monitoring points MW-4 and MW-5.

1.2 Scope of Work

The overall scope of work for investigatory activities completed at the Gasco property during the timeframe June through December 2004 is summarized below, with sampling locations depicted on Figures 2 and 3.

- Installation of 10 push probe borings for identification of subsurface lithological and contaminant distribution conditions at a location between the former tar pond area and the Willamette River embankment, and in the area of the historic effluent discharge / filled area located upland of the surficial tar body previously identified in the Willamette River.

- Collection of depth discrete exploratory groundwater quality samples from push probe borings installed at two locations (borings B-56 and B-59) to further evaluate horizontal and vertical distribution of groundwater impacts adjacent to the Willamette River embankment.

- Collection of soil samples from select boring locations primarily across depths of interest with regard to potential human and/or ecological exposure (upper 3 to 12 feet below ground surface) for laboratory physical testing of polynuclear aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylene (BTEX), and total cyanide.

- Collection, preservation, and shipment of undisturbed soil core across the oil-bearing zone identified in the area of historic

effluent discharge for photographic evaluation and completion of analyses related to potential dense non-aqueous phase liquid (DNAPL) mobility.

- Installation of three new wells (MW-16-45, MW-16-65, and MW-16-125) in the area of historic effluent discharge to evaluate groundwater contaminant plume conditions in this area, as well as the potential to yield DNAPL from a well screened across the oily zone identified within soils at this location (e.g., MW-16-45).

- Sampling and analytical testing of groundwater samples from the MW-16 well cluster and all other wells at the site.

- Sampling of DNAPL from well MW-16-45, with physical and chemical testing of the oil.

1.3 Report Organization

This report is organized as follows:

- Section 1 provides a summary of the purpose, objectives, and scope of work for the investigation activities, as well as a description of the report's organization.

- Section 2 describes the supplemental RI activities completed at the site.

- Section 3 provides the results of the supplemental activities completed at the site.

- Section 4 provides a summary of the results and conclusions of the investigation

2.0 SUPPLEMENTAL INVESTIGATION ACTIVITIES

2.1 Push Probe Boring Installation

Push probe borings were installed in the vicinity of the former effluent discharge feature / low area located east of the Fuel and Marine Marketing (FAMM) tank farm in the boring B-29 vicinity; as well as in the vicinity of boring B-31, located mid-way between the MW-4 and MW-5 monitoring well clusters, between the former tar pond area and the Willamette River (Figures 2 and 3).

As previously stated, the objective of the push probe work in the former effluent discharge / low area (boring B-29 vicinity) was to support evaluation of the extent and thickness of tarry and oily zones previously identified in the subsurface at this portion of the site, as well as to collect a vertical profile of groundwater quality to support the selection of screened intervals for a new monitoring well cluster to be installed in a subsequent phase of investigation.

The objective of the push probe work completed in the former B-31 vicinity, a location situated between the river and the former tar pond area, was to obtain a vertical profile of groundwater quality to supplement data currently available in this area at the adjacent MW-4 and MW-5 well cluster locations.

All push probe boring installation and abandonment activities were conducted in accordance with the April 28, 2004 Work Plan (HAI 2004), with drilling activities conducted by Geo-Tech Explorations, Inc. / Boart Longyear, Inc. of Tualatin, Oregon (Oregon Monitoring Well Constructor License No. 1011). A truck-mounted push probe unit using a 1.5-inch outside-diameter (OD) hydraulically-driven steel rod was used to advance all push probe soil borings.

Soil samples were collected from push probe borings using a 2-inch OD, 5-foot long, stainless-steel Macro-Core sampler, fitted with a PVC sleeve, that was advanced in 5 foot intervals into the undisturbed soils. All soil samples were screened in the field for the presence of contaminants by visual (color), olfactory, sheen, headspace vapor, and ultraviolet fluorescence methods.

The results of the field screening observations are noted on the field boring logs. Soil sampling and screening activities were conducted in accordance with a DEQ-approved April 28, 2004 Work Plan (HAI 2004).

Where groundwater samples were collected for vertical contaminant profiling, a temporary 3.25-inch diameter steel casing was set through visually impacted zones in order to isolate upper zones of impact prior to advancing to the lower portions of each borehole. Further, all groundwater samples were collected from a new boring advanced directly to the targeted screen intervals without collection of soil samples, thereby reducing the potential for groundwater mixing within an open borehole prior to sample collection. Groundwater sampling activities were conducted in accordance with the approved April 28, 2004 Work Plan (HAI 2004).

2.1.1 Former Effluent Discharge / Low Area

Seven push probe borings (B-53, B-54, B-55, B-57, B-58, B-59, and B-59A) were installed in the area of the buried historical drainage / low area near boring B-29 (Figures 2 and 3) between the dates of June 7 and June 14, 2004. With the exception of borings B-53 and B-54, where sampler refusal was encountered on apparent concrete or rock within the fill at depths of 29 feet and 20 feet, respectively, all push probe borings were advanced and continuously cored to a minimum depth of 50 feet below ground surface (bgs). With the exception of those locations where sampling device refusal was encountered, all borings were advanced to a sufficient depth such that the base of oily zones within subsurface soils could be observed and documented.

Based on the depth and thickness of oily soil zones within borings B-55, B-57, and B-58, as well as within previous boring B-29, the location for a deep push probe boring was selected for soil description and vertical groundwater quality profiling purposes. As reviewed with Mr. Matt McClincy and Mr. Rod Struck of the DEQ during a site meeting conducted on June 8, 2004, and as approved during a June 9, 2004 telephone conversation (Mr. Rob Ede to Mr. Matt McClincy), it was agreed that a deep boring (i.e., boring B-59) would be installed at a location approximately midway between borings B-57 and B-58, and as close to the river embankment as possible. The preceding location was selected since it was deemed likely to adequately represent the

oily zone identified in adjacent borings, and would suitably represent contaminant conditions immediately upland relative to the "surficial tar body" previously identified within the Willamette River (Figure 2). The surficial tar body was the subject of a separate and synchronous investigation conducted for NW Natural under oversight of the EPA by Anchor Environmental, LLC (Anchor), with results of that investigation included within a September 2004 Anchor report (Anchor 2004), and summarized in Section 2.9 herein.

Deep boring B-59 was advanced to a total depth of 175 feet bgs in an attempt to identify the top of gravels typical of the base of the Alluvial WBZ, or the top of the basalt bedrock. Boring B-59 was continuously logged to a depth of 50 feet bgs, below which soil cores were collected and logged at intervals ranging from 20 to 30 feet. The boring was terminated at a depth of 175 feet bgs prior to encountering the base of the Alluvial WBZ due to concerns of losing the tooling if the sampler should become stuck within hard substrate at this depth.

Lithological descriptions and field screening for potential soil contamination were obtained during the advancement of boring B-59. To prevent mixing of groundwater within the open borehole resulting from soil sample collection, groundwater samples were collected in a new boring installed adjacent to the first boring. Specifically, depth discrete groundwater samples were collected from adjacent boring B-59A from a temporary well point screened across depth intervals of 46 to 50 feet bgs; 76-80 feet bgs; 96-100 feet bgs; 116-120 feet bgs; 144-148 feet bgs; and 171-175 feet bgs.

The properties of each soil sample were noted in the field by the HAI scientist. Boring logs prepared by HAI for the push probe borings, including a description of field screening results and groundwater sample depth intervals, are included in Appendix A.

2.1.2 Former Tar Pond and River Embankment Area

Three deep push probe borings (B-56, B-56A, and B-56B) were advanced in the immediate vicinity of former boring B-31 (Figure 2), located between the former effluent tar pond and the Willamette River embankment, for screening

of soils and collection of groundwater samples. Lithological descriptions and field screening for potential contamination were obtained during the advancement of boring B-56. Boring B-56 was continuously logged to a depth of 50 feet bgs, with subsequent soil cores collected every 10 feet through a depth of 110 feet bgs, and every 25 feet below 110 feet bgs. This boring was advanced to a total depth of 179 feet bgs, where sampling equipment refusal occurred in dense gravels / basalt bedrock.

To prevent mixing of groundwater within the open borehole, groundwater samples were collected in new borings installed adjacent to B-56. Specifically, after collection of a groundwater sample within the Surficial Fill WBZ, a 3.25-inch OD protective outer steel casing was advanced to a depth of 30 feet bgs, through which a temporary well point was advanced directly to targeted groundwater sampling depths. Depth discrete groundwater samples were collected from adjacent boring B-56A from a temporary well point screened across depth intervals of 18 to 22 feet bgs; 40-44 feet bgs; 60-64 feet bgs; 80-84 feet bgs; and 100-104 feet bgs. As depicted on the boring log for B-56A (Appendix A), the well point became stuck after being advanced to a depth of 140 feet bgs, at which time the probe rod became separated at a depth of 30 feet bgs. Attempts to retrieve the probe rod and well point (extending across a depth interval of 30 to 140 feet bgs) using a hollow-stem auger drill rig and a stinger were unsuccessful. Therefore, the well point and probe rod were pressure grouted and chipped in-place with bentonite from 40 feet bgs to ground surface. Below 40 feet bgs, the formation had heaved around the probe rod, preventing lowering of the grout tremie tube to a greater depth.

Push probe boring B-56B was subsequently installed adjacent to the sealed B-56A location, with depth discrete groundwater samples collected across depth intervals of 136-140 feet bgs and 174-178 feet bgs.

The properties of each soil sample were noted in the field by the HAI scientist. Boring logs prepared by HAI for the push probe borings, including a description of field screening results and groundwater sample depth intervals, are included in Appendix A.

2.2 Monitoring Well Installation

With the completion of groundwater and soil sampling activities associated with the push probe boring component of work (Section 2.1), and the receipt of analytical results from the groundwater investigation, NW Natural and DEQ met on July 7, 2004 and agreed upon the location and depth of monitoring wells. Approval of the proposed MW-16 series monitoring well cluster location was provided during this meeting in order to facilitate completion of well installation activities during the week of July 12, 2004. Proposed screen intervals for the MW-16 series wells were approved in an e-mail dated July 12, 2004 (Mr. Matt McClincy to Mr. Rob Ede). As agreed during the meeting, three monitoring wells were constructed near the shoreline riverward of boring B-59. Based on groundwater quality data obtained at the boring B-56 location, it was agreed that installation of permanent monitoring wells in the vicinity of this boring would not be necessary.

Of the wells proposed for installation as part of the MW-16 series cluster, the deepest well, designed to monitor chemical concentrations within the basal portion of the contaminant plume, was constructed with a screen interval of 115 to 125 feet bgs, with a stainless steel sump from 125 to 127.5 feet bgs. It was agreed that temporary well point data collected from below 144 feet bgs at boring B-59 was sufficient to provide vertical plume delineation in this area.

The intermediate-depth well, designed to target the dissolved phase contaminant plume within the upper Alluvial WBZ across an elevation similar to adjacent wells at the existing MW-3 and MW-4 well clusters, was constructed with a screened interval of 55 to 65 feet bgs, with a stainless steel sump from 65 to 67.5 feet bgs.

The shallow-depth well, designed to target the oil-bearing zone found within the upper Alluvial WBZ (across a depth interval of approximately 28 to 44 feet bgs), was constructed with a screened interval of 30 to 45 feet bgs, with a stainless steel sump from 45 to 47.5 feet bgs.

All well construction activities were conducted in accordance with the April 28, 2004 Work Plan (HAI 2004), with drilling activities conducted by Geo-Tech Explorations, Inc. / Boart Longyear, Inc. of Tualatin, Oregon (Oregon Monitoring Well Constructor License No. 1011). A sonic drill rig using 8-inch and/or 6-inch OD steel drive casing was used for all drilling activities, which occurred from July 14 through July 20, 2004.

During the drilling of monitoring well boreholes, continuous soil core was extruded from 4-inch to 6-inch diameter core barrels that were advanced 2 to 10 feet into undisturbed soils. With exception of select depth intervals at the MW-16-65 well location, soil cores were extruded into labeled plastic bags of approximately 2 to 3 foot lengths prior to being sliced open for field screening and description. At MW-16-65 , soil cores across a depth interval of 26 to 46 feet bgs and 60 to 63 feet bgs were collected with the use of 4-inch OD polycarbonate resin (Lexan®) tubes to facilitate recovery of relatively undisturbed soil. Upon being brought to the surface, the Lexan® tubes were immediately cut, capped, and labeled for placement within sample coolers containing dry ice. These core samples were maintained in a horizontal and frozen state prior to, and during, overnight shipment to the testing laboratory, where photographic logs, as well as physical and non-aqueous phase liquid (NAPL) mobility screening occurred (Section 2.8).

Details of the field methods employed to install the monitoring wells, and soil and groundwater sampling protocols, are included in the approved Work Plan (HAI 2004). Boring logs that describe the soils encountered and well construction details are included in Appendix B.

2.3 Monitoring Well Development

Wells MW-16-45, MW-16-65, and MW-16-125 underwent development with an electric submersible pump from July 28, 2004 through August 3, 2004 in an attempt to remove the fine sediment from around the well bore.

Development continued until indicator parameters (pH, temperature, specific conductivity, and dissolved oxygen) stabilized, and until turbidity levels within the purged water consistently dropped to acceptable levels, using a turbidity goal of 5 NTU.

Well development field logs are included within Appendix C. As summarized on the field logs, development involved removal of 82 gallons of groundwater (25 well casing volumes) from well MW-16-45; 96 gallons of groundwater (13 well casing volumes) from well MW-16-65; and 382 gallons (22 well casing volumes) from well MW-16-125. All indicator parameters stabilized prior to completing development, while final turbidity measurements (2.24 to 9.21 NTU) were at or near the 5 NTU goal.

2.4 Monitoring Well Sampling

Site-wide groundwater monitoring activities, including sample collection from all non-product containing wells at the site (including the new MW-16 well cluster) were conducted by HAI between the dates of August 12 and August 26, 2004 in accordance with a DEQ-approved monitoring plan and schedule, dated July 22, 2004. Field sampling records documenting purging and sampling activities related to the August 2004 groundwater monitoring event are included within Appendix D.

2.5 Investigation-Derived Waste Management

Push probe and monitoring well installation activities, including Anchor's synchronous barge-based investigation activities related to the off-shore tar body (Section 2.9), generated 20 full and 9 partially filled 55-gallon drums of soil sample wastes, and 18 55-gallon drums filled with equipment decontamination and monitoring well development water. The 9 partially filled drums of soil were consolidated into 2 full drums prior to off-site shipment, resulting in 22 drums of soil sample wastes requiring management.

All equipment decontamination water was treated within the on-site wastewater treatment system, and discharged through NW Natural's National Discharge Elimination System (NPDES) permitted outfall in batches on June 23, 2004 and on August 4, 2004.

Soil sampling wastes were characterized as non-hazardous under the Resource Conservation and Recovery Act (RCRA), as summarized in a non-hazardous waste determination memorandum included within Appendix E.

Based on the waste determination referenced above, and approval of the waste profile from Pollution Control Industries, Inc. (PCI), of Millington, Tennessee, the target treatment/disposal facility, all soils were removed from the site under a non-hazardous waste manifest by WasteWatch, Inc., of Troutdale, Oregon on August 26, 2004. The soils were transported to PCI's Millington, Tennessee facility for incineration as non-hazardous waste. The non-hazardous waste manifest, documenting removal from the site and receipt by the treatment facility, is included within Appendix E, as is a certificate of thermal destruction documenting completion of treatment.

2.6 Elevation Survey

Monitoring wells and push probe boring locations were surveyed for location and elevation (mean seal level, City of Portland datum) by Mr. Robert Taylor, an Oregon Registered Professional Land Surveyor employed by NW Natural. For monitoring wells, both the ground surface and the top of the casing elevations were surveyed. All top of casing survey elevation data were collected within an accuracy of 0.01 feet vertically, while ground surface data was collected with an accuracy of 0.1 feet vertically. All elevation information has been included on the boring and well construction logs (Appendices A and B).

2.7 Non-Aqueous Phase Liquid Measurements

The evaluation for the presence of NAPL at wells MW-16-45, MW-16-65, and MW-16-125 has been conducted numerous times subsequent to completion of installation activities, as follows:

- Immediately after well installation activities were completed on July 21, 2004;
- Before and after conducting development activities on August 3 and 4, 2004;
- Prior to conducting a round of water levels at the site on August 12, 2004;

- Prior to collecting groundwater samples from the wells within the MW-16 well cluster on August 26, 2004;

- During a NAPL check conducted on September 29, 2004 (in which NAPL was first identified in the sump of well MW-16-45);

- After identification of NAPL at the base of well MW-16-45, subsequent checks were conducted at this well location in tandem with NAPL removal activities occurring between October and December 2004.

All measurements were conducted by lowering an interface probe across the entire water column of the three MW-16 cluster wells and checking for identification of NAPL by a "sounding" of the probe alarm, and by conducting a visual evaluation of the probe tip and measuring tape upon removal from each well.

Prior to the September 29, 2004 NAPL check, measurements with an interface probe across the entire water column of the three MW-16 cluster wells did not result in the identification of NAPL, either by "sounding" the probe alarm, or as indicated by visual evaluation of the probe tip upon removal from the wells.

During the NAPL check conducted on September 29, 2004, although the NAPL sounding feature did not signal, approximately 1.5 feet of NAPL was observed adhering to the probe tip and base of the measuring tape upon withdrawal from well MW-16-45. Removal of the NAPL from the base of the well was subsequently conducted on numerous occasions with a clear bottom-filling weighted bailer between the dates of October 5 and December 2, 2004. NAPL removal was conducted primarily for the collection of sufficient sample volume for physical and chemical testing, as well as to support initial evaluation of the feasibility of possible longer term NAPL recovery at this location.

2.8 Laboratory Analyses

With the exception of undisturbed soil core collected during the installation of well MW-16-45, all soil and groundwater samples collected as part of the supplemental RI or routine groundwater monitoring activities described herein were shipped in sealed coolers with chain-of-custody documentation to North Creek Analytical Laboratory in Beaverton, Oregon.

Soil core collected from the boring for well MW-16-65 as part of the supplemental RI activities were shipped to PTS Laboratories in Santa Fe Springs, California for physical testing and NAPL mobility-related screening analyses.

Additionally, samples of NAPL collected from well MW-16-45 were shipped to both North Creek Analytical, Inc. and to PTS Laboratories for both chemical and physical testing.

2.8.1 Groundwater

Groundwater samples collected for screening purposes from the deep push probe boring installed in the former effluent discharge/low area (boring B-59) were analyzed for those indicator constituents useful in ascertaining the overall presence and magnitude of site-related impacts. Specifically, samples from this push probe location were analyzed for volatile organic compounds (VOCs) by EPA Method 8260B.

Groundwater samples collected from the deep push probe boring installed between the former tar pond and the river (boring B-56), as well as from new monitoring wells within the MW-16 cluster and from immediately adjacent plume monitoring wells MW-3-56, MW-4-57, and MW-5-100, were analyzed for VOCs by EPA Method 8260B; semi-volatile organic compounds (SVOCs) by EPA Method 8270C; polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8270 SIM; total and amenable cyanide by EPA Method 9010; and total and/or dissolved metals arsenic, chromium, copper, nickel, lead, and zinc by EPA Method 6010.

Groundwater samples collected from the on-site groundwater monitoring well network in August 2004 were analyzed for SVOCs, PAHs, VOCs, BTEX, total and amenable cyanide, and select metals, as per methodologies indicated above, in accordance with a DEQ-approved monitoring plan and schedule dated July 22, 2004.

Results of the June 2004 push probe / temporary well point groundwater sampling analyses are summarized on Tables 1 through 4, with chain-of-custody documentation and laboratory analytical reports included within Appendix F. Results of the August 2004 site-wide groundwater monitoring event are summarized on Tables 5 through 8, with chain-of-custody documentation and laboratory analytical reports included within Appendix G.

2.8.2 Soil

2.8.2.1 Chemical Testing

Seven select soil samples obtained during the June 2004 push probe investigation, primarily collected across depths of interest with regard to potential human and/or ecological exposure (upper 3 to 12 feet bgs), were selected to undergo laboratory analyses for PAHs by EPA Method 8270 SIM and BTEX by EPA Method 8021, two of the samples were selected for analysis of total cyanide content by EPA Method 9010, and one sample received follow-up analysis for leachable benzene by EPA Method 1311 (Toxicity Characteristic Leaching Procedure)/8021. Results of these soil analyses are set out in Tables 9 through 13 (see borings B-53 through B-56; Tar Pond Area), which also include a summary of all other available soil data for the site as a whole. Chain-of-custody documentation and laboratory analytical reports documenting analytical results of the June 2004 samples are included within Appendix H.

2.8.2.2 Physical Soil Core Testing

The soil core collected from the boring for well MW-16-65 within Lexan® liners, frozen, and shipped to PTS Laboratories, Inc. (PTS) in Santa Fe Springs, California has undergone various types of physical testing, as described below.

Specifically, the soil core depth intervals from 26 to 46 feet bgs and from 60 to 61 feet bgs, were cut open and photographed under both white light and ultraviolet light. The photographs, which depict the soil type, structure, and presence and distribution of NAPL within the soils, are within the PTS Laboratory Report (PTS 2005), included as Appendix I.

Based on evaluation of the MW-16-65 core photo log, as well as boring logs for the MW-16 well cluster, 11 depth intervals for particle size testing using American Society of Testing and Materials (ASTM) Method D422/D4464M, and pore fluid saturation testing using ASTM D2216 / American Petroleum Institute (API) RP40 methodology (includes % water saturation and % NAPL saturation; total porosity, air filled porosity, grain density, dry bulk density, and initial moisture content) were selected. Specifically, these tests were conducted on undisturbed, frozen core submitted to PTS for the following depths: 27.5 feet, 29.2 feet, 31.5 feet, 33.5 feet, 35.7 feet, 38.5 feet, 40.4 feet, 42.5 feet, 44.8 feet, 45.3, and 60.7 feet bgs.

Results of the particle size and the physical properties testing of the above-referenced samples are summarized within the PTS Report included within Appendix I.

Based on results of the pore fluid saturation testing summarized in the PTS report, soil from three depth intervals (35.7, 40.4, and 42.5 feet bgs) were selected to undergo "Free Product Mobility/Residual Saturation" testing using centrifuge methodology as specified within ASTM Method D425M. These samples were selected since they contained a range of pore fluid saturations with regard to NAPL content (i.e., ranging from 1.4% at 42.5 feet bgs, to 50.3% at 35.7 feet bgs). This testing uses a large amount of force (1,000-times the force of gravity) such that minimum residual NAPL levels may be estimated. Results of these tests are included within the PTS Report included within Appendix I.

Finally a sample of core from a depth of approximately 35.6 feet bgs was selected for wettability index analysis by Amott Wettability methodology using site-specific NAPL and groundwater that was recovered from well MW-16-45 as part of the NAPL recovery evaluation described in Section 2.7. Wettability is a measure of a liquid's relative affinity for a solid. For example,

a "wetting" fluid will preferentially spread over a solid surface (e.g., soil particle) at the expense of a "non-wetting" fluid. Thus, a strongly "water-wet" system would tend to result in lower residual NAPL saturation levels (e.g., greater mobility potential) than a strongly "NAPL-wet" system. Results of these tests are included within the PTS Report included within Appendix I.

2.8.3 NAPL

Samples of NAPL collected from the sump of well MW-16-45 were analyzed by North Creek Analytical (NCA) for chemistry and by PTS for physical parameters. Analyses conducted by NCA include the following:

- Flashpoint by EPA Method 1010
- pH by EPA Method 9040A
- SVOCs by EPA Method 8270C
- PAHs by EPA Method 8270 SIM
- VOCs by EPA Method 8260C
- Fuel Fingerprinting by NW-TPH Methodology

Laboratory reports documenting results of NCA's NAPL analyses are included within Appendix J, while these results, in addition to results from the previous testing of other wells at the site where NAPL has been identified (i.e., wells MW-6-36, MW-10-32, and MW-11-32), are summarized in Tables 14 through 16.

A second sample of NAPL and water collected from the sump of well MW-16-45 was analyzed by PTS as per their "Fluid Properties Package-NAPL and Water". This suite of analyses includes dynamic viscosity and fluid density at three temperatures, surface tension for each fluid, and interfacial tension for three phase pairs (oil/water; oil/air; and water/air) as per ASTM D445 and D1481.

Laboratory reports documenting results of PTS's NAPL analyses are also included within Appendix I, and are summarized, in part, on Table 14.

2.9 Sediment Characterization

NW Natural entered into an Administrative Order on Consent (Order) with EPA on April 28, 2004 to perform a sediment removal action at the Gasco site. In accordance with the Statement of Work (SOW) attached to the Order, sediment characterization was performed by Anchor adjacent to the Gasco site in July 2004 to facilitate design of the removal action. The characterization protocols were discussed in detail in the Field Sampling Plan which was an Appendix to the Remedial Action Work Plan (Anchor 2004). The design characterization included the collection of subsurface cores within the removal action area in order to:

- Establish the lateral and vertical extents and the physical characteristics of the tar body
- Estimate elutriate concentrations in the nearby water column that may occur during the removal action
- Profile the contaminated materials to be removed to determine a suitable disposal location
- Determine the chemical/physical characteristics of the sediments residing within and beneath the visibly contaminated strata
- Provide observational data to support evaluation of the potential that NAPL identified in proximity of the historical drainage area upland of the off-shore tar body is a present oil migration threat to Willamette River sediments.

2.9.1 Sediment Collection and Processing

Twenty sediment samples (RAA-01 to RAA-20) were collected by Anchor in July 2004 from the locations depicted in Figure 3 and 11. The AN-X series of samples was collected during a previous sediment investigation in 2002. For all samples with sufficient water depths, the sampling was conducted from a shallow draft barge equipped with a hydraulic coring device (i.e.,

Geoprobe). The Geoprobe was deployed through a "moonhole" in the middle of the barge deck space. Horizontal positioning at each sampling location was determined using a differential global positioning system (DGPS) in latitude and longitude to the nearest 0.01 second in the North American Datum (NAD) 1983. Where water depths precluded collection from the waterside, the cores were taken using a portable track-mounted Geoprobe rig from the landside. Coring began at the mudline/ground surface elevation using a 4-foot long, 2.5-inch inside diameter (ID) core sampler. Following penetration of the full length of the core tube (5 feet), the sampler was withdrawn to retrieve the liner containing the sediment sample. This process was repeated to a maximum depth of approximately 20 to 40 feet below mudline for all sampling stations.

Following retrieval, sediment cores were immediately opened and logged on the sampling vessel and the desired samples from the appropriate intervals were collected. Based on the heterogeneity of the strata encountered, a spatially representative subset of 17 samples from the total of 40 collected samples was selected for chemical and physical analyses.

2.9.2 Visual Characterization

To establish the lateral and vertical extents of the tar body and assess whether offshore migration of contamination from the uplands is potentially occurring, the cores were visually logged by Anchor personnel as to their color, structure, texture, mineral composition, moisture, and percent recovery, according to ASTM Method D 2487. In addition, particular emphasis was placed on identification of the tar body, visibly contaminated, and visibly uncontaminated zones. During evaluation of the cores, Anchor and EPA's oversight contractor, Parametrix, Inc., reached consensus on the depth(s) of the zones present at each station for the purposes of sampling. To maintain a consistent definition of each zone throughout the characterization, each zone was identified through the presence of particular physical characteristics. Observations of the tar body included:

- Thin tar laminations bounded by sediments
- Lenses of tar
- Somewhat soft, sticky masses of tar
- Dense brittle fragments of tar containing little or no sediments.

Observations of the visibly contaminated zone included sediments:

- Saturated (i.e., visibly detectable) oil (but composed primarily of sediments)
- Saturated with tar and tarry like substances (but composed primarily of sediments)
- With a heavy sheen
- With blebs of oil and/or tar
- With a slight sheen.

Sediments with no sheen, oil, tar, or petroleum odor noted were identified as the visibly uncontaminated zone.

2.9.3 Chemical Testing

The 17 selected samples were subjected to the following suite of analyses: total organic carbon (TOC; PSEP protocols), BTEX (EPA method 8260), PAHs (EPA Method 8270), total cyanide (EPA Method 335.2), total solids (TS; EPA Method 160.3) and grain size (ASTM D 422). In addition, a representative subset of 9 samples with sufficient silt content was analyzed for Atterberg limits (ASTM D 4318). A TCLP (EPA Method 6010) and Dredge Elutriate Test (DRET) was also conducted on 2 representative tar body zone samples and visibly contaminated zone samples. These chemical analyses were conducted to facilitate a removal and disposal alternatives evaluation in accordance with the Order. The chemical laboratory analytical results will be included in the Remedial Action Project Plan (RAPP), to be prepared by Anchor, which is currently in draft form (Anchor 2004).

3.0 RESULTS

3.1 Former Tar Pond / River Embankment Vicinity

Push probe boring B-56 was installed with the primary objective of obtaining depth discrete groundwater quality data near the former boring B-31 area, located between the former tar effluent pond and the Willamette River embankment (Figure 2 and 3). A hydrogeologic cross-section parallel to the river (Figure 4), including the B-56 boring location, is included as Figure 5. Results of these investigatory activities are summarized below:

3.1.1 Subsurface Conditions

- Soils encountered at the B-56 boring location (Appendix A and Figure 5) consisted of gravelly sands and silts, including patches or flecks of solid black carbon pitch (fill) to a depth of approximately 22.5 feet bgs, where an approximate 0.5-foot thick layer of solid, ductile tar was identified. Below the tar were interbedded sands, silty sands, and silts characteristic of the Alluvial WBZ extending to a depth of 174 feet bgs. Sandy gravel including angular basalt fragments were identified at this location from 174 to 179 feet bgs, where soil sampler refusal, potentially on basalt bedrock, was encountered.

- The silt layer that typically defines the top of the Alluvial WBZ in the more upland reaches of the site, and typically becomes thin to absent in the vicinity of the Willamette River shoreline, was not observed at the B-56 boring location (Figure 5).

- The thin layer of tar identified at the apparent base of the fill unit across a depth of 22 to 22.5 feet bgs at the B-56 location is consistent with the previous identification of this material at the immediately adjacent former B-31 boring location. Tar has not been identified within soils either immediately west (MW-4 well

cluster) or immediately east (MW-5 well cluster) of the B-31/B-56 boring location (Figure 5). No evidence of oil was identified within either the fill or the underlying alluvial materials at these locations. The tar identified at this location was likely the result of historical discharge to the pre-fill ground surface.

3.1.2 Groundwater Analytical Results

Results of the testing of groundwater samples collected from the boring B-56 location are summarized in Tables 1 through 4. Hydrogeologic cross-sections through the B-56 boring location (oriented parallel to the river), are included as Figures 5A (depicting benzene concentrations) and 5B (depicting naphthalene concentrations). Additionally, plume iso-concentration maps depicting benzene and naphthalene concentrations within the Surficial Fill WBZ and the Alluvial WBZ across the site and the western portion of the adjacent Siltronic property, are provided as Figures 7 through 10.

Groundwater quality data from the adjacent Siltronic property that are posted on the referenced figures were obtained from results of investigatory activities conducted by HAI for NW Natural, as well as Limno-Tech, Inc. (LTI), Maul Foster Alongi, Inc. (MFA), and others for Siltronic. Primary sources for the Siltronic property data include a 2003 HAI report (HAI 2003), as well as 2003 and 2004 reports prepared by MFA (MFA 2003, 2004a through h), and a 1990 report prepared by CH2M HILL, Inc. (CH2M HILL 1990).

Key findings from evaluation of the preceding groundwater quality results are summarized below:

- The greatest benzene concentration in groundwater at the B-56 boring location was 8 parts per billion (ppb), as identified within the Surficial Fill WBZ across the 18-22 foot interval. Within the Alluvial WBZ, detectable concentrations of benzene were found to range from 3.1 ppb (80 to 84 feet bgs) to 3.62 ppb (60 to 64 feet bgs).

- The greatest concentrations of PAHs in groundwater (with the exception of naphthalene) at the B-56 location were identified in the Surficial Fill WBZ, where individual PAHs were identified at concentrations ranging from 4 ppb to 54.1 ppb. In contrast, individual PAH concentrations (except naphthalene) from discrete zones within the Alluvial WBZ were typically identified at concentrations less than 0.2 ppb. With regard to naphthalene, the greatest concentration was identified across the 80 to 84 foot depth interval at this location, where a concentration of up to 405 ppb was identified.

  The concentrations of PAHs identified within the Surficial Fill WBZ at the B-56 boring location (317 ppb) were slightly elevated above PAH concentrations identified within the Surficial Fill WBZ at adjacent monitoring well locations to the west (MW-4-35 with 65 ppb) and east (MW-5-32 with 0.27 ppb). This occurrence, however, is likely a function of the presence of soil impacts across the temporary well point screen interval, in conjunction with the typically turbid nature of temporary well point samples. Specifically, because PAHs have a strong affinity to bind to soil particles, PAH results from turbid samples may be skewed high because results would be a function of both the dissolved phase (water) and the solid phase (soil) components. Such an effect is common and is exemplified at the MW-5-32 well location, where initial sampling in 1995 (when drilling-induced turbidity was greatest) identified 288 ppb total PAHs, while in 2004 only 0.27 ppb total PAHs were identified at this location.

- With regard to the Alluvial WBZ, as depicted on Figures 5, 8 and 10, concentrations of benzene (3.6 ppb maximum) and naphthalene (441 ppb maximum) as identified at the B-56 boring location were found to be significantly lower than concentrations of the same contaminants as identified at locations either immediately west (15,000 ppb benzene; 3,780 ppb naphthalene at MW-4-57) or immediately east (11,500 ppb benzene; 11,900 naphthalene at MW-5-100).

  Such a contaminant distribution as described above suggests the presence of two somewhat discrete contaminant plumes within

the Alluvial WBZ at this portion of the site (Figures 8 and 10), with data from boring B-56 defining the eastern limit of the relatively shallow (approximately 45 to 120 feet bgs) plume identified at shoreline well cluster locations MW-4 and MW-16; while also providing definition of the western limit of the somewhat deeper (approximately 70 to 140 feet bgs) plume identified at shoreline well location MW-5-100 and extending east (to the adjacent Siltronic property) to wells WS-14 and WS-11. The eastern limit of this plume is defined by the WS-12 well location.

Based on the plume morphology (Figures 8 and 10), as well as observations of soil core, it appears that there are two different sources for the impacts observed within the Alluvial WBZ, with both sources appearing to correspond to locations where effluent, including NAPL, were formerly discharged directly onto the historic ground surface (i.e., the surface of the alluvial unit).

The western benzene and naphthalene plume appears to originate within the southern portion of the former tar ponds/former Koppers waste discharge area, generally between the MW-11 / MW-14 well locations and the MW-8 well cluster, with contaminant contribution to the Alluvial WBZ occurring to the north within the former tar pond area and adjacent low area/former discharge. NAPL source within the Alluvial WBZ has been observed within the former tar pond area (e.g., borings B-32, B-33, B-35 and MW-8), and within the upper portion of the Alluvial WBZ in the former effluent discharge area (e.g., borings B-55 through B-59, B-29 and MW-16).

The eastern benzene and naphthalene plume (e.g., MW-5, WS-11, and WS-14 down-gradient monitoring points), appears to be the result of deep NAPL migration near the eastern limit of the former tar ponds in vicinity of the Gasco/Siltronic property boundary (proximate to the former pond overflow point as depicted on Figure 3). Specifically, the deepest NAPL directly observed on either property has been identified in this area (B-33, B-35, B-1-8, and WS-16 boring locations), where NAPL has been logged at depths ranging from 67 feet bgs (B-33) to 74 feet bgs (WS-16). Further, the presence in DNAPL immediately north

of these areas in wells WS-11-125 and WS-14-125, as identified by MFA (2004h), suggests the presence of NAPL in this area to depths as great as 125 feet bgs. The deeper NAPL penetration in this area has resulted in deeper dissolved phase contamination as compared to the western plume (Figures 5a and 5b).

3.1.3 Soil Analytical Results

Soil samples were collected at depths of 2.5, 11, and 26 feet bgs at boring B-56 to undergo laboratory analyses for BTEX, PAHs, and total cyanide analyses (Tables 9 through 12). Results of these tests indicated BTEX and cyanide to be non-detected at concentrations greater than laboratory reporting levels, while total PAH concentrations ranged from 14 parts per million (ppm) at 2 feet bgs to 525 ppm at 26 feet bgs, collected beneath the tarry zone described in Section 3.1.1.

3.2 Former Effluent Discharge and Low Area

Push probe borings B-53, B-54, B-55, B-57, B-58, B-59, and B-59A, in addition to monitoring wells MW-16-45, MW-16-65, and MW-16-125, were installed in the former low area that historically received MGP effluent that discharged directly to the Willamette River (Figures 2 and 3). Results of these investigatory activities are described below.

3.2.1 Subsurface Conditions

Observations regarding soil type and field screening information collected as part of the June 2004 push probe boring investigatory activities are summarized below. Further, Figure 11 identifies those depths at which tarry or oily soils were encountered across the northeastern portion of the site, as do cross-sections included as Figures 5 and 6.

- Soils consisted of gravelly sands, silts, brick and concrete fragments and large concrete and rock chunks (fill) to depths ranging from 25 feet bgs (B-55) to approximately 33.5 feet bgs (B-58). Beneath the fill were interbedded sands, silts, and silty

sands characteristic of the Alluvial WBZ, extending to the maximum depth of exploration at 175 feet bgs (boring B-59).

- The silt layer that typically defines the top of the Alluvial WBZ but is often thin to absent in the vicinity of the Willamette River shoreline, was identified at the B-55 (25 feet bgs); B-57 (30.5 feet bgs); B-58 (33.5 feet bgs); B-59 (27 feet bgs); and MW-16 (26 feet bgs) locations.

- A soil matrix including tar (primarily black, patchy, solid to semi-solid) was identified within fill at depths ranging from 1 to 2 feet bgs and extending to depths ranging from approximately 22 to 30 feet bgs at all boring locations except P-53 and P-54 (near the river embankment), where only very minor patchy tar or tar flecks were identified within the fill.

- Several zones of patchy or massive hard carbon pitch were encountered within the fill at borings B-53 (patchy from 2.5 to 29 feet bgs); B-54 (patchy from 10 to 20 feet bgs); B-55 (massive from 22.5 to 25 feet bgs), B-57 (patchy from 20 to 23 feet bgs); B-58 (patchy from 17-22.5 feet bgs); and B-59 (patchy from 17.5-27 feet bgs).

- Visually-impacted zones containing oil were identified within and beneath the fill across depth intervals of 27.5 to 32 feet bgs at boring B-55; 26.5 to 37.5 feet bgs at boring B-57; 22.25 feet bgs (thin zone) and 30.5 to 37 feet bgs at boring B-58; and 30 to 38 feet bgs at boring B-59. Further, an impacted zone containing oil and extending from 27.5 to 40 feet bgs was previously identified at the former boring B-29 location (near B-59 and adjacent to the embankment) (Figures 5, 6, and 11).

- At certain locations (e.g., B-55 at 32 feet bgs; B-57 at 37.5 feet bgs; and B-59 at 38 feet bgs), a thin silt or sandy silt layer was identified that appeared to locally control vertical movement of the NAPL, with oily soils identified above the layer, while no oily soils were identified below the layer. At other boring locations (e.g., B-29 and B-58), no direct visual evidence of such a confining or

partially confining silt layer was identified. However, the apparent base of the oil was visually identified at all boring locations.

- The presence of oil-bearing soils adjacent to the embankment appears limited to an approximate 200 foot length of shoreline within the former effluent discharge/low area (e.g., B-29, B-57, -58, -59, and MW-16-45 locations) with no oil identified to total depth at the B-9 or the MW-3 boring locations to the west, or within the boring for MW-4 to the east (Figures 5, 6, and 11).

- Boring logs indicate the presence of tars and carbon pitch (e.g., lampblack and/or pencil pitch) within materials used to fill the tar ponds and the adjacent low areas, with tarry soils identified immediately beneath the ground surface at many boring locations within these areas. However, based on borings installed closest to the river embankment (e.g., borings B-29, B-53, B-54, and MW-16), it appears that tarry soils were not used for construction of the river embankment (Figure 11).

Observations regarding soil type and field screening information collected as part of the boring investigatory activities related to the installation of the MW-16 well cluster (installed near the former B-29 boring location) are summarized below, while the boring logs are included within Appendix B.

- Soils consisted predominantly of gravelly sandy silt with brick fragments and concrete to a depth of 25 feet bgs. Likely native silt was encountered at a depth of 25 feet, underlain by interbedded silts, sands, and silty sands to the maximum depth of exploration at this location of 127.5 feet bgs.

- Likely carbon pitch flecks (black, hard fragments) were identified sporadically within fill across a depth interval of approximately 12 feet to 23 feet bgs.

- Semi-solid tar blebs were encountered in fill at a depth of 24.5 feet bgs, with black staining present between 24.5 feet through 27.5 feet bgs.

- Brown oil was observed to be coating soil between a depth interval of 27.5 feet bgs to 37.5 feet bgs, with less oil (limited to more of a petroleum sheen) observed between a depth interval of 37.5 and 40 feet bgs (Figures 5, 6, and 11). Oil was observed coating soil between 40 and 44 feet bgs, with no oil identified at depth below 44 feet bgs. Evidence of a possible silt layer at 44 feet was identified, however, due to vibrations and extrusion related to sample collection, the soil core was highly disturbed and interpretation of the representativeness of the silt layer was difficult.

3.2.2 Photo Evaluation and Physical Testing of Soil Core

Relatively undisturbed soil core was collected, frozen and shipped to PTS in Santa Fe Springs, California for detailed evaluation including photography and physical testing. The core was obtained across a depth interval of 26 to 46 feet bgs, as well as 60 to 61 feet bgs during drilling of the boring for monitoring well MW-16-65. Photographs and results of physical testing (Appendix I) indicate the following:

- **26 to 29 feet bgs:** Patchy zones of apparent oily tar were identified from 26 to 29 feet bgs, with individual blebs all less than 0.1-inch diameter through 27 feet bgs, becoming larger from 27 to 29 feet bgs (black and moist where cut). Sieve testing of this zone (27.5 feet bgs) indicates the mean grain size description to be silt, with the median grain size being 0.027 millimeters (mm). Porosity was measured as 50.6%, with approximately 11.2% of the pore fluid being NAPL.

- **29 to 31 feet bgs:** An apparent increase in sand content occurs between 29 and 30 feet bgs, with a respective increase in black oily tar content. There is evidence of layering of tar/oil from 29 to 30 feet bgs, while only small blebs of tar exist from 30 to 31 feet bgs. Sieve testing of this zone (29.2 feet bgs) indicates the mean grain size description to be silt, with the median grain size being 0.044 mm. Porosity was measured as 53%, with approximately 23.1% of the pore fluid being NAPL.

- **31 to 36 feet bgs:** The core appears sandier below 31 feet bgs, with oil (more brown than black in coloration) fairly uniformly present throughout core to a depth of approximately 36 feet bgs. Sieve testing of this zone (31.6, 33.5, and 35.7 feet bgs) indicates the mean grain size description to be fine sand, with the median grain size ranging from 0.134 mm to 0.199 mm. Porosity was measured as ranging from 50.6% to 52.37%, with approximately 20.7% (at 33.5 feet bgs) to 50.3% (at 35.7 feet bgs) of the pore fluid being NAPL.

  A sample of core from a depth of 35.55 feet bgs that underwent a free product mobility screening analysis found 51.9% initial NAPL saturation, with 34.4% residual saturation remaining after the core was centrifuged at 1,000-times the force of gravity, an approximate 34% decline in NAPL saturation after centrifuging. The preceding decline in NAPL saturation, in addition to the entry of NAPL through the coarse-grained sand pack of well MW-16-45, suggests the potential for NAPL mobility across this depth interval under certain conditions (e.g., in the presence of a coarse-grained sand matrix).

- **36 to 39 feet bgs:** Between 36 and 39 feet bgs, oily zones within the core are somewhat more patchy, although the ultraviolet photograph continues to indicate the presence of petroleum throughout these soils. Sieve testing of this zone (38.9 feet bgs) indicates the mean grain size description to be fine sand, with the median grain size being 0.187 mm. Porosity was measured as 51%, with approximately 33.8% of the pore fluid being NAPL.

- **39 to 42 feet bgs:** Below 39 feet there is a noticeable decline in oil content, with the greatest occurrences of oil found in blebs or layers up to 0.2 feet thick, although a thicker zone occurs between 41.5 and 42 feet bgs, with the potential petroleum presence in surrounding soils only indicated based on photography under ultraviolet light. Sieve testing of this zone (40.4 feet bgs) indicates the mean grain size description to be fine sand, with the median grain size being 0.145 mm. Porosity was measured as 47.5%, with approximately 30.8% of the pore fluid being NAPL.

A sample of core from a depth of 40.10 feet bgs that underwent a free product mobility screening analysis found 23% initial NAPL saturation, with 17.3% residual saturation remaining after the core was centrifuged at 1,000-times the force of gravity, an approximate 25% decline in NAPL saturation after centrifuging. The preceding suggests the possibility of NAPL mobility across this depth interval under certain conditions.

- **42+ feet bgs:** Below 42 feet bgs, there is no oil indicated within soils based on white light photographs. However, there are indications of a potential light presence of petroleum between 42 and 43 feet bgs; 44.5 and 45 feet bgs; and a potential very light presence between 60.5 and 61 feet bgs, as observed under ultraviolet light. Although unknown, it is possible that the lower depth and lower level indications of petroleum (especially that only appearing in ultraviolet photographs), could be related to drag-down resulting from drilling or core tube insertion. Drag down is apparent in other segments of the core, as evidenced by indications of petroleum extending downward along the surface of the core. Sieve testing of this zone (42.5, 44.8, and 45.3 feet bgs) indicates the mean grain size description to be fine sand, with the median grain size ranging from 0.175 mm to 0.257 mm. Porosity was measured as ranging from 42.2% to 48.1%, with no NAPL detected (60.7 feet bgs) to 3.2% NAPL detected (45.3 feet bgs).

  A sample of core from a depth of 42.35 feet bgs that underwent a free product mobility screening analysis found 1.2% initial NAPL saturation, with 1.2% residual saturation remaining after the core was centrifuged at 1,000-times the force of gravity, a 0% decline in NAPL saturation after centrifuging, indicating that the NAPL in this zone is not potentially mobile.

3.2.3 Groundwater Analytical Results

Results of the testing of groundwater samples collected from the boring B-59 location are summarized in Tables 1 through 4, while results of the testing of samples collected from the MW-16 well cluster are included within Tables 5 through 8. Hydrogeologic cross-sections through the B-59/MW-16 area (oriented parallel to the river), are included as Figures 5A (depicting benzene concentrations) and 5B (depicting naphthalene concentrations), while cross-

sections oriented normal to the river are included as Figures 6A (depicting benzene concentrations) and 6B (depicting naphthalene concentrations). Additionally, plume iso-concentration maps depicting benzene and naphthalene concentrations within the Surficial Fill WBZ and the Alluvial WBZ across the site and the western portion of the adjacent Siltronic property, are provided as Figures 7 through 10. Key groundwater data from the former effluent discharge/low area, are summarized below:

- Analytical results from the testing of groundwater samples collected across multiple depths (beneath the identified oily soils) at the boring B-59 location indicate that the greatest contaminant concentrations (5,570 ppb benzene and 4,460 ppb naphthalene) were present across the shallowest interval sampled - a depth interval of 46 to 50 feet bgs, while no contaminant concentrations greater than indicated screening levels were detected below a depth of 120 feet bgs (Table 1).

- Analytical results from the testing of groundwater samples collected from well MW-16-45, screened across the oily zone within the uppermost Alluvial WBZ, indicate the presence of 2,880 ppb benzene and 7,500 ppb naphthalene. Vertically, concentrations of these constituents were found to decline significantly with depth, with benzene not detected above laboratory method detection limits at a depth of 115 to 125 feet bgs, while naphthalene was identified at a concentration of only 26.5 ppb (below screening level) across the same depth interval (Tables 5 and 6; Figures 5 and 6).

- Laterally, benzene concentrations within the upper Alluvial WBZ as identified at the B-59 / MW-16 location depict attenuating concentrations relative to the "benzene high" previously identified to the east at the MW-4-56 well location. Specifically, benzene concentrations are found to decrease in a westerly direction from 15,000 ppb identified at well MW-4-56, to approximately 3,000 to 5,000 ppb identified at the B-59/MW-16 location, and finally to less than 100 ppb as identified at the MW-3 well location (Figure 8). As described in Section 3.2.5, analysis of a NAPL sample recovered from well MW-16-45 did not detect the presence of benzene at concentrations greater than laboratory method

reporting levels (10,000 ppb), and therefore the decrease in benzene concentration at well MW-16-45 relative to MW-4-57, even with the presence of NAPL in the well casing, does not appear anomalous.

- The naphthalene concentration as identified across the oily zone at well MW-16-45 (7,500 ppb), represents an increase in concentration relative to adjacent well locations. Specifically, less than 1 ppb naphthalene was identified within the upper Alluvial WBZ along the shoreline to the west at the MW-3 well location, while 3,780 ppb naphthalene was identified across the most heavily impacted zone (upper Alluvial WBZ) to the east at the MW-4-57 well location (Figure 10). As described in Section 3.2.5, analysis of a NAPL sample recovered from well MW-16-45 identified the presence of naphthalene at a concentration of 15,600,000 ppb (48% of the total PAH content), thereby providing rationale for the elevated naphthalene concentration identified in groundwater at this location.

- As depicted in Figures 5 through 10, the NAPL and dissolved phase hydrocarbon presence on-site within the Alluvial WBZ is primarily limited to the former tar pond area as well as the former effluent discharge area to the immediate west, while impacts within the overlying Surficial Fill WBZ across much of the same area are much less pronounced. The preceding suggests the petroleum impacts identified within the Alluvial WBZ at this portion of the site are likely the result of historical discharge of NAPL and tar effluent directly to the pre-fill ground surface (e.g., typically the alluvial silt) in these areas.

3.2.4 Soil Analytical Results

Soil samples were collected from a depth of 2.5 feet bgs at borings B-53 and B-55; and from depths of 2 feet and 7.5 feet bgs at the B-54 boring location to undergo laboratory analyses for BTEX and PAHs (Tables 9 and 10). Results of these tests indicated BTEX to be non-detect for samples collected from borings B-53 and B-54 (where no shallow tar was identified), while the sample collected from boring B-55 (which contained solid tar in the sample matrix), identified the presence of 137 ppm benzene. Similarly, the sample

from boring B-55 containing tar identified the presence of 61,008 ppm total PAHs, while samples from borings B-53 and B-54 identified from 3.06 ppm (2 feet bgs at B-53) to 268.6 ppm (7.5 feet bgs at B-54) total PAHs.

3.2.5 NAPL Characterization

Well MW-16-45 was screened immediately adjacent to the river embankment within a zone of oily soils (Section 3.2.1), with a screen set in the upper Alluvial WBZ from 30 to 45 feet bgs, and a primary sand-pack extending from 27 to 45 feet bgs. A sump was placed below the screen interval, extending from 45 to 47.5 feet bgs.

On September 29, 2004 approximately 1.5 feet of brown oil (NAPL) was identified in the sump of well MW-16-45. The NAPL was subsequently removed from the sump of the well over several days with the use of a disposable bailer to provide sufficient volume of sample for lab analysis, as well as to conduct an initial evaluation of the ability to remove NAPL from this location. No NAPL has been identified in intermediate-depth Alluvial WBZ well MW-16-65, or in deep Alluvial WBZ well MW-16-125.

Table 17 depicts the measured NAPL thickness at the MW-16-45 location during each measurement event, as well as the estimated volume of NAPL removed from the well. The volume of NAPL removed from this well is also depicted graphically on Figure 12. As depicted, approximately 1 liter of oil was initially removed from the well, with successive events yielding between 0.25 and 0.5 liters of NAPL. The NAPL recovered from the well has been observed (qualitative) to be highly viscous and tacky.

Results of the chemical and physical testing of the recovered NAPL are summarized on Tables 14 through 16, and as follows:

- The fuel fingerprint indicates the NAPL contains diesel- and heavy oil-range petroleum hydrocarbons. Evaluation of the chromatogram with various standards (Appendix J) resulted in the following description provided by the laboratory.

"The sample exhibited a pattern consistent with a medium distillate non-fuel gas-oil (e.g., creosote or coal oil) by the HCID method. Further investigation by the GC-MS confirmed the majority of the sample was made up of polycyclic aromatic hydrocarbons (PAHs) although the majority were naphthalenes and its alkl homologues. From this we conclude the sample may have been derived from only a few likely sources, those being: coal oil based creosote or the cracking and coking operations in many refineries (e.g., light cycle oil residue or coke oil)." The preceding, in conjunction with knowledge of site history, strongly suggests the source of the oil to be cracking and coking processes related to the former oil gas MGP.

- The NAPL has a specific gravity of 1.084 at ambient temperature, and is therefore slightly denser than water (specific gravity of 1.0). At higher temperatures the NAPL was found to maintain a similar specific gravity.

- The NAPL has a viscosity of 105 centistokes (114 centipoise) at a temperature of 70 degrees F. For comparison, water has a viscosity of 1 centistoke or centipoise (by definition), while honey has a viscosity of approximately 10,000 centipoise. As summarized on Table 14, the NAPL at MW-16-45 has the greatest viscosity of any of the NAPL samples previously collected at the site, which ranged from 7.2 centistokes at well MW-6-32 (where active recovery is occurring) to 45.7 centistokes at well MW-11-32.

- Relatively low levels of aromatic hydrocarbons were identified within the NAPL as compared with NAPL from all other areas of the site, with ethylbenzene, toluene, xylene, and trimethlybenzenes all identified at concentrations less than 70 ppm (Table 14). Benzene was not detected within the NAPL at a concentration greater than laboratory method reporting levels (10 ppm).

- The NAPL has no flashpoint below 150°F (Table 12). The low level of volatile aromatic hydrocarbons in the oil likely contributes to the oil's high flash point.

- PAHs were identified within the NAPL at a combined total concentration of 32,787 ppm, of which the carcinogenic PAH fraction consisted of 2,647 ppm. Further, naphthalene comprised almost 50% of total PAHs, with 15,600 ppm identified (Tables 14 and 15). In addition to PAHs, one additional SVOC (2-methylnaphthalene at a concentration of 5,500 ppm) was identified.

3.2.6 NAPL Distribution and Mobility Screening

As depicted on Figures 11 and in a schematic cross-section included as Figure 13, NAPL has been identified beneath a portion of the former discharge / low area, with the extent of NAPL in proximity of the embankment having been delineated to the east by well cluster MW-4 and to the west by well cluster MW-3, to the north by RAA-8, RAA-15, RAA-18, RAA-19, and RAA-20, and to the south by borings B-9 and B-30. As described in Section 3.2.3, the source of the NAPL is likely a function of historical discharge to the pre-fill ground surface in the former low area / discharge area immediately south of the MW-3 / above-ground storage tank farm area. The estimated locations of former effluent discharge features within this area (wastewater outfall and ditch), based on aerial photographs and/or facility diagrams, are included on Figure 11.

As depicted in Figures 11 and 13, the thickness and depth of the oil (NAPL) tends to become greater in a northerly direction, toward the river (although not extending to the river), with the NAPL present primarily across the upper portion of the alluvial unit. As observed at numerous push probe boring locations, the vertical migration of the NAPL appears to have been interrupted by the presence of numerous individual thin silt layers in the upper Alluvial WBZ. Although the continuity of individual silt layers is unknown, it appears sufficient silt is present within the upper Alluvial WBZ such that vertical NAPL migration has been restricted, as evidenced by lack of field screening evidence of impact at depth, as well as diminishing concentrations of dissolved contaminants in groundwater with increasing depth.

As described in Section 3.2.2, results of physical testing of soil core collected from within the zone of NAPL occurrence at the MW-16-65 well location has provided physical data such as total porosity, particle size, pore fluid saturation (water and NAPL), specific gravity, density, viscosity, and interfacial / surface tension data for the core and/or NAPL (Appendix I).

Results of the preceding testing found the mean grain size of a majority of the soils within the NAPL zone to be classified as "fine sand", with total porosities ranging from 45.9% to 52%. NAPL saturations (as a percentage of total pore space) at select depth intervals between approximately 29 feet bgs and 40 feet bgs at the MW-16 location were found to range from 25.7% (at 33.5 feet bgs) to 62.6% (at 35.7 feet bgs). For comparison, residual (non-mobile) NAPL levels as cited in the literature (EPA 1992 and Jackson et.al. 2004), typically range from 5% to 50% of total porosity in soils present below the water table. Residual saturation of NAPL is the saturation at which the NAPL is immobilized by capillary forces as discontinuous ganglia under ambient groundwater flow conditions (Cohen and Mercer 1993).

With regard to NAPL mobility screening of site soils, minimum potential residual saturation levels were estimated by centrifuging soils at 1,000-times the force of gravity, an exertion of force much greater than would be exerted based on gravity, capillary effects, or hydraulic gradient. Based on the centrifuge testing results, minimum residual saturation levels (for soils in the primary zone of NAPL occurrence above 41 feet bgs) were identified as 17.3% (23% initial saturation), and 34.4% (51.9% initial saturation). Based on the preceding, it was possible to mobilize 25% to 34% of the NAPL with the application of sufficient force (1,000-times gravity), with an average minimum residual saturation after centrifuging of 26% (Appendix I).

The mobility screening evaluation is meant to indicate the magnitude of NAPL that may be present at levels greater than possible residual saturation levels, with the centrifuging meant to mimic an infinite amount of time under ambient gravity conditions (with a lack of adjacent barrier material). Due to the qualitative nature of the screening and the presence of apparent silt barrier material as observed in the shoreline borings, it is clear that the preceding estimation does not equate to a given percentage of NAPL that is presently mobile at the site. Rather, it suggests that NAPL is likely present at the site at levels greater than residual saturation, and as such, the NAPL

has the potential for mobility given suitable conditions (i.e., as evidenced by flow into the course-grained sand pack of well MW-16-45).

In addition to the preceding, whether DNAPL or groundwater is the wetting fluid in the formation can have an effect on the distribution and fate of DNAPL in the saturated zone. Specifically, the size and distribution of NAPL ganglia or blebs in the saturated zone is affected by the wetting characteristic of the NAPL in the formation (Dwarakanath, et. al.). Water is typically the wetting fluid in the presence of NAPL, which results in smaller blebs of NAPL trapped within the soil pores, with minimal contact between the NAPL and soil (water preferentially coats the soil). Results of the site-specific wettability testing (Appendix I) found the NAPL/water system to be neutrally-wet, indicating that neither fluid (NAPL or water) has a preferred affinity over the other to spread over the soil particles. The preceding suggests that larger blebs of NAPL may become trapped within the soil pores (e.g., higher residual saturation) than would otherwise be encountered in a "typical" system where water is more strongly wetting.

Overall, the identified viscosity, specific gravity, and interfacial tension of the NAPL or NAPL/water system (Table 14) are within the typical range of an oil tar or creosote. With respect to mobility potential, the high viscosity, low specific gravity, and moderate interfacial tension all suggest limited mobility potential.

Section 3.3 of this report provides a description of tar/oil distribution in sediments immediately off-shore of the oil-bearing soils described herein, and is based on investigation and evaluation conducted by Anchor (Anchor 2004). The primary purpose of the evaluation provided in Section 3.3 is to assess the possibility that a complete migration pathway presently exists between NAPL in upland soils and NAPL observed in off-shore sediments.

3.3 Visible Tar Distribution in Offshore Sediments

As described by Anchor (2004), the physical characteristics of the tar material in offshore sediments were spatially heterogeneous and varied in consistency from soft, sticky, plastic, stiff and firm, to brittle. The brittle material is generally gravel-size lumps of tarry sand that appears to have weathered. Much of the brittle tar is found on the sediment surface and was generally found at stations closer into the shoreline in areas that have been exposed to air during low flow conditions. Small pieces of this material were also found at depth in some cores. Most of the tar present below this weathered layer was a softer consistency. Although it smears on surfaces it touches, it is too viscous to flow noticeably and the intermixed sands and non-plastic silt/sands prohibited it from acting viscid when sheared in place. None of the tar layers identified exhibited a noticeable sheen.

The visually contaminated zone in sediments varied in consistency from sediments with a slight hydrocarbon odor, slight sheen, slight oil staining, and minor blebs of oil and/or tar to sediments with more extreme hydrocarbon odor, heavy sheen, and sediments more heavily saturated in tar. In some cases, this saturation had the consistency of somewhat more liquid material that was still very viscous and sticky that was termed "oil" in field logs. No free liquid hydrocarbon product beyond small scattered oily blebs was identified in any of the cores either in tar or in visually contaminated sediments. All "oily" sediments encountered felt viscous to the touch, were intermixed in a mostly sand/silt matrix and did not flow noticeably during the core cutting and sampling procedure.

Based on the physical definitions discussed in Section 2.9 the lateral and vertical extents of the tar body were delineated. The elevations and thicknesses of the surface tar body and visibly contaminated zones are depicted in Figure 6A. As shown, the primary geologic unit in the nearshore zone is silt with discontinuous lenses of sands at variable depths. Discontinuous "pockets" of tar and very viscous "oily" sediment in the nearshore stations are confined to the sediments consisting primarily of sand just below the mudline elevation. Both the tar and "oily" sediment layers were viscous to the touch and exhibited no free flowing properties during sampling, in contrast to the tar and oil zones identified in the upland shoreline area.

The sediment layers where viscous "oily" saturated sands were observed are not laterally continuous with the tar and oil zones identified in the upland borings (see Figure 13). The upland areas with tar or oil product (B-59, B-29, MW-16) are intervened by offshore cores RAA-18, RAA-04, RAA-01, and RAA-02 with no (or very little) "oily" type products present (RAA- and AN-series boring logs are included in Appendix A). Similar observations were made at other intervening core locations (RAA-15, RAA-19, and RAA-20). One core, RAA-01, had very poor recovery in the top 10 feet of core, but the top material recovered was sandy tar and the material below this was firm sticky product in a silt matrix. The only oily type products in sediments were found further out in the AN-series cores in scattered relatively thin layers. In addition, the upland oils are present in alluvial soils with considerable sand content. Underneath these oils are silt layers that appear to extend towards a thicker sequence of surficial offshore silts. In the offshore sediments, this silt layer is typically quite thick and only occasionally interrupted by pockets of more sandy material. These silts appear to be acting as a barrier to the transport of the subsurface NAPL (Figure 13). Consequently, there appears to be no complete physical subsurface pathway between the upland oils in the alluvial sand material to the off-shore tar body or the scattered oily layers in the further offshore silts.

4.0 CONCLUSIONS

Perhaps the most significant finding derived from results of the upland and in-water investigation activities described herein is the lack of connectivity between oil saturated soils within the Alluvial WBZ beneath the upland portion of the site and oily or tarry sediments within the Willamette River, thereby indicating that the NAPL has not in the past, nor is it currently, discharging to Willamette River sediments. As such, oil and tar noted in Willamette River sediments appear to be the result of previous overland discharge of these waste products that occurred at this portion of the site between 1913 and approximately 1941.

In addition to the preceding primary conclusion, the following general conclusions regarding the nature and extent of groundwater impacts and NAPL distribution adjacent to the Willamette River down-gradient of the former tar ponds and the former effluent discharge area, including the pathway between the upland and river areas, are as follows:

Visual Impacts Within Fill

1) Fill encountered adjacent to the embankment within both the former tar pond area and the former effluent discharge area consisted of gravelly sands and silts, including patches or flecks of solid black carbon pitch, with the fill extending to depths of approximately 22.5 feet bgs (B-56) to 26 feet bgs (MW-16).

2) Tar was mixed with other materials for use as fill within the former low area/effluent discharge area, with tar identified within fill ranging from 1 to 2 feet bgs and extending to depths ranging from approximately 22 to 30 feet bgs at borings near, but not immediately adjacent to, the embankment. Direct observation of fill in borings along the embankment indicates that tar was not a component of the fill used to construct the river embankment.

3) An approximate 0.5-foot thick layer of solid, ductile tar identified on the inferred former ground surface riverward of the former tar ponds (B-56), and an approximate 0.5-foot zone containing oily/tar blebs identified near the inferred former ground surface riverward of the former effluent discharge area (MW-16) were likely the result of direct placement prior to filing.

Alluvial Unit Geology

4) Beneath the fill were interbedded sands, silts, and silty sands characteristic of the Alluvial WBZ, extending to a depth of approximately 179 feet bgs near the river embankment down-gradient of the former tar pond area, with similar depths anticipated below the former effluent area. A gravelly layer was observed at the base of the Alluvial unit, below which is inferred to be basaltic bedrock.

Alluvial Unit Groundwater Contaminant Nature and Extent

5) Groundwater data from boring B-56 suggest the presence of two apparently distinct petroleum-related contaminant plumes in the Alluvial WBZ down-gradient of the former tar pond area and the former effluent discharge area.

6) The western plume, located west of boring B-56 in the upper to mid-Alluvial WBZ, extends from approximately 45 feet bgs to 120 feet bgs near the river embankment (MW-4; B-59). The lateral extent of this plume is defined to the west by the MW-3 well cluster and to the east by the B-56 well point location. This plume appears to be the result of NAPL and groundwater penetration into the upper Alluvial WBZ within the southern portion of the former tar ponds/former Koppers waste discharge area.

7) The eastern plume, located east of boring B-56 in the mid to lower portions of the Alluvial WBZ, extends from approximately 70 to 150 feet bgs (MW-5). The lateral extent of this plume is defined to the west by the B-56 well point location and to the east by the Siltronic WS-12 well cluster location. This plume appears to be the result of deeper NAPL migration near the eastern limit of the former tar pond/tar pond overflow area proximate to the former Siltronic property line.

NAPL-Bearing Soils-Former Effluent Discharge Area

8) The lateral limit of oil-bearing soils in proximity to the river embankment at the Gasco site has been found to be limited to an approximate 200 foot interval between the MW-3 and MW-4 well cluster locations (i.e., limited to the former effluent discharge/low area). NAPL-bearing Alluvial soils were similarly identified in push probe borings installed within the former effluent/low area further south of the embankment (e.g., borings B-55 and B-57 through B-59). Borings installed at the base of the embankment show that oil-bearing soils present within the Alluvial WBZ do not extend northward to the Willamette River.

9) The source of the observed NAPL is likely a function of historical discharge to the pre-fill ground surface in the former low area / discharge area southeast of the MW-3 / above-ground storage tank farm area.

10) Vertically, NAPL upland of the river embankment at MW-16 has been identified within visually-impacted soils across a depth interval of approximately 26 to 42 feet bgs, with thin silt layers within the upper Alluvial WBZ observed to be inhibiting vertical migration.

11) Fuel fingerprint analyses indicate that the NAPL contains diesel- and heavy oil-range petroleum hydrocarbons with the chromatograph suggesting it to be a creosote or oil derived from

cracking/coking operations, both of which are consistent with operations historically conducted at the Gasco site.

12) Physical testing of soil core from the MW-16 NAPL zone indicates typical porosities ranging from 42% to 53%, with 11% to 25% of the pore fluids from 26 to 31 feet bgs consisting of NAPL; 20% to 50% of the pore fluids from 31 to 42 feet bgs consisting of NAPL; and 0 to 3% of the pore fluids below 42 feet bgs consisting of NAPL.

13) NAPL mobility screening results indicate that NAPL: is likely present at levels greater than residual saturation at depths between 29 feet bgs and 42 feet bgs at the MW-16 well location. Screening did not indicate potential NAPL mobility below 42 feet bgs. As such, and without consideration of underlying or adjacent low permeability silts, then migration of the NAPL across this depth interval would be deemed possible. However, observed NAPL distribution indicates the presence of underlying and adjacent silts have prevented NAPL migration from the MW-16 area to the adjacent river sediments. is not

14) Physical properties associated with the NAPL identify it as low density fluid (slightly more dense than water), with a high viscosity, moderate interfacial tension, and neutral wettability – all of which suggests poor mobility in the subsurface.

15) Limited NAPL removal activities at the MW-16-45 location suggests that removal of 15 to 30 liters (4 to 8 gallons) of NAPL per month from this location may be feasible, although the likely duration of such yields is not known.

Pathway Evaluation-Upland and Offshore NAPL

16) Sediment borings installed near the toe of the river embankment did not identify the presence of NAPL as identified at adjacent upland locations B-29 and MW-16.

17) Sediment layers offshore of the former effluent discharge area containing viscous oil and tar are laterally discontinuous with the tar and oil zones identified at upland boring locations.

18) A laterally thickening zone of silt present between the upland portion of the site and the river appears to be acting as a barrier to the transport of NAPL, with no complete physical subsurface pathway between the zone of NAPL below the upland portion of the site and the tar body or scattered oily layers identified in offshore sediments.

19) Tar and oil within off-shore sediments appears to be the result of previous overland discharge of these waste products that occurred at this portion of the site between 1913 and approximately 1941.

5.0 LIMITATIONS AND SIGNATURES

The information presented in this report was collected, analyzed, and interpreted following the standards of care, skill, and diligence ordinarily provided by a professional in the performance of similar services as of the time the services were performed. This report and the conclusions and/or recommendations contained in it are based solely upon research and/or observations, and physical sampling and analytical activities, if any, that were conducted at the Client's request.

The information presented in this report is based only upon activities witnessed by HAI or its contractors, and/or upon information provided to HAI by the Client and/or its contractors. The analytical data presented in this report, if any, document only the concentrations of the target analytes in the particular sample, and not the property as a whole.

Unless otherwise specified in writing, this report has been prepared solely for the use by the Client and for use only in connection with the evaluation of the subject property. Any other use by the Client or any use by any other person shall be at the user's sole risk, and HAI shall have neither liability nor responsibility with respect to such use.

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MFA (2004g) *Results of Direct Push Upland Shallow Soil, Siltronic Corporation, 7200 NW Front Avenue, Portland, Oregon.* Maul Foster Alongi, Inc., December 7, 2004

MFA (2004h) *MGP Data Submittal, Siltronic Corporation, 7200 NW Front Avenue, Portland, Oregon.* Maul Foster Alongi, Inc., December 13, 2004

PTS (2005) Core Photography and Physical Properties Data, NW Natural – Gasco Project No. 2708-10, PTS File No.: 34452, PTS Laboratories, Inc., dated January 2005.

U.S. EPA (1992) *Estimating Potential for Occurrence of DNAPL at Superfund Sites*, EPA 9355.4-07FS, January 1992.

7.0 GLOSSARY OF ABBREVIATIONS

Anchor	Anchor Environmental, LLC
API	American Petroleum Institute
ASTM	American Society of Testing Materials
bgs	below existing ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
DEQ	Oregon Department of Environmental Quality
DNAPL	dense non-aqueous phase liquid
EPA	U.S. Environmental Protection Agency
FAMM	Fuel and Marine Marketing, Inc.
HAI	Hahn and Associates, Inc.
LTI	Limno-Tech, Inc.
MFA	Maul Foster Alongi, Inc.
mm	millimeter
msl	mean sea level
NAPL	non-aqueous phase liquid
NCA	North Creek Analytical
NPDES	National Pollution Discharge Elimination System
OAR	Oregon Administrative Rules
OD	outside diameter
OWRD	Oregon Water Resources Department
PAHs	polynuclear aromatic hydrocarbons
PCI	Pollution Control Industries, Inc.
PTS	PTS Laboratories, Inc.
ppb	parts per billion
ppm	parts per million
QA/QC	quality assurance / quality control
RCRA	Resource Conservation and Recovery Act
SVOCs	semi-volatile organic compounds
VOCs	volatile organic compounds

TABLES

SCOEPA00003798

TABLE 1 – Summary of Analytical Results for Groundwater Samples: Temporary Well Points
Volatile Organic Compounds by EPA Method 8260

Well Point Location	Sample Number	Sample Date	Screen Interval (feet bgs)	Analytical Results – ug/L (ppb) VOCs by EPA Method 8260											
				Aromatic VOCs (AVOCs)						Chlorinated VOCs					Other VOCs
				Benzene	Ethyl-benzene	Toluene	Total Xylenes	1,2,4-TMB	Naphthalene	1,1-DCE	cis-1,2-DCE	PCE	TCE	Vinyl Chloride	
			Reference Level [1] ==>	51. [2]	7.3 [4]	9.8 [4]	13. [4]		620. [4]	3.2 [2]	590. [4]	590. [4]	30. [2]	530. [2]	
Push Probe Boring Samples															
B-56A	2708-040602-101	2-Jun-04	18-22	8.	5. U	5. U	10. U	5. U	328.	5. U	5. U	5. U	5. U	5. U	U
	2708-040603-102	3-Jun-04	40-44	1. U	1. U	1. U	2. U	1. U	2.57	1. U	1. U	1. U	1. U	1. U	U
	2708-040603-103	3-Jun-04	60-64	3.62	**70.**	1. U	**18.64**	2.06	140.	1. U	1. U	1. U	1. U	1. U	U
	2708-040603-104	3-Jun-04	80-84	5. U	5. U	5. U	10.6	5. U	441.	5. U	5. U	5. U	5. U	5. U	U
(duplicate)	2708-040603-105	3-Jun-04	80-84	3.1	2.02	2. U	6.96	2. U	273.	2. U	2. U	2. U	2. U	2. U	U
	2708-040604-106	4-Jun-04	100-104	1. U	1. U	1. U	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U
B-56B	2708-040614-115	14-Jun-04	136-140	1. U	1. U	1. U	2. U	1. U	3.26	1. U	1. U	1. U	1. U	1. U	U
	2708-040614-116	14-Jun-04	174-178	1. U	1. U	1. U	2. U	1. U	4.2	1. U	1. U	1. U	1. U	1. U	U
B-59A	2708-040611-108	11-Jun-04	46-50	**5,570.**	**317.**	50. U	**85.5**	63.	**4,460.**	50. U	50. U	50. U	50. U	50. U	U
	2708-040611-109	11-Jun-04	76-80	**230.**	**25.8**	**12.4**	**26.**	6.65	582.	5. U	5. U	5. U	5. U	5. U	U
	2708-040611-110	11-Jun-04	96-100	**113.**	**9.78**	6.16	11.28	2.58	272.	2. U	2. U	2. U	2. U	2. U	U
	2708-040611-112	11-Jun-04	116-120	**166.**	3.02	2.16	7.05	1.51	116.	1. U	1. U	1. U	1. U	1. U	U
	2708-040611-113	11-Jun-04	144-148	19.3	2.58	1.43	3.58	1.17	119.	1. U	1. U	1. U	1. U	1. U	U
	2708-040614-114	14-Jun-04	171-175	2.29	1. U	1. U	2. U	1. U	3.46	1. U	1. U	1. U	1. U	1. U	U
Quality Control Samples															
Equipment Blank	2708-040602-100	2-Jun-04	-	1. U	1. U	1. U	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U
Trip Blank	TB57	-	-	1. U	1. U	1. U	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U
Trip Blank	2708-040604-098	4-Jun-04	-	1. U	1. U	1. U	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U
Equipment Blank	2708-040604-107	4-Jun-04	-	1. U	1. U	1. U	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U
Trip Blank	2708-040604-097	4-Jun-04	-	1. U	1. U	1. U	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U
Equipment Blank	2708-040611-111	11-Jun-04	-	1. U	1. U	1.13	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U
Trip Blank	2708-040614-096	6/14/04	-	1. U	1. U	1. U	2. U	1. U	2. U	1. U	1. U	1. U	1. U	1. U	U

Note:
AVOCs = aromatic volatile organic compounds
bgs = below ground surface
AWQC = Ambient Water Quality Criteria
DCE = dichloroethene
PCE = tetrachloroethene
DEQ = Oregon Department of Environmental Quality
ppb = parts per billion
TCE = trichloroethene
TMB = trimethylbenzene
U = not detected above detection limit indicated
ug/L = micrograms per liter
VOCs = volatile organic compounds

1 = Reference Level is lowest of EPA AWQC for aquatic life protection, AWQC for human consumption of organisms only, or DEQ SLV for aquatic receptors
2 = Ambient Water Quality Criteria (EPA 822-R-02-047, November 2002) (AWQC) based on human consumption of organisms only
3 = AWQC based on Freshwater Aquatic Life Protection, CCC Values
4 = DEQ Level II Ecological Screening Level Values (SLVs) for aquatic receptors (December 2001)
Bold = Concentration exceeds Reference Level

TABLE 2 - Summary of Analytical Results for Groundwater Samples: Temporary Well Points
Polynuclear Aromatic Hydrocarbons by EPA Method 8270 SIM or 8270C

PAHs by EPA Method 8270 (SIM)				Analytical Results in ug/L (ppb)															
				Carcinogenic PAHs								Non Carcinogenic PAHs								
Well Point Location	Sample Number	Sample Date	Screen Interval (feet bgs)	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	Acenaph thene	Acenaph thylene	Anthracene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	Total PAHs
			Reference Level [1] ==>	0.02 [2]	0.01 [4]	0.02 [2]		0.02 [2]	0.02 [2]	0.02 [2]	0.02 [2]	520. [4]		13. [4]	6.16 [4]	3.9 [4]	620. [4]	6.3 [4]	4,000. [2]	
Push Probe Boring Samples																				
B-56A	2708-040602-101	2-Jun-04	18-22	**7.99**	**9.45**	**7.03**	6.89	**6.04**	**10.2**	4. U	**4.81**	54.1	4.08	**14.1**	**44.2**	**23.3**	21.	**53.7**	50.7	317.6
	2708-040603-102	3-Jun-04	40-44	**0.0239**	**0.0196**	**0.0234**	0.1000 U	**0.0188**	**0.0345**	0.0100 U	0.0167	0.3420	0.1000 U	0.1000 U	0.1680	0.1320	3.6100	0.3300	0.2230	4.9419
	2708-040603-103	3-Jun-04	60-64	0.0100 U	0.0100 U	0.0100 U	0.1000 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.1030	0.1000 U	0.1000 U	0.1000 U	0.1000 U	63.8000	0.1000 U	0.1000 U	63.9030
	2708-040603-104	3-Jun-04	80-84	**0.0315**	**0.0313**	**0.0236**	0.1000 U	0.0166	**0.0416**	0.0100 U	0.0154	0.1260	0.1500 U	0.1000 U	0.1650	0.1500 U	358.00	0.2800	0.2300	358.9610
(duplicate)	2708-040603-105	3-Jun-04	80-84	0.03 U	0.0300 U	0.0300 U	0.1000 U	0.0300 U	0.0300 U	0.0300 U	0.0300 U	0.1500 U	0.1500 U	0.1000 U	0.1320	0.1500 U	405.00	0.2140	0.1840	405.5300
	2708-040603-106	4-Jun-04	100-104	0.0167	**0.0170**	0.0121	0.1000 U	0.0113	**0.0216**	0.0100 U	0.0108	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.8500	0.1000 U	0.1000 U	0.9395
B-56B	2708-040614-115	14-Jun-04	136-140	**0.1700**	**0.1370**	0.1000 U	0.1000 U	0.1000 U	**0.2140**	0.2000 U	0.1000 U	0.6460	0.1000 U	0.3920 U	1.1000	0.4490	2.5800	2.9900	1.3100	9.5960
	2708-040614-116	14-Jun-04	174-178	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.2000 U	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.1000 U	0.9200	0.1440	0.1060	1.1700
Quality Control Samples																				
Equipment Blank	2708-040604-107	4-Jun-04	-	0.01 U	0.01 U	0.01 U	0.1 U	0.01 U	0.01 U	0.01 U	0.01 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

Note:
AWQC = Ambient Water Quality
bgs = below ground surface
DEQ = Oregon Department of Environmental Quality
EB = equipment blank
EPA = U.S. Environmental Protection Agency
PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
U = not detected above detection limit indicated
ug/L = micrograms per liter

1 = Reference Level is lowest of EPA AWQC for aquatic life protection, AWQC for human consumption of organisms only, or DEQ SLV for aquatic receptors
2 = Ambient Water Quality Criteria (EPA 822-R-02-047, November 2002) (AWQC) based on human consumption of organisms only
3 = AWQC based on Freshwater Aquatic Life Protection, CCC Values
4 = DEQ Level II Ecological Screening Level Values (SLVs) for aquatic receptors (December 2001)
Bold = Concentration exceeds Reference Level

TABLE 3 - Summary of Analytical Results for Groundwater Samples: Temporary Well Points

Detected Semi-Volatile Organic Compounds by EPA Method 8270C

SVOCs by EPA Method 8270				Analytical Results in ug/L (ppb)																			
Well Point Location	Sample Number	Sample Date	Screen Interval (feet bgs)	Acenaphthene	Anthracene	Benzenemethanol (alpha,alpha,-dimethyl)[5]	Benzo (a) anthracene	Benzo (a) pyrene	Benzo (b) fluoranthene	Benzo (b) thiophene[5]	Benzo (ghi) perylene	Benzo (k) fluoranthene	Bis(2-ethylhexyl)phthalate	Carbazole	Chrysene	Fluoranthene	Fluorene	Indane[5]	Indeno (1,2,3-cd) pyrene	Naphthalene	Naphthalenecarboxylic acid[5] (Isomer)	1,8-Naphthalic anhydride[5]	Phenanthrene	Pyrene
			Reference Level [1]	520. [4]	13. [4]	8.6 [4]	0.02 [2]	0.01 [4]	0.02 [2]	##	##	0.02 [2]	2.2 [2]	##	0.02 [2]	6.16 [4]	3.9 [4]	##	0.02 [2]	620. [4]	##	##	6.3 [4]	4,000. [2]
Push Probe Boring Samples																								
B-56A	02-101	2-Jun-04	18-22	71.3	**45.9**	50. U	**50.4**	**66.7**	**39.4**	50. U	50.9	**40.6**	50. U	25. U	**69.2**	**161.**	**34.5**	50. U	**36.9**	25. U	50. U	50. U	**136.**	199.
	03-102	3-Jun-04	40-44	5. U	5. U	-	5. U	5. U	5. U	-	5. U	5. U	**17.4**	5. U	5. U	5. U	5. U	-	5. U	5.19	-	-	5. U	5. U
	03-103	3-Jun-04	60-64	5. U	5. U	-	5. U	5. U	5. U	-	5. U	5. U	10. U	5. U	5. U	5. U	5. U	-	5. U	41.5	-	-	5. U	5. U
	03-104	3-Jun-04	80-84	5. U	5. U	**25.9** J	5. U	5. U	5. U	10.7 J	5. U	5. U	10. U	5. U	5. U	5. U	5. U	349. J	5. U	317.	15.5 J	90.7 J	5. U	5. U
	04-106	4-Jun-04	100-104	5. U	5. U	-	5. U	5. U	5. U	-	5. U	5. U	10. U	5. U	5. U	5. U	5. U	-	5. U	5. U	-	-	5. U	5. U
B-56B	14-115	14-Jun-04	136-140	5. U	5. U	-	5. U	5. U	5. U	-	5. U	5. U	10. U	5. U	5. U	5. U	5. U	-	5. U	5. U	-	-	5.16	5. U
	14-116	14-Jun-04	174-178	5. U	5. U	-	5. U	5. U	5. U	-	5. U	5. U	10. U	5. U	5. U	5. U	5. U	-	5. U	5. U	-	-	5. U	5. U

Note: Sample Prefix = 2708-0406
AWQC = Ambient Water Quality Criteria
bgs = below ground surface
DEQ = Oregon Department of Environmental Quality
EB = equipment blank
EPA = U.S. Environmental Protection Agency
PAHs = polynuclear aromatic hydrocarbons
ND = not detected
ppb = parts per billion
U = not detected above detection limit indicated
ug/l = micrograms per liter
J = estimated concentration

1 = Reference Level is lowest of EPA AWQC for aquatic life protection, AWQC for human consumption of organisms only, or DEQ SLV for aquatic receptors
2 = Ambient Water Quality Criteria (EPA 822-R-02-047, November 2002) (AWQC) based on human consumption of organisms only
3 = AWQC based on Freshwater Aquatic Life Protection, CCC Values
4 = DEQ Level II Ecological Screening Level Values (SLVs) for aquatic receptors (December 2001)
5 = Tentatively Identified Compound by GC/MS
Bold = Concentration exceeds Reference Level

TABLE 4 - Summary of Analytical Results for Groundwater Samples: Temporary Well Points
Metals and Cyanide

Well Point Location	Sample Number	Sample Date	Screen Interval (feet bgs)	Analytical Results - mg/l (ppm)													
				Dissolved Metals by EPA 6000/7000 Series Methods						Total Metals by EPA 6000/7000 Series Methods						EPA Method 9010	
				Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Amenable Cyanide	Cyanide
			Reference Level [1] ==>	1.4E-04 [2]	0.011 [2]	2.7E-03	5.4E-04 [3,5]	0.016 [2]	0.037 [3,5]								0.005 [2]
Push Probe Boring Samples																	
B-56A	2708-040602-101	2-Jun-04	18-22	**0.00134**	0.00100	0.00200 U	0.00100 U	**0.0238**	0.0199	0.00177	0.00803	0.00856	0.00446	0.0121	0.0288	0.0343	**0.0800**
	2708-040603-102	3-Jun-04	40-44	**0.00119**	0.00498	0.00218	0.00100 U	**0.0320**	**0.0647**	0.00401	0.0595	0.0202	0.00232	0.0256	0.270	0.105	**0.517**
	2708-040603-103	3-Jun-04	60-64	**0.00796**	0.00538	0.00200 U	0.00100 U	**0.0338**	0.0103	0.0143	0.0460	0.0336	0.00446 U	0.117	0.224	0.0842	**0.406**
	2708-040603-104	3-Jun-04	80-84	**0.00724**	0.00653	0.00200 U	0.00100 U	**0.0325**	**0.0755**	0.0179	0.316	0.194	0.0256	0.145	0.702	0.107	**0.506**
	2708-040604-106	4-Jun-04	100-104	**0.00515**	0.00123	0.00200 U	0.00100 U	**0.0173**	0.0103	0.00869	0.0375	0.0415	0.00457	0.0505	0.100	0.156	**0.533**
B-56B	2708-040614-115	14-Jun-04	136-140	**0.00582**	0.001 U	0.002 U	0.001 U	0.0162	**0.191**	0.0290	0.827	0.457	0.0306	0.291	6.51	0.005 U	**0.006**
	2708-040614-116	14-Jun-04	174-178	0.001 U	0.001 U	0.002 U	0.001 U	0.00445	**0.0383**	0.00369	0.0351	0.0218	0.00204	0.0246	0.177	0.0319	**0.0557**
Quality Control Samples																	
Equipment Blank	2708-040604-107	4-Jun-04	-	0.001 U	0.001 U	0.002 U	0.001 U	0.002 U	0.005 U	-	-	-	-	-	-	-	-

AWQC = Ambient Water Quality Criteria
bgs = below ground surface
EPA = U.S. Environmental Protection Agency
J = estimated concentration

1 = Reference Level is lowest of EPA AWQC for aquatic life protection, AWQC for human consumption of organisms only, or DEQ SLV for aquatic receptors
2 = Ambient Water Quality Criteria (EPA 822-R-02-047, November 2002) (AWQC) based on human consumption of organisms only
3 = AWQC based on Freshwater Aquatic Life Protection, CCC Values
4 = DEQ Level II Ecological Screening Level Values (SLVs) for aquatic receptors (December 2001)
Bold = Concentration exceeds Reference Level

Table 5 - Summary of Analytical Results for Groundwater Samples
August 2004 Sampling Event

Well Number	HAI Sample Number[1]	Sample Date	Analytical Results																					
			EPA Method 8021 or 8260B ug/l (ppb)					EPA Method 8260B ug/l (ppb)							EPA Method 9010A	EPA Method 9012A	Total (Unfiltered) Metals by EPA Method 6010B or 6020B						EPA Method 8270-SIM ug/l (ppb)	
			Select Aromatic VOCs (AVOCs)					Select Halogenated VOCs (HVOCs)							mg/l (ppm)	mg/l (ppm)	mg/l (ppm)							
			Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	1,1-DCE	CIS-1,2-DCE	trans-1,2-DCE	TCE	PCE	chloroethane	Vinyl Chloride	Amenable Cyanide	Total Cyanide	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Carcinogenic PAHs	Total PAHs
Ambient Water Quality Criteria (AWQC) for Surface Water[2]			51.[4]	200,000.[4]	29,000.[4]	#	#	100.	100.	100.	100.	100.	100.	100.	#	620.[4]	0.00014[4]	0.011[3]	0.009[3]	0.0025[3]	0.052[4]	0.120[3]	#	#
MW-1-22	2708-040825-MW1-22-019	25-Aug-04	4.66	5.87	6.59	46.3	63.42	-	-	-	-	-	-	-	1.89	4.31	**0.00302**	**0.0315**	ND>0.00200	**0.0182**	**0.168**	**0.23**	0.26	589.25
MW-2-32	2708-040816-MW2-32-009	16-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.0285	0.0835	**0.00108**	ND>0.0010	ND>0.0020	ND>0.0010	0.00621	ND>0.0050	ND	ND
MW-2-61	2708-040813-MW2-61-002	13-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.09	0.82	**0.0016**	0.0017	ND>.00200	ND>.00100	0.0105	ND>.00500	ND	ND
MW-3-26	2708-040823-MW3-26-010	23-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.18	0.18	ND>0.0010	ND>0.0010	ND>.00200	ND>.00100	**0.0983**	0.0069	ND	ND
MW-3-56	2708-040823-MW3-56-011	23-Aug-04	10.6	ND>1.00	ND>1.00	ND>1.00	10.6	ND>1.00	ND>1.00	ND>1.00	ND>1.00	ND>1.00	ND>1.00	ND>1.00	0.03	0.03	**0.0035**	0.0018	ND>.00200	ND>.00100	0.0042	ND>.00500	ND	56.64
MW-4-35	2708-040823-MW4-35-012	23-Aug-04	1.61	ND>0.500	ND>0.500	1.65	3.26	-	-	-	-	-	-	-	0.1	0.18	**0.0067**	ND>0.0010	ND>.00200	ND>0.0010	0.0073	ND>.00500	ND	65.33
MW-4-57	2708-040824-MW4-57-018	24-Aug-04	15,000.	ND>100	748.	122.	15,870.	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	0.26	1.76	**0.0126**	0.0011	ND>.00200	ND>0.0010	0.0079	ND>.00500	1.21	3,822.66
MW-4-101	2708-040816-MW4-101-007	16-Aug-04	513.	ND>2.5	3.14	ND>5.00	516.14	-	-	-	-	-	-	-	0.005	0.005	**0.0142**	ND>0.0010	ND>0.0020	ND>0.0010	ND>0.0020	ND>0.0050	ND	26.74
MW-5-32	2708-040816-MW5-32-008	16-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.175	0.521	ND>0.0010	ND>0.0010	ND>0.0020	ND>0.0010	0.00359	ND>0.0050	ND	0.27
MW-5-100	2708-040824-MW5-100-015	24-Aug-04	11,500.	ND>100	683.	253.	12,436.	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	ND>100	0.3	0.82	**0.0087**	ND>0.0010	ND>0.0020	ND>0.0010	0.002	ND>0.0050	ND	11,921.9
MW-5-175	2708-040824-MW5-175-013	24-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.01	0.01	**0.0062**	0.0012	ND>0.0020	ND>0.0010	0.0031	ND>0.0050	ND	ND
MW-8-29	2708-040825-MW8-29-022	25-Aug-04	85.9	13.4	14.3	29.1	142.7	-	-	-	-	-	-	-	0.138	2.69	**0.00243**	0.0066	ND>0.00200	ND>0.00100	0.0113	ND>0.00500	38.52	3,072.45
MW-8-56	2708-040825-MW8-56-021	25-Aug-04	20,300.	248.	795.	831.	22,174.	-	-	-	-	-	-	-	0.153	0.474	**0.00766**	0.0072	ND>0.00200	ND>0.00100	0.0076	0.00535	ND	10,832.7
MW-9-29	2708-040812-MW9-29-001	12-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.01	0.01	**0.002**	0.0014	ND>.00200	ND>.00100	0.0027	ND>.00500	ND	ND
MW-10-61	2708-040813-MW10-61-005	13-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.03	0.06	**0.0023**	0.0036	0.0041	ND>.00100	0.013	0.0183	0.1	0.53
MW-12-36	2708-040825-MW12-36-017	25-Aug-04	235.	584.	458.	991.	2,298.	-	-	-	-	-	-	-	ND>.00500	ND>.00500	**0.0297**	ND>0.00100	ND>0.00200	ND>0.00100	ND>0.00200	ND>0.00500	ND	696.31
MW-13-30	2708-040825-MW13-30-018	25-Aug-04	1,150.	8.25	120.	75.6	1,353.65	-	-	-	-	-	-	-	0.055	0.1	**0.0144**	ND>0.00100	ND>0.00200	ND>0.00100	ND>0.00200	ND>0.00500	ND	354.41
MW-13-61	2708-040813-MW13-61-003	13-Aug-04	2.19	ND>0.500	ND>0.500	ND>1.00	2.19	-	-	-	-	-	-	-	0.04	0.13	**0.0077**	0.0018	0.0024	ND>.00100	0.0138	0.0061	ND	0.28
MW-14-110	2708-040824-MW14-110-014	24-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	0.02	0.02	**0.0114**	ND>0.0010	ND>0.0020	ND>0.0010	0.0028	ND>.00500	ND	0.08
MW-15-50	2708-040825-MW15-50-020	25-Aug-04	40,500.	ND>250	288.	764.	41,552.	-	-	-	-	-	-	-	0.418	0.48	**0.0172**	0.00141	0.00285	ND>0.00100	0.00529	ND>0.00500	ND	6,268.1
MW-15-66	2708-040813-MW15-66-006	13-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND	-	-	-	-	-	-	-	ND>.00500	ND>.00500	**0.0048**	0.0027	0.003	ND>.00100	0.0055	0.00895	ND	ND
MW-16-45	2708-040826-MW16-45-028	26-Aug-04	2,880.	959.	460.	867.	5,166.	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50.0	ND>50	0.0725	0.138	**0.0092**	**0.0138**	0.00473	0.00138	**0.131**	0.011	10.77	7,946.17
MW-16-65	2708-040826-MW16-65-026	26-Aug-04	1,370.	388.	236.	552.	2,546.	ND>50	ND>50	ND>50	ND>50	ND>50	ND>50.0	ND>50	0.186	0.402	**0.00173**	0.00137	0.00201	ND>0.00100	0.0197	0.00782	0.54	3,838.12
	2708-040826-MW16-65-027	26-Aug-04	1,250.	339.	223.	486.	2,298.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.76	4,098.68
MW-16-125	2708-040826-MW16-125-025	26-Aug-04	ND>1.00	ND>1.00	ND>1.00	ND>2.00	ND	ND>1.00	ND>1.00	ND>1.00	ND>1.00	ND>1.00	1.17	ND>1.00	0.0747	0.0943	**0.00481**	0.00134	ND>0.00200	ND>0.00100	0.00542	ND>0.00500	ND	38.88

Note:
# = Reference Level not established
AWQC = Ambient Water Quality Criteria
Bold = Detected above Reference Level
BTEX = benzene, toluene, ethylbenzene, and xylenes

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

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

1 = Sample Prefix: 2708-03
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA-822-R-02-047, November 2002) based on Freshwater Chronic (Aquatic Life Protection) and Fish Consumption (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC, November 2002 revision
4 = Reference Level based on Human Fish Consumption Criteria of AWQC, November 2002 revision

Table 6 - Summary of Analytical Results for Groundwater Samples: PAHs
August 2004 Sampling Event

Well Number	HAI Sample Number [1]	Sample Date	PAHs by EPA Method 8270-SIM Analytical Results ug/l (ppb)																	
			Carcinogenic PAHs							Non-carcinogenic PAHs										
			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 PAHs
Ambient Water Quality Criteria (AWQC) for Surface Water [2]			0.018[4]	0.018[4]	0.018[4]	0.018[4]	0.018[4]	0.018[4]	0.018[4]	990.[3]	#	40,000[4]	#	140.[4]	5,300.[4]	620.[3]	#	4,000.[4]	#	#
MW-1-22	2708-040825-MW1-22-019	25-Aug-04	0.130 J	ND>0.100	ND>0.100	ND>0.100	0.131 J	ND>0.200	ND>0.100	50.	ND>0.5	7.	ND>0.5	2.61	46.9	403.	77.4	2.34	0.26	589.25
MW-2-32	2708-040815-MW2-32-009	16-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND	ND
MW-2-61	2708-040813-MW2-61-002	13-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND	ND
MW-3-26	2708-040823-MW3-26-010	23-Aug-04	ND>0.050	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND	ND
MW-3-56	2708-040823-MW3-56-011	23-Aug-04	ND>0.50	ND>0.50	ND>0.50	ND>0.50	ND>0.50	ND>1.00	ND>0.50	25.8	0.500 J	2.29	ND>0.500	6.75	10.2	0.554 J	3.94	6.62	ND	56.64
MW-4-35	2708-040823-MW4-35-012	23-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>0.500	ND>0.500	ND>1.0	ND>0.500	32.6	1.39	1.02	ND>0.500	7.46	11.4	1.44	2.46	7.36	ND	65.33
MW-4-57	2708-040815-MW4-57-018	16-Aug-04	0.275	0.168 J	0.167 J	0.207	0.275	ND>0.2	0.113 J	42.1	ND>5.0	ND>5.0	ND>5.0	ND>5.0	ND>5.0	3,780.	ND>5.0	ND>5.0	1.21	3,822.66
MW-4-101	2708-040816-MW4-101-007	16-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	0.541	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	26.2	ND>0.100	ND>0.100	ND	26.74
MW-5-32	2708-040815-MW5-32-008	16-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	0.269	ND	0.27
MW-5-100	2708-040824-MW5-100-015	24-Aug-04	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>2.5	21.9	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>2.5	11,900.	ND>2.5	ND>2.5	ND	11,921.9
MW-5-175	2708-040824-MW5-175-013	24-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND	ND
MW-8-29	2708-040825-MW8-29-022	25-Aug-04	7.49	4.95	4.34	8.19	9.56	ND>1.00	4.99	234.	2.82	16.1	8.01	27.8	56.6	2,520.	136.	34.6	38.52	3,072.45
MW-8-56	2708-040825-MW8-56-021	25-Aug-04	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>5.0	ND>2.5	165.	57.2	11.7	ND>2.5	14.7	59.8	10,400.	108.	16.3	ND	10,832.7
MW-9-29	2708-040812-MW9-29-001	12-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND	ND
MW-10-61	2708-040813-MW10-61-005	13-Aug-04	ND>0.100	ND>0.100	ND>0.100	0.104	ND>0.100	ND>0.200	ND>0.100	ND>0.100	ND>0.100	ND>0.100	0.11	0.14	ND>0.100	ND>0.100	ND>0.100	0.18	0.1	0.53
MW-12-36	2708-040825-MW12-36-017	25-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND>0.500	62.	ND>1.00	2.66	ND>0.500	6.34	29.6	554.	36.2	5.51	ND	696.31
MW-13-30	2708-040825-MW13-30-018	25-Aug-04	ND>0.500	ND>0.500	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND>0.500	171.	ND>1.50	6.48	ND>0.500	2.94	35.9	78.6	57.1	2.41	ND	354.41
MW-13-61	2708-040813-MW13-61-003	13-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	0.115	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	0.168	ND>0.100	ND>0.100	ND	0.28
MW-14-110	2708-040824-MW14-110-014	24-Aug-04	ND>0.050	ND>0.050	ND>0.050	ND>0.050	ND>0.050	ND>0.100	ND>0.050	0.0828 J	ND>0.050	ND>0.050	ND>0.050	ND>0.050	ND>0.050	ND>0.050	ND>0.050	ND>0.050	ND	0.08
MW-15-50	2708-040825-MW15-50-020	25-Aug-04	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>2.5	ND>5.0	ND>2.5	35.3	50.9	4.23 J	ND>5.0	4.44 J	51.9	6,130.	3.93 J	ND>5.00	ND	6,255.1
MW-15-66	2708-040813-MW15-66-006	13-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND	ND
MW-16-45	2708-040826-MW16-45-025	26-Aug-04	2.04	2.57	ND>1.25	2.23 J	3.33	ND>2.5	ND>1.25	137.	17.8 J	22.4	ND>10.0	19.6 J	60.7	7,500.	154.	23.9	10.77	7,946.17
MW-16-65-026	2708-040826-MW16-65-026	26-Aug-04	9.34	ND>0.200	ND>0.200	ND>0.2	0.3	ND>0.400	ND>0.200	91.	ND>10.0	10.3	ND>5.0	5.54 J	42.8	3,600.	61.1	6.84 J	0.54	3,835.12
MW-16-65-027	2708-040826-MW16-65-027	26-Aug-04	9.34	ND>0.250	ND>0.250	ND>0.250	0.41	ND>0.500	ND>0.250	85.6	ND>10.0	10.3	ND>5.0	5.62 J	39.5	3,870.	60.2	6.70 J	0.76	4,096.68
MW-16-125	2708-040826-MW16-125-025	26-Aug-04	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.100	ND>0.200	ND>0.100	1.74	ND>0.500	0.676 J	ND>0.500	0.62	1.14	26.5	5.39	0.816 J	ND	36.88

Note: Bold = detected above Reference Level
ND = not detected above detection limit indicated

PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion

ug/l = micrograms per liter

1 = Sample Prefix: 2708-03
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA-822-R-02-047, November 2002) based on Freshwater Chronic (Aquatic Life Protection) and Fish Consumption (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC, November 2002 revision
4 = Reference Level based on Human Fish Consumption Criteria of AWQC, November 2002 revision
J = Estimated concentration between method detection limit and method reporting level

Table 7 - Summary of Analytical Results for Groundwater Samples: SVOCs
August 2004 Sampling Event

Well Number	HAI Sample Number [1]	Sample Date	SVOCs by EPA Method 8270C Analytical Results ug/l (ppb)				
			Carbazole	4-Chloro-3-methylphenol	Dibenzofuran	2-Methylnapthalene	PAHs
Ambient Water Quality Criteria (AWQC) for Surface Water [2]			-	-	-	-	See Table 6
MW-3-56	2708-040823-MW3-56-011	23-Aug-04	18.6	ND>5.0	9.27	ND>5.0	See Table 6
MW-4-57	2708-040824-MW4-57-016	24-Aug-04	ND>500	ND>500	ND>500	ND>500	See Table 6
MW-5-100	2708-040824-MW5-100-015	24-Aug-04	ND>500	ND>500	ND>500	ND>500	See Table 6
MW-16-45	2708-040826-MW16-45-028	26-Aug-04	137.	ND>100	ND>100	544.	See Table 6
MW-16-65	2708-040826-MW16-65-026	26-Aug-04	ND>100	ND>100	ND>100	460.	See Table 6
MW-16-125	2708-040826-MW16-125-025	26-Aug-04	ND>5.00	6.27	ND>5.00	6.23	See Table 6

Note: **Bold** = detected above Reference Level
ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppb = parts per billion
SVOCs = semi-volatile organic compound
ug/l = micrograms per liter

1 = Sample Prefix: 2708-03
2 = Reference Level indicated is the lowest guidance value provided in the Ambient Water Quality Criteria (EPA-822-R-02-047, November 2002) based on Freshwater Chronic (Aquatic Life Protection) and Fish Consumption (Human Health Protection)
3 = Reference Level based on Aquatic Fresh Chronic Criteria of AWQC, November 2002 revision
4 = Reference Level based on Human Fish Consumption Criteria of AWQC, November 2002 revision

Table 8 - Summary of Analytical Results for Quality Assurance / Quality Control (QA/QC) Samples
August 2004 Sampling Event

QA/QC Sample Type	HAI Sample Number [1]	Sample Date	Comment	Analytical Results ug/l (ppb)								
				EPA Method 8260B					EPA Method 8270			
				Select Aromatic VOCs (AVOCs)					Polynuclear Aromatic Hydrocarbons (PAHs) [2]			
				Acetone	Benzene	Toluene	Ethyl benzene	Xylenes	Naphthalene	Phenanthrene	All Others	Total PAHs
Equipment Blank	2708-040813-MW7-004	13-Aug-04	DI Water sampled from decontaminated pump after sampling MW-13-61	-	ND>0.500	ND>0.500	ND>0.500	ND>1.00	ND>0.100	ND>0.100	ND	ND
Equipment Blank	2708-040826-MW7-023	26-Aug-04	DI Water sampled from decontaminated pump after sampling MW-8-29	140.	ND>1.00	ND>1.00	ND>1.00	1.67	0.322	0.140	ND	0.462
Equipment Blank	2708-040826-MW7-024	26-Aug-04	DI Water sampled from decontaminated pump after sampling MW1-22	153.	ND>1.00	ND>1.00	ND>1.00	1.71	0.188	ND>0.0500	ND	0.188

Note:
'-' = not analyzed
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
ND = not detected above detection limit indicated

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

1 = Sample Prefix: 2708-03
2 = Only detected compounds shown

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
		EPA PRGs for Industrial Soil [2] ==>			#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
FAMM	B-07	950927-B7-05	27-Sep-95	17.0							ND	ND							
	B-08	950918-B8-04	18-Sep-95	10.0				X		54.	185.	338.49							
		950918-B8-05	18-Sep-95	12.5						15.									
		950918-B8-08	18-Sep-95	18.0							ND	0.243							
	B-10	950925-B10-04	25-Sep-95	17.5							ND	ND	ND>0.3	ND>0.3	ND>0.3	ND>0.3		ND	ND>0.5
	B-47	000829-039	29-Aug-00	0.2							2.39	3.93							
		000829-040	29-Aug-00	0.2 (dup)							0.055	0.055							
		000829-041	29-Aug-00	5.0				X			54.09	105.89	ND>0.0031	ND>0.0031	ND>0.0031	ND>0.00904	ND		
		000829-042	29-Aug-00	11.5				X			213.5	841.	ND>0.00298	ND>0.00298	ND>0.00298	ND>0.00893	ND		
		000829-043	29-Aug-00	11.5 (dup)							875.	2,277.	ND>0.00309	ND>0.00309	ND>0.00309	ND>0.00926	ND		
		000829-045	29-Aug-00	31.0							54.55	181.34	ND>0.00294	0.004	0.017	0.062	0.083		
	B-51	000828-023	28-Aug-00	0.2							9.12	19.055							
		000828-024	28-Aug-00	2.0															
		000828-025	28-Aug-00	8.5															
	B-52	000828-026	28-Aug-00	0.2							7.355	13.55							
		000828-027	28-Aug-00	3.5	X														
		000828-028	28-Aug-00	10.5	X														
		000828-029	28-Aug-00	10.5 (dup)	X														
		950918-B8-06	18-Sep-95	12.5 (dup)						18.									
	GT-1	971117-001	17-Nov-97	3.0							2.24	4.34	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02
		971117-004	17-Nov-97	10.5	X	X			300 [6]	13,400 [6]	ND	6.17	ND>0.025	ND>0.025	0.034	0.13	0.164		ND>0.03 UJ
		971117-006	17-Nov-97	16.0							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
		971117-008	17-Nov-97	20.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
		971117-011	17-Nov-97	35.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
	GT-2	971117-012	17-Nov-97	3.5							ND	0.084	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
		971117-017	17-Nov-97	15.5							ND	ND	0.027	ND>0.025	ND>0.075	ND>0.075	0.027		ND>0.02
		971117-021	17-Nov-97	33.0							ND	ND	ND>0.025 UJ	ND>0.025 UJ	ND>0.075 UJ	ND>0.075 UJ	ND		ND>0.02
	GT-3	971118-023	18-Nov-97	3.0							21.9	43.09	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
		971118-026	18-Nov-97	12.5							ND	0.05	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
		971118-032	18-Nov-97	36.0							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
	GT-4	971118-034	18-Nov-97	13.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02
		971118-038	18-Nov-97	40.5							ND	ND	ND>0.025	ND>0.025	ND>0.075	ND>0.075	ND		ND>0.02

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
			EPA PRGs for Industrial Soil [3] ==>		#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
FAMM (cont.)	MW-13-61	971218-M13-02	18-Dec-97	6.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02
		971218-M13-03	18-Dec-97	10.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02
		971218-M13-04	18-Dec-97	13.5							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02
		971218-M13-05	18-Dec-97	18.0							0.342	1.	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02
		971218-M13-08	18-Dec-97	24.5							ND	ND	0.069	ND>0.025	ND>0.025	ND>0.075	0.069		0.04
		971218-M13-10	18-Dec-97	28.0							ND	0.058							
		971218-M13-11	18-Dec-97	31.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		0.02
		971218-M13-17	18-Dec-97	57.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
	SS-5	981112-SS-05	12-Nov-98	0.2				X			255.3	398.5							1.3
	SS-8	981112-SS-08	12-Nov-98	0.2							1.532	2.568							0.58
	SS-10	981112-SS-10	12-Nov-98	0.2	Prussian Blue			X			16.52	35.28							41.
Office Area	B-38	000828-014	28-Aug-00	0.2							10.39	19.18							
		000828-015	28-Aug-00	2.0				X			4.9	10.4	ND>0.00284	ND>0.00284	ND>0.00284	ND>0.00852	ND		
		000828-016	28-Aug-00	8.5				X			0.395	0.72	ND>0.00305	ND>0.00305	ND>0.00305	ND>0.00915	ND		
	B-39	000828-004	28-Aug-00	0.2							6.49	11.57							
		000828-005	28-Aug-00	3.0							ND	ND	ND>0.00294	ND>0.00294	ND>0.00294	ND>0.00882	ND		
		000828-006	28-Aug-00	9.5							ND	ND	ND>0.00278	ND>0.00278	ND>0.00278	ND>0.00833	ND		
	B-40	000828-010	28-Aug-00	0.2							32.38	56.155							
		000828-011	28-Aug-00	2.5							ND	ND	ND>0.00269	ND>0.00269	ND>0.00269	ND>0.00806	ND		
		000828-012	28-Aug-00	9.5							ND	ND	ND>0.00329	ND>0.00329	ND>0.00329	ND>0.00987	ND		
	B-41	000828-007	28-Aug-00	0.2							14.885	27.285							
		000828-008	28-Aug-00	2.5							12.58	26.43	ND>0.00278	ND>0.00278	ND>0.00278	ND>0.00833	ND		
		000828-009	28-Aug-00	9.5							ND	ND	ND>0.00278	ND>0.00278	ND>0.00278	ND>0.00833	ND		
Retorts / Koppers	B-11	950928-B11-01	28-Sep-95	0.2						1,600. J									
		950928-B11-06	28-Sep-95	12.5	X					1,700. J	3.26	972.87	ND>0.3	ND>0.3	3.4 J	3. J	6.4		
		950928-B11-09	28-Sep-95	23.0							ND	1.051							
	B-13	951006-B13-03	6-Oct-95	10.5	X	X			1,000.	2,700.	3,915.9	29,386.9	28.	ND>20	110.	22.	160.	ND	ND>0.1
		951006-B13-07	6-Oct-95	18.5							ND	ND							
		951006-B13-10	6-Oct-95	24.0					ND>10	ND>5	ND	ND							
	B-14	950928-B14-01	28-Sep-95	0.2															
		950928-B14-02	28-Sep-95	2.5	X					280 J									
		950928-B14-03	28-Sep-95	5.0							ND	ND							
	B-15	951006-B15-05	6-Oct-95	21.0	X				70.	200.	45.9	637.6	7.9	ND>0.3	3.9	2.5	14.3		
		951006-B15-08	6-Oct-95	27.0							0.21	1.791							
	B-17	950929-B17-01	29-Sep-95	3.0							24.07	59.079							
		950929-B17-05	29-Sep-95	16.5	X	X			2400. J	4700. J	114.1	1,814.						ND	
		950929-B17-07	29-Sep-95	23.5							ND	0.888							

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
			EPA PRGs for Industrial Soil [3] ==>		#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
Retorts / Koppers (cont.)	B-18	950919-B18-05	19-Sep-95	12.0	X				3,100.	99.	0.659	59.306	360.	280.	31.	220.	891.	0.36	ND>0.25
		950919-B18-08	19-Sep-95	19.5	X				850.	44.									
		950919-B18-09	19-Sep-95	22.0					24.	380.									
		950919-B18-10	19-Sep-95	24.5							ND	ND							
	B-19	950919-B19-01	19-Sep-95	0.2						68.	324.2	933.22	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	
		950919-B19-03	19-Sep-95	6.5	X	X			1,600.	1,500.	35.76	408.28	41.	120.	39.	160.	360.	ND	
		950919-B19-04	19-Sep-95	10.5	X				3,200. J	1,500. J									
		950919-B19-05	19-Sep-95	12.0					1,900.	6,800.									
		950920-B19-07	20-Sep-95	18.0					130. J	760. J	0.101	80.001							
		950920-B19-08	20-Sep-95	27.0							0.027	1.956							
	B-20	950929-B20-03	29-Sep-95	10.5	X	X			940 J	340. J	244.507	1,092.607	120 J	64.	16.	60.	260.	ND	
		950929-B20-07	29-Sep-95	23.5					220 J	11.	0.255	12.686							
	B-21	951003-B21-04	3-Oct-95	11.5							0.418	7.107							
	B-22	951003-B22-01	3-Oct-95	3.5	X	X				530.									
		951003-B22-05	3-Oct-95	13.5	X						1.727	40.268	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	
		951003-B22-09	3-Oct-95	24.0	X	X				600.	30.23	485.234	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	
		951003-B22-10	3-Oct-95	26.5						12.									
	B-23	951003-B23-02	3-Oct-95	10.5	X				1,300.	930.									0.17
		951003-B23-05	3-Oct-95	18.5	X					16.									
		951003-B23-08	3-Oct-95	26.5	X			X		110.	1.117	76.897	13 J	ND>0.3	ND>0.3	1.3	14.3	ND	
		951003-B23-10	3-Oct-95	31.5	X														
		951003-B23-12	3-Oct-95	34.5							ND	ND	ND>0.3 UJ	ND>0.3 UJ	ND>0.3 UJ	ND>0.3 UJ	ND		
	B-24	951002-B24-03	2-Oct-95	10.5	X		X		1,500.	640.	276.5	1,091.8							
		951002-B24-10	2-Oct-95	29.0							ND	0.14	6.8 J	2.3 J	ND>0.3 UJ	0.34 J	9.44		
	B-25	951002-B25-03	2-Oct-95	12.5	X				120. J	35.	3.328	12.458							
		951002-B25-05	2-Oct-95	20.0							ND	0.45							
	B-27	950920-B27-06	20-Sep-95	13.0	X					8.5									
		950920-B27-08	20-Sep-95	18.0															
		950920-B27-10	20-Sep-95	23.0	X	X			700.	570.	90.5	1,243.4	110.	46.	ND>30	ND>30	156.	ND	
		950920-B27-12	20-Sep-95	28.0					94.	ND>5	9.605	125.405	22.	3.6	ND>0.6	1.2	26.8		
		950920-B27-15	20-Sep-95	35.5							1.211	12.241							
	B-42	000828-020	28-Aug-00	0.2							0.825	1.52							
		000828-021	28-Aug-00	1.0							15.535	29.745	ND>0.00269	ND>0.00269	ND>0.00269	ND>0.00806	ND		
		000828-022	28-Aug-00	7.5							2.	6.315	ND>0.00272	ND>0.00272	ND>0.00272	ND>0.00815	ND		
	B-43	000829-050	29-Aug-00	0.2				pencil pitch			10,340.	16,920.							
		000829-046	29-Aug-00	2.0							6.16	10.835	ND>0.00266	ND>0.00266	ND>0.00266	ND>0.00798	ND		
		000829-047	29-Aug-00	2.0 (dup)							2.8	4.235	ND>0.00269	ND>0.00269	ND>0.00269	ND>0.00806	ND		
		000829-048	29-Aug-00	8.5							843.	1,410.75	ND>0.00275	ND>0.00275	ND>0.00275	ND>0.00824	ND		
		000829-049	29-Aug-00	8.5 (dup)							184.75	316.6	ND>0.00275	ND>0.00275	ND>0.00275	ND>0.00824	ND		

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
		EPA PRGs for Industrial Soil [2] ==>			#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
Retorts / Koppers (cont.)	B-44	000829-052	29-Aug-00	0.2							32.28	99.95							
		000829-051	29-Aug-00	3.5							5.525	8.46	ND>0.00263	ND>0.00263	ND>0.00263	ND>0.00789	ND		
		000829-053	29-Aug-00	10.0	X		X	X			13,770.	62,405.	58.7	9.21	0.792	8.65	75,352.		
	B-45	000829-054	29-Aug-00	0.2							234.25	388.2							
		000829-055	29-Aug-00	2.0							0.06	0.06	ND>0.00333	ND>0.00333	ND>0.00333	ND>0.010	ND		
		000829-056	29-Aug-00	2.0 (dup)							0.085	0.16	ND>0.00333	ND>0.00333	ND>0.00333	ND>0.010	ND		
		000829-057	29-Aug-00	8.5							5.315	8.355	ND>0.00281	ND>0.00281	ND>0.00281	ND>0.00843	ND		
	B-46	000829-058	29-Aug-00	0.2							144.25	240.15							
		000829-059	29-Aug-00	5.0							2.065	3.135	ND>0.00272	ND>0.00272	ND>0.00272	ND>0.00815	ND		
		000829-060	29-Aug-00	10.5	X						0.14	0.36	ND>0.00312	ND>0.00312	ND>0.00312	ND>0.00938	ND		
	MW-06-61	951107-M6-01	7-Nov-95	2.5							ND	ND							
		951107-M6-08	7-Nov-95	30.0	X	X					1,389.	20,614.	67.	ND>30	140.	56.	263.		
		951107-M6-10	7-Nov-95	38.5							0.108	1.819	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		
		951107-M6-11	7-Nov-95	43.0							ND	0.056							
	MW-09-29	951023-M9-01	23-Oct-95	0.2							11.7	21.502							
		951023-M9-04	23-Oct-95	5.0						19.	78.5	163.02	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		518.
		951023-M9-05	23-Oct-95	11.5							0.163	0.521							
	MW-10-61	951108-M10-01	8-Nov-95	0.2							45.	78.741						ND	
		951108-M10-02	8-Nov-95	0.2 (dup)							64.1	106.99							
		951108-M10-09	8-Nov-95	28.0							ND	0.764	43.	3.	0.73	ND>0.3	46.73		
	MW-12-36	951023-M12-01	23-Oct-95	0.2						29. J	65.5	116.21							
		951023-M12-06	23-Oct-95	22.0	X	X			160.	30.	0.27	8.6	ND>3.	8.2	3.5	21.	32.7	ND	
		951023-M12-07	23-Oct-95	26.5							ND	ND							
	M-15	990628-02	28-Jun-99	6.0									ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
	MW-15-66	990628-03	28-Jun-99	9.5									4.8	18.4	111.	289.	423.2		
		990629-12	29-Jun-99	51.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
		990629-16	29-Jun-99	64.0							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
	Dust -1	960212-D1-01	12-Feb-96	N/A							210.8	381.3							
	Dust -2	960227-D2-01	12-Feb-96	N/A				pencil pitch			15,554.	26,919.							
	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							197.25	662.							
	SS-15	000829-064	29-Aug-00	0.2 (dup)							314.5	527.6							

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
			EPA PRGs for Industrial Soil [3] ==>		#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
Spent Oxide	B-01	950921-B1-01	21-Sep-95	0.2					ND>10 UJ	130.	7.17	13.358	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		0.427
		950921-B1-02	21-Sep-95	0.2 (dup)						220.	26.14	55.96							0.382
		950921-B1-05	21-Sep-95	10.5	X			X		640.	336.7	1,279.7							50.7
		950921-B1-06	21-Sep-95	12.0						560.									
		950921-B1-09	21-Sep-95	21.0							0.926	5.026							4.07
	B-02	950927-B2-05	27-Sep-95	16.0				X											4.51
		950927-B2-07	27-Sep-95	20.5															
	B-03	950921-B3-05	21-Sep-95	10.5				X		120.	23.04	49.04	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	7.44
		950921-B3-07	21-Sep-95	15.0						5.9	ND	ND							
		950921-B3-10	21-Sep-95	22.5															3.07
	B-04	950921-B4-05	21-Sep-95	16.5															0.277
	B-05	950928-B5-05	28-Sep-95	15.5						780. J	0.94	3.64							2.67
	B-06	950927-B6-02	27-Sep-95	8.0	X		X			810. J	4,413.	12,486.8							
		950927-B6-03	27-Sep-95	15.5						54. J	40.2	86.45							
	B-36	000828-017	28-Aug-00	0.2							6.59	11.09							
		000828-018	28-Aug-00	3.5							0.515	1.16	ND>0.00294	ND>0.00294	ND>0.00294	ND>0.00882	ND		
		000828-019	28-Aug-00	10.0							0.315	0.635	ND>0.00305	ND>0.00305	ND>0.00305	ND>0.00915	ND		
	B-37	000828-001	28-Aug-00	0.2							36.04	63.655							
		000828-002	28-Aug-00	4.5							1.965	3.705	ND>0.00266	ND>0.00266	ND>0.00266	ND>0.00798	ND		
		000828-003	28-Aug-00	11.0							ND	ND	ND>0.00275	ND>0.00275	ND>0.00275	ND>0.00824	ND		
	MW-01-22	951024-M1-01	24-Oct-95	0.2							3.07	5.78							0.25
		951024-M1-02	24-Oct-95	3.5						460.	8.35	12.84							ND>.5
		951024-M1-06	24-Oct-95	23.5						ND>5	ND	0.461							0.88
	MW-02-32	951106-M2-01	6-Nov-95	0.2							5.2	10.293							0.47
		951106-M2-06	6-Nov-95	24.0						ND>5	0.152	0.432							
	MW-02-61	981007-M2-01	7-Oct-98	2.0							54.3	110.	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
		981007-M2-02	7-Oct-98	5.5							2,299.8	5,425.3	0.03 J	ND>0.025 UJ	ND>0.025 UJ	0.17 J	0.2		61.
		981007-M2-03	7-Oct-98	32.0							ND	0.424	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
	SS-7	981112-SS-07	12-Nov-98	0.2							108.3	183.55							13.
	SS-8	981112-SS-08	12-Nov-98	0.2							ND	ND							ND>0.50
	SS-9	981112-SS-09	12-Nov-98	0.2	Prussian Blue			X			22.4	55.51							56.

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
			EPA PRGs for Industrial Soil [3] ==>		#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
Tar Pond	B-09	950918-B9-02	18-Sep-95	10.0	X		X		1,200.	25.	2,421.5	19,437.5	104.	44.2	78.2	102.6	329.		
		950918-B9-08	18-Sep-95	28.0	X				270.	1,600.									
		950918-B9-09	18-Sep-95	30.5	X						9.48	43.54							
		950918-B9-10	18-Sep-95	34.0							ND	0.464							
	B-26	951003-B26-01	4-Oct-95	0.2							5.13	9.319							
		951003-B26-06	4-Oct-95	20.5	X	X			1,300.	1,600.	861.7	15,529.7	160.	110.	16.	90.	376.	ND	
		951003-B26-13	4-Oct-95	39.5					ND>10	ND>5	ND	1.12							
	B-28	951002-B28-01	2-Oct-95	0.2					ND>10 UJ	35.	45.5	86.836	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	
		951002-B28-02	2-Oct-95	0.2 (dup)							65.5	135.19							
		951002-B28-07	2-Oct-95	15.0	X	X			24 J	200.	167.2	611.5	5.5 J	ND>2	ND>2	2.3	7.8	ND	
		951002-B28-11	2-Oct-95	24.0					ND>10 UJ	ND>5	ND	2.298	0.99 J	ND>0.3 UJ	ND>0.3 UJ	ND>0.3 UJ	0.99		
	B-29	950922-B29-01	22-Sep-95	0.2						190.	138.8	230.07							
		950922-B29-08	22-Sep-95	18.0			X												
		950922-B29-10	22-Sep-95	23.5					ND>10	9.3									
		950922-B29-12	22-Sep-95	28.0	X	X			53.	220.									
		950922-B29-15	22-Sep-95	35.5	X	X			1,600.	4,800.	5,214.1	58,821.7	150.	140.	35.	110.	435.	ND	
		950925-B29-17	25-Sep-95	44.0					ND>10	44.	2.614	16.454							
		950925-B29-18	25-Sep-95	47.0							ND	0.18							
	B-30	950922-B30-01	22-Sep-95	0.2						390.	500.	964.5							
		950922-B30-06	22-Sep-95	11.5	X			X	320.	3,200.	938.7	6,775.7	18.	1.9	12.	20.	51.9	ND	3.03
		950922-B30-08	22-Sep-95	17.0															
		950922-B30-12	22-Sep-95	28.5	X				150.	120.	94.3	853.	17.	ND>3.	2.8	ND>3.	19.8		
		950922-B30-13	22-Sep-95	33.5					12.	ND>5									
	B-31	950925-B31-01	25-Sep-95	0.2					-	240.	22.98	38.148	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND		0.59
		950925-B31-06	25-Sep-95	21.0	X		X	X	250.	2,200.	1,846.1	12,665.7	ND>3	ND>3	9.1	9.6	18.7	ND	
		950925-B31-08	25-Sep-95	24.5					ND>10	34.	2.089	5.494							
		950925-B31-10	25-Sep-95	28.0							ND	ND							
		950925-B31-11	25-Sep-95	28.0 (dup)							ND	ND							
	B-32	951003-B32-01	4-Oct-95	0.2						66 J	34.8	61.21							
		951003-B32-03	4-Oct-95	11.5				X	760.	6,600.	3,158.3	28,772.3							3.02
		951003-B32-15	4-Oct-95	46.5	X	X			1,400.	4,100.	1,728.	21,961.							
		951003-B32-18	4-Oct-95	58.5	X						ND	1.202	0.95 J	ND>0.3 UJ	ND>0.3 UJ	ND>0.3 UJ	0.95		
	B-33	951005-B33-01	5-Oct-95	0.2						170 J	575.3	955.4							
		951005-B33-02	5-Oct-95	3.0						140 J	151.77	37.51							
		951005-B33-03	5-Oct-95	5.5	X		X		430.	2,700.J	1,054.4	8,238.4	47.	22.	29.	28.	126.	ND	3.9
		951005-B33-11	5-Oct-95	38.5	X		X		1,700.	7,600. J									
		951005-B33-14	5-Oct-95	54.0	X		X		36.	230.	3.02	65.04	0.72	0.82	1.	1.1	3.64	ND	
		951006-B33-18	6-Oct-95	69.0							0.525	5.682							

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
			EPA PRGs for Industrial Soil [3] ==>		#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
Tar Pond (cont.)	B-34	950926-B34-01	26-Sep-95	0.2						41 J	49.2	94.09							
		950926-B34-05	26-Sep-95	11.5	X		X		3,400.	4,200. J	1,639.	13,499.							6.48
		950926-B34-12	26-Sep-95	36.5	X	X			1,900.	69.									
	B-35	951005-B35-01	5-Oct-95	0.2						27. J	19.49	38.94	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	
		951005-B35-06	5-Oct-95	22.0	X	X			2,200.	7,700. J	4,013.5	41,601.5							0.67
		951005-B35-10	5-Oct-95	29.0							0.784	9.294							
	B-48	000828-031	28-Aug-00	5.0	X		X	X			2,270.	11,925.	107.	78.1	103.	141.	429.1		
		000828-032	28-Aug-00	9.5	X		X	X			424.5	2,387.	6.8	8.26	15.6	19.8	50.46		
	B-49	000828-036	28-Aug-00	0.2															
		000828-037	28-Aug-00	1.5				X			343.4	562.1	ND>0.00301	ND>0.00301	ND>0.00301	ND>0.00904	ND		
		000828-038	28-Aug-00	8.0	X		X	X			634.	3,992.	1.78	0.895	18.	24.5	45.175		
	B-50	000828-033	28-Aug-00	0.2															
		000828-034	28-Aug-00	1.0	X		X	X			369.5	1,740.5	14.3	5.68	21.2	43.9	85.08		
		000828-035	28-Aug-00	6.0	X		X	X			1,272.5	10,585.5	11.6	ND>3.330	27.2	31.5	70.3		
	B-53	040607-011	7-Jun-04	2.5 - 3.0				X			30.58	56.621	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500		
	B-54	040608-013	8-Jun-04	2.0 - 2.5							1.64	3.06	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500		
		040608-014	8-Jun-04	7.5 - 8.0							107.3	268.6	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500		
	B-55	040607-006	7-Jun-04	2.5 - 3.0			X				5,831.	61,008.	137.[7]	95.6	77.3	92.6	402.5		
	B-56	040601-001	1-Jun-04	2.5 - 3.5							13.4 U	14.	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500		0.435 U
		040601-003	1-Jun-04	11 - 12							170.5	356.9	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500		0.379 U
		040601-004	1-Jun-04	26 - 27							193.1	525.2	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500	ND < 0.0500		
	MW-03-56	951101-M3-10	1-Nov-95	31.0	X						3.718	10.128							
		951101-M3-13	1-Nov-95	38.0							ND	ND							
		951101-M3-17	1-Nov-95	53.5							ND	ND							
		951101-M3-18	1-Nov-95	53.5 (dup)							0.044	0.157							
	MW-04-57	951030-M4-01	30-Oct-95	0.2						57.	114.	195.1						ND	0.8
		951030-M4-06	30-Oct-95	25.5	X						872.	3,281.	ND>0.3	ND>0.3	ND>0.3	ND>0.3	ND	ND	1.3
		951030-M4-15	30-Oct-95	57.0							ND	0.263							
	MW-04-101	981014-M4-01	14-Oct-98	2.0							722.9	976.4	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
		981014-M4-02	14-Oct-98	6.0							0.257	0.367	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
		981014-M4-03	14-Oct-98	10.5							0.77	1.44	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02
	MW-05-32	951027-M5-01	27-Oct-95	0.2							0.817	1.43							
		951027-M5-05	27-Oct-95	15.5					ND>10 UJ	350. J	810.	1,942.1							
		951027-M5-07	27-Oct-95	21.5							0.242	0.908							
		951027-M5-10	27-Oct-95	31.5							ND	ND							
	MW-05-175	981019-M5-01	19-Oct-98	5.0							63.2	112.35	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
		981019-M5-02	19-Oct-98	5.0 (dup)							19.53	87.21	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		
		981019-M5-03	19-Oct-98	9.5							ND	ND	ND>0.025	ND>0.025	ND>0.025	ND>0.075	ND		ND>0.02
		981020-M5-09	20-Oct-98	71.0							ND	ND							

TABLE 9 – Summary of Analytical Results for Soil Samples
TPH, BTEX, Total PAHs, Total Phenols, and Cyanide

Study Area	Soil Boring Number	Sample Number[1]	Sample Date	Depth (feet bgs)	Field Observation				Analytical Results mg/kg (ppm)										
									DEQ Method		EPA Method 8270 SIM		EPA Method 8020					EPA Method 8270	EPA Method 9010
									TPH-G	418.1M									
					Sheen	Oil	Tar	Carbon Pitch (lampblack or pencil pitch)	Gasoline	Diesel/Oil	Carcinogenic PAHs	Total PAHs	Benzene	Toluene	Ethyl benzene	Xylenes	Total BTEX	Total Phenols	Total Cyanide
EPA PRGs for Industrial Soil [3] ==>					#	#	#	#	#	#	see Table 5	see Table 5	1.30	520	20	420	#	see Table 6	12,000
Tar Pond (cont.)	MW-08-56	951025-M8-01	25-Oct-95	0.2							203.4	280.8							0.61
		951025-M8-11	25-Oct-95	44.0	X						0.783	8.063							
		951025-M8-15	25-Oct-95	55.0							ND	0.842							
	M-11	951102-M11-01	2-Nov-95	0.2						14.	67.4	105.83							
		951102-M11-09	2-Nov-95	39.0	X						9.723	7.876							
		951102-M11-10	2-Nov-95	43.5							0.966	10.915							
	MW-14-110	981014-M14-01	14-Oct-98	3.5				X			1,610.2	5,876.7	7.6	1.9	10.	19.	38.5		
		981014-M14-02	14-Oct-98	6.0				X			632.4	1,697.2	2.3	ND>1.25	5.2	7.7	15.2		
		981014-M14-03	14-Oct-98	10.0		X					389.8	1,410.1	0.3	0.6	5.	6.4	12.3		1.1
		981014-M14-07	14-Oct-98	43.5							1.55	10.83	ND>0.025 UJ	ND>0.025 UJ	ND>0.025 UJ	ND>0.025 UJ	ND		
		981016-M14-13	16-Oct-98	69.5							ND	ND	0.68	ND>0.025	ND>0.025	ND>0.025	0.68		
		981019-M14-20	19-Oct-98	108.0							ND	ND							
	SS-1	981112-SS-01	12-Nov-98	0.2							1.898	3.222							0.68
	SS-2	981112-SS-02	12-Nov-98	0.2							6.61	11.598							ND>0.50
	SS-3	981112-SS-03	12-Nov-98	0.2				X			54.5	84.8							0.58
	SS-4	981112-SS-04	12-Nov-98	0.2							12.77	21.202							ND>0.50
	SS-11	981112-SS-11	12-Nov-98	0.2							0.497	0.821							ND>0.50

NOTE:
1 = Sample number prefix: 2708-
2 = Reserved
3 = EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil (Revised 10/1/2002)
4 = Reserved
5 = Reserved
6 = Analyzed via Northwest Methods NW-TPH-G and NW-TPH-Dx
7 = Leachable benzene by TCLP = 4.10 milligrams per liter
J indicates an estimated value (validation qualifier)

# = not established
BTEX = benzene, toluene, ethylbenzene, and xylenes
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
U = not detected above concentration indicated

ND = not detected above detection limit indicated
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
TPH = total petroleum hydrocarbons
BOLD = Detected above Reference Level

Table 10 – 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	Dibenz (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 PAHs
		EPA PRGs for Industrial Soil[3] ==>			2.1	2.1	21.	0.21	210.	0.21	2.1	29,000.	#	100,000.	#	22,000.	26,000.	190.	#	29,000.	#	#
FAMM	B-07	950927-B7-05	27-Sep-95	17.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND
	B-08	950918-B8-04	18-Sep-95	10.0	18.	40.	12.	47.	24.	6.	38.	0.48	4.	2.6	56.	26.	0.71	2.3	7.2	52.	185.	153.49
		950918-B8-08	18-Sep-95	18.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.18 J	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.063 J	ND * UJ	ND * UJ	ND * UJ	ND	0.243
	B-10	950925-B10-04	25-Sep-95	17.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	B-47	000829-039	29-Aug-00	0.2	0.3	0.445	0.315 J	0.445	0.365	0.135	0.385	ND *	ND *	ND *	0.48	0.455	ND *	ND *	0.18	0.425	2.39	1.54
		000829-040	29-Aug-00	0.2 (dup)	ND *	ND *	0.055 J	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.055	ND
		000829-041	29-Aug-00	6.0	8.7	8.45	7.85	11.4	9.45	1.14	7.1	1.65	ND *	2.14	8.05	15.6	0.675	0.085	8.5	15.1	54.09	51.8
		000829-042	29-Aug-00	11.5	42. J	27.5 J	29. J	40. J	45.5 J	8. J	21.5 J	58.5	ND <5,000	76.5	23.5 J	136.	42.	12. J	166.	112.	213.5	827.5
		000829-043	29-Aug-00	11.5 (dup)	148. J	132. J	127. J	176. J	156. J	38. J	108. J	100.	ND <5,000	108.	120. J	306.	69.	87. J	332.	280.	875.	1,402.
		000829-045	29-Aug-00	31.0	8.2	7.65	6.85	12.	10.1	1.6	8.15	9.95	1.75	6.25	10.8	25.8	4.94	14.2	24.7	28.4	54.55	126.79
	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	0.175	ND *	1.82	2.78	0.065	0.425	2.02	2.59	9.12	9.935
		000828-024	28-Aug-00	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		000828-025	28-Aug-00	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-52	000828-026	28-Aug-00	0.2	0.85	1.35	0.97	1.52	1.5	0.245	0.92	ND *	0.13	0.32	1.14	1.61	ND *	0.23	0.825	1.94	7.355	6.196
		000828-027	28-Aug-00	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		000828-028	28-Aug-00	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		000828-029	28-Aug-00	10.5 (dup)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	GT-1	971117-001	17-Nov-97	3.0	0.27	0.5	0.16	0.58	0.25	ND *	0.46	ND *	ND *	ND *	1.	0.38	ND * UJ	ND *	0.06 J	0.66 J	2.24	2.1
		971117-004	17-Nov-97	10.5	ND f	ND f	ND f	ND f	ND f	ND f	ND f	1.4	ND f	0.97	ND f	ND f	2.1	ND f	ND f	1.7	ND	6.17
		971117-006	17-Nov-97	18.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971117-008	17-Nov-97	20.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971117-011	17-Nov-97	35.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	GT-2	971117-012	17-Nov-97	3.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.084	ND *	ND *	ND *	ND *	ND *	ND	0.084
		971117-017	17-Nov-97	15.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971117-021	17-Nov-97	33.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	GT-3	971118-023	18-Nov-97	3.0	2.2	3.3	8.4	3.8	1.8	ND *	2.4	0.33	0.29	0.11	4.1	7.5	ND *	0.14	0.12	8.6	21.9	21.19
		971118-029	18-Nov-97	12.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.05	ND *	ND *	ND *	0.049	ND	0.099
		971118-032	18-Nov-97	36.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	GT-4	971118-034	18-Nov-97	13.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971118-038	18-Nov-97	40.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	MW-13	971218-M13-02	18-Dec-97	8.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971218-M13-03	18-Dec-97	10.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971218-M13-04	18-Dec-97	13.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971218-M13-05	18-Dec-97	18.0	0.09	0.071	ND *	0.061	0.12	ND *	ND *	ND *	ND *	ND *	ND *	0.16	ND *	0.23	0.093	0.17	0.342	0.653
		971218-M13-08	18-Dec-97	24.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971218-M13-10	18-Dec-97	28.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.058	ND *	ND	0.058
		971218-M13-11	18-Dec-97	31.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		971218-M13-17	18-Dec-97	57.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	SS-05	981112-SS-05	12-Nov-98	0.2	21.9	60.9	17.	69.1	29.7	9.4	47.3	0.59	11.1	2.	69.9	16.1	0.61	5.	4.7	33.2	255.3	143.2
	SS-06	981112-SS-06	12-Nov-98	0.2	0.13	0.37	0.11	0.36	0.15	0.062	0.35	ND*	0.078	ND*	0.55	0.15	ND*	ND*	0.058	0.2	1.532	1.036
	SS-10	981112-SS-10	12-Nov-98	0.2	2.6	6.6	1.8	ND*	3.5	0.52	2.5	0.14	0.31	0.36	3.1	5.	0.12	0.23	2.7	6.8	16.52	18.76

Table 10 – 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	Dibenz (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 PAHs
EPA PRGs for Industrial Soil [2] ==>					2.1	2.1	21.	0.21	210.	0.21	2.1	29,000.	#	100,000.	#	22,000.	26,000.	190.	#	29,000.	#	#
Office Area	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	ND *	ND *	1.93	2.94	ND *	ND *	1.11	2.68	10.39	8.79
		000828-015	28-Aug-00	2.0	1.15	1.55	ND *	0.85	0.8	ND *	0.55	ND *	ND *	ND *	0.65	1.15	ND *	ND *	1.85	1.85	4.9	5.5
		000828-016	28-Aug-00	8.5	0.095	0.135	ND *	ND *	0.09	0.075	ND *	ND *	ND *	ND *	ND *	0.09	ND *	ND *	0.135	0.1	0.395	0.325
	B-39	000828-004	28-Aug-00	0.2	1.	1.16	0.705	1.36	1.13	0.255	0.88	0.085	0.055	ND *	1.02	1.62	ND *	0.08	0.52	1.72	6.49	5.08
		000828-005	28-Aug-00	3.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		000828-006	28-Aug-00	9.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	B-40	000828-010	28-Aug-00	0.2	4.88	5.45	4.14	6.5	5.2	1.47	4.76	0.36	0.065	0.56	5.8	7.05	0.14	ND *	3.	6.8	32.38	23.775
		000828-011	28-Aug-00	2.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		000828-012	28-Aug-00	9.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	B-41	000828-007	28-Aug-00	0.2	2.16	2.64	1.74	3.1	2.43	0.595	2.22	0.165	0.17	ND *	2.56	3.66	0.07	0.075	1.68	3.82	14.885	12.4
		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	0.41	2.09	3.26	ND>0.1	0.24	2.26	5.2	12.58	13.85
		000828-009	28-Aug-00	9.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
Retorts / Koppers	B-11	950928-B11-06	28-Sep-95	12.5	0.83	0.5	ND *	0.53	1.4	ND *	ND *	7.8	0.61	2.7	ND *	4.2	6.7	915.	25.2	7.4	3.26	969.61
		950928-B11-09	28-Sep-95	23.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.071 J	ND * UJ	0.094 J	ND * UJ	0.17 J	0.076 J	ND * UJ	0.35 J	0.29 J	ND	1.051
	B-13	951006-B13-03	6-Oct-95	10.5	564.	752.	238.	942.	811.	69.9	519.	1,630.	155.	578.	747.	2,350.	481.	13,000.	2,950.	3,580.	3,915.9	25,471.
		951006-B13-07	6-Oct-95	18.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		951006-B13-10	6-Oct-95	24.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND * UJ	ND *	ND *	ND * UJ	ND *	ND	ND
	B-14	950928-B14-03	28-Sep-95	5.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND
	B-15	951006-B15-05	6-Oct-95	21.0	8.8	9.7	3.2	9.3	9.7	1.	6.2	16.1	4.1	6.6	9.	27.7	6.9	460.	60.	41.3	45.9	591.7
		951006-B15-08	6-Oct-95	27.0	ND *	0.05	0.16	ND *	ND *	ND *	ND *	ND *	0.053	0.13	ND *	0.24 J	0.038	0.13	0.59 J	0.4	0.21	1.581
	B-17	950929-B17-01	29-Sep-95	3.0	3.5 J	5.6 J	1.3 J	5.7 J	3.6 J	0.67 J	3.7 J	0.026 J	0.22 J	0.92 J	5.3 J	10.5 J	0.15 J	0.093 J	4. J	13.8 J	24.07	35.009
		950929-B17-05	29-Sep-95	16.5	28.	15.	5.6	16.	44.	1.1	4.2	161.	10.	111.	5.9	114.	119.	478.	477.	224.	114.1	1,699.9
		950929-B17-07	29-Sep-95	23.5	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.078 J	ND * UJ	0.086 J	ND * UJ	0.072 J	0.062 J	0.16 J	0.32 J	0.11 J	ND	0.888
	B-18	950919-B18-05	19-Sep-95	12.0	0.17	0.09	0.032	0.074	0.26	ND *	0.033	1.9	0.16	0.44	0.047	1.1	1.8	44.8	6.7	1.7	0.659	58.647
		950919-B18-10	19-Sep-95	24.5	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND
	B-19	950919-B19-01	19-Sep-95	0.2	53.1	57.8	29.8	61.	71.4	10.	41.5	6.8	0.52	212.	46.	115.	20.1	2.9	91.7	114.	324.2	609.02
		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
		950920-B19-07	20-Sep-95	18.0	0.054 J	ND * UJ	0.047 J	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.5 J	0.17 J	ND * UJ	ND * UJ	0.18 J	0.77 J	78.3 J	1.7 J	0.28 J	0.101	79.9
		950929-B19-08	20-Sep-95	27.0	0.027 J	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.081 J	ND * UJ	0.081 J	ND * UJ	0.13 J	0.097 J	1.1 J	0.3 J	0.14 J	0.027	1.929
	B-20	950929-B20-03	29-Sep-95	10.5	40.4	44.5	19.	45.	67.1	4.707	23.8	35.6	9.4	122.	29.3	113.	57.6	27.8	239.	214.	244.507	848.1
		950929-B20-07	29-Sep-95	23.5	0.048 J	0.06 J	ND * UJ	0.053 J	0.054 J	ND * UJ	0.04 J	0.068 J	0.095 J	0.063 J	0.055 J	0.18 J	0.11 J	11.2 J	0.36 J	0.3 J	0.255	12.431
	B-21	951003-B21-04	3-Oct-95	11.5	0.12 J	0.079 J	0.079 J	ND * UJ	0.14 J	ND * UJ	ND * UJ	1.3 J	0.44 J	0.2 J	ND * UJ	0.59 J	0.089 J	0.71 J	2.5 J	0.86 J	0.416	6.689
	B-22	951003-B22-05	3-Oct-95	13.5	0.63	0.19	0.12	0.15	0.58	ND *	0.057	9.4	0.078	1.2	0.055	5.3	5.7	0.31	12.2	4.3	1.727	38.541
		951003-B22-09	3-Oct-95	24.0	9.2	4.	1.7	2.6	12.	0.15	0.58	78.8	0.504	17.6	0.49	65.4	59.9	0.41	160.2	71.7	30.23	455.004
	B-23	951003-B23-08	3-Oct-95	26.5	0.2	0.19	0.097	0.2	0.27	ND *	0.16	0.87	1.2	0.52	0.19	1.4	3.	58.8	8.2	1.6	1.117	75.78
		951003-B23-12	3-Oct-95	34.5	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND
	B-24	951002-B24-03	2-Oct-95	10.5	41.9	53.2	21.3	59.5	64.1	8.5	31.	52.4	7.5	34.9	42.	132.	28.5	115.	186.	217.	276.5	815.3
		951002-B24-10	2-Oct-95	29.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.14 J	ND * UJ	ND * UJ	ND	0.14

Table 10 – 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	Dibenz (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 PAHs
		EPA PRGs for Industrial Soil[3] ==>			2.1	2.1	21.	0.21	210.	0.21	2.1	29,000.	#	100,000.	#	22,000.	26,000.	190.	#	29,000.	#	#
Retorts / Koppers (cont.)	B-25	951002-B25-03	2-Oct-95	12.5	0.41	0.71	0.25	0.78	0.6	0.078	0.5	0.41	0.15	0.29	0.75	1.2	0.53	1.2	2.5	2.1	3.328	9.13
		951002-B25-05	2-Oct-95	20.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.45 J	ND * UJ	ND * UJ	ND	0.45
	B-27	950920-B27-10	20-Sep-95	23.0	17.2	18.3	6.2	18.3	21.	1.9	9.6	53.	32.6	21.9	13.6	79.1	45.7	586.	208.	113.	90.5	1,152.9
		950920-B27-12	20-Sep-95	28.0	1.9	1.6	0.78	1.7	2.6	0.11	0.915	8.6	2.	3.1	1.3	9.9	6.5	44.7	26.4	13.3	9.605	116.8
		950920-B27-15	20-Sep-95	35.5	0.31 J	0.26 J	0.091 J	0.16 J	0.28 J	ND * UJ	0.11 J	1.1 J	0.14 J	0.36 J	0.15 J	1.3 J	0.88 J	1.8 J	3.5 J	1.8 J	1.211	11.03
	B-42	000828-020	28-Aug-00	0.2	0.12	0.135	0.17	0.165	0.16	ND *	0.055	ND *	ND *	ND *	0.18	0.205	ND *	ND *	0.115	0.195	0.825	0.695
		000828-021	28-Aug-00	1.0	2.47	2.47	1.83	3.26	2.68	0.605	2.22	0.22	ND *	ND *	2.77	4.86	0.08	0.18	1.98	4.12	15.535	14.21
		000828-022	28-Aug-00	7.5	0.255	0.275	0.21	0.405	0.37	0.09	0.395	ND *	0.26	ND *	0.675	0.64	0.085	0.58	1.36	0.715	2.	4.315
	B-43	000829-050	29-Aug-00	0.2	1,490.	1,760.	1,460.	2,020.	1,650.	500.	1,460.	110.	ND >5	139.	1,600.	1,980.	55.	11.	825.	1,860.	10,340.	6,580.
		000829-046	29-Aug-00	2.0	0.355	0.95	0.565	1.26	0.595	0.345	2.09	ND *	0.165	ND *	3.26 J	0.49 J	ND *	0.1	0.105	0.535 J	6.16	4.675
		000829-047	29-Aug-00	2.0 (dup)	0.16	0.545	0.315	0.595	0.275	0.16	0.75	ND *	0.11	ND *	1.03 J	0.125 J	ND *	ND *	ND *	0.17 J	2.8	1.435
		000829-048	29-Aug-00	8.5	125. J	148. J	118. J	171. J	138. J	25. J	120. J	10.2 J	ND *	14.2 J	132. J	172. J	5.15 J	1.2	75. J	158. J	843.	567.75
		000829-049	29-Aug-00	8.5 (dup)	27.4 J	35.2 J	28. J	40.4 J	29. J	6.15 J	18.6 J	2.5 J	ND *	4. J	19.8 J	39.2 J	1.15 J	ND *	18.8 J	48.4 J	184.75	131.85
	B-44	000829-052	29-Aug-00	0.2	6.05	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
		000829-051	29-Aug-00	3.5	0.5	1.	0.595	1.32	0.755	0.245	1.11	ND *	0.14	ND *	1.55	0.53	ND *	ND *	ND *	0.715	5.525	2.935
		000829-053	29-Aug-00	10.0	2,450.	1,720.	1,700.	2,780.	2,880.	448.	1,800.	125.	3,480.	2,580.	2,000.	8,000.	1,900.	8,300.	14,000.	8,250.	13,770.	45,635.
	B-45	000829-054	29-Aug-00	0.2	33.6	47.1	36.6	47.	38.5	7.75	23.7	2.15	ND *	4.3	23.3	52.5	1.4	ND *	24.8	45.5	234.25	153.95
		000829-055	29-Aug-00	2.0	ND *	0.06	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.06	ND
		000829-056	29-Aug-00	2.0 (dup)	ND *	0.085	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.075	ND *	ND *	ND *	ND *	0.085	0.075
		000829-057	29-Aug-00	8.5	0.355	0.98	0.635	1.05	0.865	0.23	1.4	ND *	0.21	ND *	1.98	0.36	ND *	ND *	ND *	0.49	5.315	3.04
	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	ND *	2.45	15.1	29.6	0.75	ND *	14.3	32.4	144.25	95.9
		000829-059	29-Aug-00	5.0	0.135	0.365	0.29	0.48	0.19	0.15	0.435	ND *	0.075	ND *	0.825	0.095	ND *	ND *	0.135	0.14	2.065	1.07
		000829-060	29-Aug-00	10.5	ND *	0.09	ND *	ND *	ND *	ND *	0.05	ND *	ND *	ND *	0.085	ND *	ND *	ND *	0.135	ND *	0.14	0.22
	MW-06-61	951107-M6-01	7-Nov-95	2.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		951107-M6-08	7-Nov-95	30.0	340.	170.	120.	190.	450.	25.	94.	2,350.	25.	1,420.	130.	1,900.	990.	3,650.	5,780.	2,980.	1,389.	19,225.
		951107-M6-10	7-Nov-95	38.5	0.042	ND *	ND *	ND *	0.066	ND *	ND *	0.22	ND *	0.18	ND *	0.22	0.095	0.076	0.6	0.34	0.108	1.711
		951107-M6-11	7-Nov-95	43.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.056 J	ND * UJ	ND	0.056
	MW-09-29	951023-M9-01	23-Oct-95	0.2	1.4 J	2.7	0.88	2.5	1.9	0.42	1.9	0.12	0.17	0.31	2.6	2.2	0.055 J	0.087	0.96	3.3	11.7	9.802
		951023-M9-04	23-Oct-95	5.0	7.4 J	19.6	5.	14.4	13.3	2.7	16.1	0.12	1.3	2.	22.6	17.9	0.4 J	1.2	8.8	30.4	76.5	84.52
		951023-M9-05	23-Oct-95	11.5	0.028 J	0.035	ND *	0.032	0.041	ND *	0.027	ND *	ND *	0.03	0.038	0.076	ND * UJ	ND *	0.096	0.12	0.163	0.358
	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	ND *	1.7	6.7	11.	0.23	0.081	3.3	9.9	45.	33.741
		951108-M10-02	8-Nov-95	0.2 (dup)	10.	17.	6.2	14.	7.5	2.2	7.2	1.1	ND *	1.1	9.	14.	0.36	0.13	5.2	12.	64.1	42.69
		951108-M10-09	8-Nov-95	28.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.038	ND *	0.038	ND *	0.078	ND *	0.23	0.22	0.16	ND	0.764
	MW-12-36	951023-M12-01	23-Oct-95	0.2	8.5 J	15.3	5.2	13.3	12.3	2.2	8.7	1.5	0.23	2.	10.8	12.4	0.54 J	0.34	5.8	17.1	65.5	50.71
		951023-M12-06	23-Oct-95	22.0	ND * UJ	ND *	ND *	ND *	0.27	ND *	ND *	0.34	ND *	0.99	ND *	0.97	0.4 J	0.23	4.	1.4	0.27	8.33
		951023-M12-07	23-Oct-95	26.5	ND * UJ	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND * UJ	ND *	ND *	ND *	ND	ND
	MW-15-66	990629-12	29-Jun-99	51.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		990629-16	29-Jun-99	64.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
	Dust -1	960212-D1-01	12-Feb-96	N/A	33.	47.8	17.9	41.4	36.1	7.5	27.3	4.4	1.7	5.6	36.5	53.7	1.9	1.1	23.7	41.9	210.8	170.5
	Dust -2	960227-D2-01	12-Feb-96	N/A	2,600.	3,436.	1,292.	2,915.	2,856.	547.	1,908.	375.	ND>20	444.	2,543.	3,483.	145.	68.	1,501.	2,806.	15,554.	11,365.
	SS-12	000829-061	29-Aug-00	0.2	0.255	0.35	0.29	0.35	0.265	0.09	0.195	ND *	ND *	ND *	0.215	0.375	ND *	ND *	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	ND *	ND *	ND *	0.195	1.04	ND *	ND *	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	ND *	ND *	1.34	2.22	0.05	ND *	0.93	2.04	9.795	6.705
	SS-15	000829-064	29-Aug-00	0.2	40.7	34.4	25.6	23.1	58.5	3.45 J	11.5 J	2.35	2.5	37.2 J	12.	198.	3.2	ND *	57.5	152.	197.25	484.75
		000829-064	29-Aug-00	0.2 (dup)	42.6	60.5	47.4	68.5	49.4	11.4 J	34.7 J	3.1	ND *	5.55 J	33.6	71.5	1.75	ND *	32.4	65.	314.5	213.1

Table 10 – 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	Dibenz (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 PAHs
EPA PRGs for Industrial Soil[1] ==>					2.1	2.1	21.	0.21	210.	0.21	2.1	29,000.	#	100,000.	#	22,000.	26,000.	190.	#	29,000.	#	#
Spent Oxide	B-01	950921-B1-01	21-Sep-95	0.2	1. J	1.6 J	0.52 J	1.5 J	1.4 J	0.22 J	0.93 J	0.14 J	ND*	0.14 J	1.3 J	1.3 J	0.055 J	0.073 J	0.88 J	2.3 J	7.17	6.188
		950921-B1-02	21-Sep-95	0.2	3.7 J	5.6 J	1.7 J	5.2 J	5.6 J	0.84 J	3.5 J	0.51 J	0.41 J	1.1 J	5.1 J	5.7 J	0.34 J	0.46 J	5.6 J	10.4 J	26.14	29.62
		950921-B1-05	21-Sep-95	10.5	45.3	72.3	26.7	55.7	82.6	7.7	46.2	6.1	5.6	21.7	65.6	140.	9.6	313.	142.	239.	336.7	943.
		950921-B1-09	21-Sep-95	21.0	0.19 J	0.21 J	0.056 J	0.17 J	0.19 J	ND* UJ	0.11 J	0.13 J	ND* UJ	0.24 J	0.17 J	0.38 J	0.14 J	0.21 J	2.2 J	0.65 J	0.926	4.1
	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.
		950921-B3-07	21-Sep-95	15.0	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND	ND
	B-05	950926-B5-05	26-Sep-95	15.5	ND* UJ	0.2 J	ND* UJ	0.16 J	ND* UJ	ND* UJ	0.56 J	0.14 J	0.44 J	0.19 J	1.1 J	0.34 J	ND* UJ	ND* UJ	ND* UJ	0.49 J	0.94	2.7
	B-06	950927-B6-02	27-Sep-95	8.0	574.	972.	370.	767.	833.	159.	738.	21.	124.	191.	1,080.	1,880.	73.8	884.	1,180.	2,840.	4,413.	8,073.8
		950927-B6-03	27-Sep-95	15.5	5.7 J	8.6 J	3.5 J	7.1 J	7.6 J	1.1 J	6.4 J	ND>1.0 UJ	0.55 J	2.1 J	9.6 J	10.2 J	ND>1.0 UJ	ND>1.0 UJ	5.5 J	18.3 J	40.2	46.25
	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	ND*	ND*	0.6	1.52	ND*	0.105	0.7	1.47	6.59	4.5
		000828-018	28-Aug-00	3.5	0.07	0.11	0.065	0.1	0.08	ND*	0.09	ND*	ND*	ND*	0.13	0.155	ND*	0.12	0.07	0.17	0.515	0.645
		000828-019	28-Aug-00	10.0	0.09	0.12	ND*	0.05	0.055	ND*	ND*	ND*	ND*	ND*	ND*	0.08	ND*	ND*	0.135	0.105	0.315	0.32
	B-37	000828-001	28-Aug-00	0.2	4.7	6.6	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
		000828-002	28-Aug-00	4.5	0.25	0.33	0.25	0.365	0.3	0.095	0.375	ND*	ND*	ND*	0.475	0.54	ND*	ND*	0.21	0.515	1.965	1.74
		000828-003	28-Aug-00	11.0	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND	ND
	MW-01-22	951024-M1-01	24-Oct-95	0.2	0.41 J	0.65	ND*	0.61	0.54 J	ND*	0.75	ND*	ND*	ND*	1.	0.71	ND*	ND*	ND*	1.	3.07	2.71
		951024-M1-02	24-Oct-95	3.5	0.91 J	1.5	0.74	1.7	1.3 J	0.4	1.8	ND*	ND*	ND*	2.3	0.79	ND*	ND*	ND*	1.4	8.35	4.49
		951024-M1-06	24-Oct-95	23.5	ND* UJ	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	0.19	ND*	0.032	ND*	ND*	0.15	0.089	ND	0.461
	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	ND>0.05	0.053	0.57	1.8	5.2	5.093
		951106-M2-06	6-Nov-95	24.0	0.039	0.036	ND*	0.04	0.037	ND*	ND*	0.2	ND*	ND*	ND*	ND*	ND*	0.08	ND*	ND*	0.152	0.26
	MW-02-51	981007-M2-01	7-Oct-98	2.0	9.7	13.1	ND*	12.8	8.9	1.9	8.	1.3	ND*	2.3	11.3	14.3	ND*	0.6	9.	16.9	54.3	55.7
		981007-M2-02	7-Oct-98	5.5	318.	563.	179.	432.	334.	87.8	389.	ND*	30.4	34.2	490.	591.	12.9	923.	309.	735.	2,299.8	3,125.5
		981007-M2-03	7-Oct-98	32.0	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	0.07	ND*	0.074	ND*	0.28 J	ND*	ND*	ND	0.424
	SS-07	981112-SS-07	12-Nov-98	0.2	12.8	25.	8.9	23.7	14.3	1.9	23.7	0.64	2.6	1.3	22.2	15.	0.41	1.8	6.9	24.2	108.3	75.25
	SS-08	981112-SS-08	12-Nov-98	0.2	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND*	ND	ND
	SS-09	981112-SS-09	12-Nov-98	0.2	3.7	6.6	1.7	3.4	4.3	0.6	2.2	0.38	0.19	1.3	2.5	10.	0.39	0.55	7.	10.8	22.4	33.11
Tar Pond	B-09	950918-B9-02	18-Sep-95	10.0	472.	420.	139.	487.	601.	56.3	246.	556.	457.	603.	344.	1,350.	464.	7,560.	3,410.	2,270.	2,421.5	17,016.
		950918-B9-09	18-Sep-95	30.5	1.6	1.8	0.66	2.1	1.9	0.22	1.2	1.9	0.17	1.3	1.6	4.4	0.99	8.3	7.8	7.4	9.48	34.06
		950918-B9-10	18-Sep-95	34.0	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	0.054 J	ND* UJ	0.08 J	ND* UJ	ND* UJ	0.2 J	0.13 J	ND	0.464
	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	ND*	0.097	0.84	1.5	ND*	ND*	0.48	1.2	5.13	4.189
		951003-B26-06	4-Oct-95	20.5	124.	134.	57.	138.	265.	20.7	123.	608.	449.	1,220.	171.	949.	681.	6,420.	2,630.	1,540.	861.7	14,688.
		951003-B26-13	4-Oct-95	39.5	ND*	ND*	ND*	ND*	ND*	ND*	ND*	0.059	0.046	0.051	ND*	0.066	0.059	0.55	0.19 J	0.099	ND	1.12
	B-28	951002-B28-01	2-Oct-95	0.2	5.1	10.1	4.3	5.6	6.2	1.6	6.6	0.73	0.26 J	4.6	6.2	9.7	0.246	0.3	4.6	12.7	45.6	41.356
		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 J	1.8	12.3	17.3	0.55	0.68	9.2	25.7	65.5	69.69
		951002-B28-07	2-Oct-95	15.0	19.1	33.4	12.6	42.7	30.2	3.6	25.6	23.8	3.7	11.2	39.5	66.1	14.	102.	74.	110.	167.2	444.3
		951002-B28-11	2-Oct-95	24.0	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	0.057 J	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	2.2 J	0.041 J	ND* UJ	ND	2.298
	B-29	950922-B29-01	22-Sep-95	0.2	10.5	31.7	11.8	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
		950922-B29-15	22-Sep-95	35.5	1,540.	758.	368.	571.	1,810.	46.1	181.	9,210.	77.6	1,650.	230.	8,480.	4,530.	7,490.	15,500.	6,530.	5,214.1	53,807.8
		950925-B29-17	25-Sep-95	44.0	0.56 J	0.45 J	0.12 J	0.91 J	0.58 J	0.054 J	0.24 J	1.1 J	0.33 J	1. J	0.3 J	1.6 J	0.64 J	0.77 J	5.1 J	2.8 J	2.614	13.64
		950925-B29-18	25-Sep-95	47.0	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	ND* UJ	0.18 J	ND* UJ	ND* UJ	ND	0.18
	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	133.6	500.	484.5
	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.
		950922-B30-12	22-Sep-95	28.5	14.3	17.4	7.4	22.	19.8	1.8	11.8	15.2	58.8	28.7	17.7	53.3	31.	327.	126.	91.	94.3	758.7

SCOEPA00003818

Table 10 – 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	Dibenz (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 PAHs
		EPA PRGs for Industrial Soil [2] ==>			2.1	2.1	21.	0.21	210.	0.21	2.1	29,000.	#	100,000.	#	22,000.	26,000.	190.	#	26,000.	#	#
Tar Pond (cont.)	B-31	950925-B31-01	25-Sep-95	0.2	2.1	5.4	1.8	4.8	3.	0.99	4.9	0.11	1.3	0.59	0.6	1.6	0.058	0.3	0.71	3.7	22.98	15.168
		950925-B31-06	25-Sep-95	21.0	319.	321.	119.	374.	394.	45.1	274.	1,120.	50.6	473.	364.	1,290.	422.	2,880.	2,620.	1,600.	1,848.1	10,819.6
		950925-B31-08	25-Sep-95	24.5	0.28 J	0.35 J	0.11 J	0.7 J	0.39 J	0.039 J	0.22 J	0.072 J	ND * UJ	0.18 J	0.27 J	0.88 J	0.063 J	ND>0.05 UJ	0.54 J	1.4 J	2.089	3.405
		950925-B31-10	25-Sep-95	28.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND
		950925-B31-11	25-Sep-95	28.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND
	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	0.68	7.4	34.8	26.41
		951004-B32-03	4-Oct-95	11.5	495.	560.	292.	585.	624.	87.3	373.	990.	807.	1,190.	529.	2,050.	610.	11,100.	4,560.	3,580.	3,158.3	25,816.
		951004-B32-15	4-Oct-95	38.5	239.	285.	61.	368.	427.	62.	238.	1,330.	39.	1,280.	354.	1,160.	520.	11,100.	2,440.	1,990.	1,728.	20,233.
		951004-B32-18	4-Oct-95	58.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.064	ND *	0.061	ND *	0.13	0.047	0.38	0.31	0.21	ND	1.202
	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	67.1	575.3	380.1
		951005-B33-02	5-Oct-95	3.0	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
		951005-B33-03	5-Oct-95	5.5	181.	185.	72.1	225.	262.	21.3	108.	369.	133.	263.	152.	527.	266.	3,480.	1,190.	824.	1,054.4	7,184.
		951005-B33-14	5-Oct-95	54.0	ND *	0.57	ND *	0.7	1.1	ND *	ND *	3.4	ND *	2.1	0.62	3.4	1.5	37.	8.6	5.4	2.37	62.02
		951006-B33-18	6-Oct-95	69.0	0.045 J	0.054 J	ND * UJ	0.37 J	0.056 J	ND * UJ	ND * UJ	0.06 J	0.35 J	0.12 J	0.047 J	0.18 J	0.12 J	3.6 J	0.47 J	0.31 J	0.525	5.157
	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
		950926-B34-05	26-Sep-95	11.5	227.	258.	153.	356.	383.	41.	223.	253.	452.	1,289.	318.	849.	409.	5,420.	1,580.	1,290.	1,839.	11,860.
	B-35	951005-B35-01	5-Oct-95	0.2	2.2	4.	1.5	4.1	4.1	0.59	3.	ND *	0.54	0.88	4.5	4.	ND *	0.34	2.2	6.7	19.49	19.16
		951005-B35-06	5-Oct-95	22.0	613.	760.	269.	954.	609.	91.5	497.	532.	1,960.	680.	714.	2,600.	962.	20,700.	4,890.	4,330.	4,013.5	37,588.
		951005-B35-10	5-Oct-95	29.0	0.13	0.14	0.068	0.17	0.18	ND *	0.096	0.52	0.28	0.27	0.14	0.5	0.28	4.3	1.4	0.82	0.784	8.51
	B-48	000828-031	28-Aug-00	5.0	425.	225.	285.	475.	535.	55.	276.	725.	ND *	590.	365.	1,460.	545.	835.	3,020.	1,640.	2,270.	9,555.
		000828-032	28-Aug-00	9.5	77.	54.5	51.	88.	92.	11.	51.	114.	30.	77.5	65.	212.	65.	755.	386.	256.	424.5	1,962.5
	B-49	000828-036	28-Aug-00	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		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	ND *	6.2	8.95	60.5	343.4	218.7
		000828-038	28-Aug-00	8.0	116.	77.	71.5	132.	140.	17.	80.5	199.	43.	121.	106.	334.	121.	1,300.	750.	384.	634.	3,358.
	B-50	000828-033	28-Aug-00	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		000828-034	28-Aug-00	1.0	69.	41.5	44.	76.5	86.	9.	43.5	145.	18.	86.	58.	220.	82.	76.	434.	254.	369.5	1,371.
		000828-035	28-Aug-00	6.0	244.	159.	142.	289.	284.	33.5	160.	344.	330.	342.	207.	875.	310.	4,190.	1,810.	995.	1,272.5	9,315.
	B-53	040607-011	7-Jun-04	2.5 - 3.0	4.21	4.87	4.21	6.82	5.32	1.04	4.01	0.67 U	0.745	0.996	5.48	6.43	0.67 U	0.67 U	2.69	9.7	30.58	26.041
	B-54	040608-013	11-Jun-04	2.0 - 2.5	0.24	0.303	0.211	0.323	0.33	0.168 U	0.233	0.168 U	0.168 U	0.168 U	0.306	0.37	0.168 U	0.168 U	0.29	0.454	1.64	1.42
		040608-014	11-Jun-04	7.5 - 8.0	15.7	20.9	11.8	22.1	20.4	3.35 U	16.4	3.35 U	3.35 U	3.35 U	24.2	56.8	3.35 U	3.35 U	18.2	62.1	107.3	181.3
	B-55	040607-006	7-Jun-04	2.5 - 3.0	1,240.	688.	731.	1,170.	1,480.	335. U	522.	977.	2,400.	1,760.	700.	4,890.	1,740.	27,600.	9,750.	5,360.	5,831.	55,177.
	B-56	040601-001	1-Jun-04	2.5-3.5	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	14.	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	14.
		040601-003	1-Jun-04	11-12	23.1	31.4	24.7	35.1	30.7	13.4 U	25.6	13.4 U	13.4 U	13.4 U	37.	41.7	13.4 U	13.4 U	38.7	69.	170.6	186.4
		040601-004	1-Jun-04	26-27	32.7	33.6	25.	41.9	37.7	13.4 U	22.2	13.4 U	13.4 U	14.	32.2	95.3	13.4 U	13.4 U	47.6	143.	193.1	332.1
	MW-03-56	951101-M3-10	1-Nov-95	31.0	0.53	0.83	0.3	0.84	0.51	0.098	0.61	0.19	0.14	0.14	0.96	1.4	0.16	0.65	0.77	2.	3.718	6.41
		951101-M3-13	1-Nov-95	38.0	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND
		951101-M3-17	1-Nov-95	53.5	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND	ND
		951101-M3-18	1-Nov-95	53.5 (dup)	ND *	0.044	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.04	0.031	ND *	ND *	ND *	0.042	0.044	0.113
	MW-04-57	951030-M4-01	30-Oct-95	0.2	16.	28.	10.	28.	15.	4.	21.	ND>5.0	4.4	2.6	35.	12.	ND>5.0	1.7	3.4	22.	114.	81.1
		951030-M4-06	30-Oct-95	25.5	190.	260.	68.	210.	180.	24.	ND *	65.	ND *	110.	190.	640.	49.	25.	480.	830.	872.	2,389.
		951030-M4-15	30-Oct-95	57.0	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.03	ND *	ND *	ND *	0.053	ND *	0.08	0.033	0.067	ND	0.263
	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	ND*	53.2	1.5	6.1	13.6	145.	722.9	253.5
		981014-M4-02	14-Oct-98	6.0	ND *	0.1	ND *	0.1	0.057	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	ND *	0.11	0.257	0.11
		981014-M4-03	14-Oct-98	10.5	0.13	0.25	ND *	0.23	0.16	ND *	ND *	ND *	ND *	ND *	ND *	0.21	ND *	ND *	ND *	0.46	0.77	0.67
	MW-05-32	951027-M5-01	27-Oct-95	0.2	0.13	0.22	0.077	0.15	0.13	ND *	0.11	ND *	ND *	ND *	0.15	0.2	ND *	ND *	0.073	0.19	0.817	0.613
		951027-M5-05	27-Oct-95	15.5	115.	170.	58.	208.	130.	25.	104.	19.	15.	41.	153.	330.	16.	6.1	113.	437.	810.	1,132.1
		951027-M5-07	27-Oct-95	21.5	0.067 J	0.039 J	ND * UJ	0.051 J	0.065 J	ND * UJ	ND * UJ	ND * UJ	ND * UJ	0.072 J	0.044 J	0.17 J	ND * UJ	ND * UJ	0.15 J	0.23 J	0.242	0.666
		951027-M5-10	27-Oct-95	31.5	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND * UJ	ND	ND

Table 10 – 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	Dibenz (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 PAHs
		EPA PRGs for Industrial Soil[3] ==>			2.1	2.1	21.	0.21	210.	0.21	2.1	29,000.	#	100,000.	#	22,000.	26,000.	190.	#	29,000.	#	#
Ter Pond (cont.)	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
		981019-M5-02	19-Oct-98	5.0 (dup)	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
		981019-M5-03	19-Oct-98	9.5	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND	ND
		981020-M5-09	20-Oct-98	71.0	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND	ND
	MW-08-56	951025-M8-01	25-Oct-95	0.2	12. J	39.6	13.8	41.7	20.5 J	9.1	48.2	ND>0.50	3.2	1.6	56.5	6.7	ND[a]	2.2	1.4	26.1	203.4	97.9
		951025-M8-11	25-Oct-95	44.0	0.17 J	0.12 J	0.053 J	0.15 J	0.21 J	ND[a] UJ	0.08 J	0.74 J	0.3 J	0.22 J	0.13 J	0.6 J	0.46 J	2.6 J	1.5 J	0.71 J	0.783	7.26
		951025-M8-15	25-Oct-95	55.0	ND[a] UJ	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	0.057	ND[a]	0.065	ND[a]	0.31	0.11	0.1	ND	0.642
	M-11	951102-M11-01	2-Nov-95	0.2	6.1	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
		951102-M11-09	2-Nov-95	39.0	0.16	0.11	0.046	0.077	0.13	ND[a]	0.047	0.85	0.083	0.21	0.063	0.94	0.65	1.5	2.1	0.91	9.723	7.306
		951102-M11-10	2-Nov-95	43.5	0.26 J	0.14 J	0.07 J	0.16 J	0.26 J	ND[a] UJ	0.076 J	0.8 J	0.089 J	0.4 J	0.11 J	1.4 J	0.65 J	2. J	3.1 J	1.4 J	0.966	9.949
	MW-14-110	981014-M14-01	14-Oct-98	3.5	357.	411.	99.2	400.	343.	ND[a]	ND[a]	42.3	138.	1.4	ND[a]	1,390.	57.	36.6	411.	2,190.	1,610.2	4,266.5
		981014-M14-02	14-Oct-98	6.0	116.	133.	37.3	136.	152.	ND[a]	58.1	10.6	21.9	23.	90.2	292.	14.2	12.9	118.	482.	632.4	1,064.8
		981014-M14-03	14-Oct-98	10.0	71.3	74.6	24.	82.5	94.8	ND[a]	42.6	39.3	6.6	37.1	57.	194.	33.	93.3	250.	310.	389.8	1,020.3
		981014-M14-07	14-Oct-98	43.5	0.31	0.33	ND[a]	0.36	0.35	ND[a]	0.2	0.39	0.36	0.36	0.32	1.2	0.45	2.1	2.3	1.8	1.55	9.28
		981016-M14-13	16-Oct-98	69.5	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	ND	ND
		981019-M14-20	19-Oct-98	106.0	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND[a] UJ	ND	ND
	SS-01	981112-SS-01	12-Nov-98	0.2	0.21	0.46	0.14	0.44	0.23	0.068	0.35	ND[a]	0.064	ND[a]	0.5	0.29	ND[a]	ND[a]	0.1	0.37	1.898	1.324
	SS-02	981112-SS-02	12-Nov-98	0.2	0.79	1.5	0.47	1.5	0.93	0.22	1.2	ND[a]	0.2	0.08	1.6	1.2	ND[a]	0.088	0.22	1.6	6.61	4.988
	SS-03	981112-SS-03	12-Nov-98	0.2	4.7	14.2	3.5	14.1	6.2	1.5	16.3	0.1	1.9	ND[a]	14.4	3.4	0.13	0.9	0.97	8.5	54.5	30.3
	SS-04	981112-SS-04	12-Nov-98	0.2	1.3	3.1	0.88	2.9	1.7	0.49	2.4	0.083	0.5	0.25	3.1	1.4	0.059	0.23	0.61	2.2	12.77	8.432
	SS-11	981112-SS-11	12-Nov-98	0.2	0.061	0.14	ND[a]	0.13	0.066	ND[a]	0.1	ND[a]	ND[a]	ND[a]	0.15	0.075	ND[a]	ND[a]	ND[a]	0.099	0.497	0.324

Note:
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
J indicates an estimated value (validation qualifier)
UJ indicates an estimated reporting limit (validation qualifier)

# = Reference level not established
1 = Sample number prefix: 2708-
2 = Reserved
3 =EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil (Revised 10/2/2002)
Bold = Detected above Reference Levels

a = detection limit is 0.05 mg/kg (ppm)
b = detection limit is 0.2 mg/kg (ppm)
c = detection limit is 1 mg/kg (ppm)
d = detection limit is 100 mg/kg (ppm)
e = detection limit is 0.5 mg/kg (ppm)
f = detection limit is 0.7 mg/kg (ppm)

TABLE 11 – 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]	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
			EPA PRGs for Industrial Soil[3] ==>			#	240	1,800	12,000	1,200	#	#	3,100	#	#	18,000	9.00	100,000	62,000	62	#
FAMM	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
Retort / Koppers	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	16.5	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
		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
		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-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>26	ND>26	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
Spent Oxide	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
Tar Pond	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-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
		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
		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>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
	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
		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

Note: 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

[1] = Sample number prefix: 2708-
[2] = Reserved
[3] = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil (Revised 10/2/2002)
# = Reference level not established

TABLE 12 – Summary of Analytical Results for Soil Samples
Priority Pollutant Metals by EPA Methods 6010 and 7471

Total Metals by EPA Method 6010 and 7471						Analytical Results mg/kg (ppm)												
Area	Soil Boring	Sample Number (Prefix: 2708-)	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
					EPA PRGs for Industrial Soil [1] ==>	410.	1.6	1,900.	810.	450.	41,000.	750.	310.	2,000.	5,100.	5,100.	67.	100,000.
					Background Levels[2] ==>	4.	7.	#	1.	42.	36.	17.	0.07	28.	2.	1.	#	86.
FAMM	B-47	000829-039	2708-S075	29-Aug-00	0.2	1.57 J	ND[a]	ND[a]	ND[a]	1.8	5.87	ND[a]	ND[b]	1.1	ND[a]	ND[a]	ND[c]	33.4
		000829-040	2708-S075	29-Aug-00	0.2 (dup)	1.42 J	ND[a]	ND[a]	ND[a]	2.46	5.92	ND[a]	ND[b]	1.95	ND[a]	ND[a]	ND[c]	35.5
		000829-041	2708-S076	29-Aug-00	5.0	1.02 J	5.25	ND[a]	ND[a]	16.1	19.6	12.1	ND[b]	13.5	ND[a]	ND[a]	ND[c]	55.2
		000829-042	2708-S076	29-Aug-00	11.5	1.07 J	2.67	ND[a]	ND[a]	13.9	17.6	14.6	2.	14.7	ND[a]	ND[a]	ND[c]	53.
		000829-043	2708-S076	29-Aug-00	11.5 (dup)	ND[a] UJ	3.33	ND[a]	ND[a]	15.1	19.4	11.9	ND[b]	12.2	ND[a]	ND[a]	ND[c]	52.5
		000829-045	2708-S076	29-Aug-00	31.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-51	000828-023	2708-S071	28-Aug-00	0.2	2.26 J	3.14	ND[a]	ND[a]	70.9	34.7	30.4	ND[b]	146.	ND[a]	ND[a]	ND[c]	114.
		000828-024	2708-S073	28-Aug-00	2.0	ND[a] UJ	2.57	ND[a]	ND[a]	12.9	11.	2.4	ND[b]	14.8	ND[a]	ND[a]	ND[c]	ND[a]
		000828-025	2708-S073	28-Aug-00	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-52	000828-026	2708-S071	28-Aug-00	0.2	ND[a] UJ	ND[a]	ND[a]	ND[a]	ND[a]	3.83	4.01	ND[b]	3.78	ND[a]	ND[a]	ND[c]	28.4
		000828-027	2708-S073	28-Aug-00	3.5	ND[a] UJ	2.54	ND[a]	ND[a]	11.8	11.8	1.78	ND[b]	14.3	ND[a]	ND[a]	ND[c]	35.9
		000828-028	2708-S073	28-Aug-00	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-
		000828-029	2708-S073	28-Aug-00	10.5 (dup)	-	-	-	-	-	-	-	-	-	-	-	-	-
	GT-1	971117-001	2708-S054	17-Nov-97	3.0	-	1.8	-	-	-	-	-	-	-	-	-	-	-
		971117-004	2708-S054	17-Nov-97	10.5	-	1.8	-	-	-	-	-	-	-	-	-	-	-
		971117-006	2708-S054	17-Nov-97	16.0	-	2.4	-	-	-	-	-	-	-	-	-	-	-
		971117-008	2708-S054	17-Nov-97	20.5	-	1.5	-	-	-	-	-	-	-	-	-	-	-
		971117-011	2708-S054	17-Nov-97	35.5	-	1.2	-	-	-	-	-	-	-	-	-	-	-
	GT-2	971117-012	2708-S054	17-Nov-97	3.5	-	1.1	-	-	-	-	-	-	-	-	-	-	-
		971117-017	2708-S055	17-Nov-97	15.5	-	2.2	-	-	-	-	-	-	-	-	-	-	-
		971117-021	2708-S055	17-Nov-97	33.0	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
	GT-3	971118-023	2708-S056	18-Nov-97	3.0	-	2.7	-	-	-	-	-	-	-	-	-	-	-
		971118-026	2708-S056	18-Nov-97	12.5	-	1.9	-	-	-	-	-	-	-	-	-	-	-
		971118-032	2708-S056	18-Nov-97	36.0	-	1.	-	-	-	-	-	-	-	-	-	-	-
	GT-4	971118-034	2708-S056	18-Nov-97	13.5	-	2.	-	-	-	-	-	-	-	-	-	-	-
		971118-038	2708-S057	18-Nov-97	40.5	-	1.3	-	-	-	-	-	-	-	-	-	-	-

TABLE 12 – Summary of Analytical Results for Soil Samples
Priority Pollutant Metals by EPA Methods 6010 and 7471

Total Metals by EPA Method 6010 and 7471						Analytical Results mg/kg (ppm)												
Area	Soil Boring	Sample Number (Prefix: 2708-)	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
					EPA PRGs for Industrial Soil [1] ==>	410.	1.6	1,900.	810.	450.	41,000.	750.	310.	2,000.	5,100.	5,100.	67.	100,000.
					Background Levels[2]==>	4.	7.	#	1.	42.	36.	17.	0.07	28.	2.	1.	#	88.
FAMM (cont.)	MW-13	971218-M13-02	2708-S058	18-Dec-97	6.0	-	2.7	-	-	-	-	-	-	-	-	-	-	-
		971218-M13-03	2708-S058	18-Dec-97	10.0	-	2.8	-	-	-	-	-	-	-	-	-	-	-
		971218-M13-04	2708-S058	18-Dec-97	13.5	-	2.7	-	-	-	-	-	-	-	-	-	-	-
		971218-M13-05	2708-S058	18-Dec-97	18.0	-	2.5	-	-	-	-	-	-	-	-	-	-	-
		971218-M13-08	2708-S058	18-Dec-97	24.5	-	1.8	-	-	-	-	-	-	-	-	-	-	-
		971218-M13-10	2708-S058	18-Dec-97	28.0	-	-	-	-	-	-	-	-	-	-	-	-	-
		971218-M13-11	2708-S058	18-Dec-97	31.0	-	1.8	-	-	-	-	-	-	-	-	-	-	-
		971218-M13-17	2708-S059	18-Dec-97	57.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Office Area	B-38	000828-014	2708-S071	28-Aug-00	0.2	1.71 J	5.26	ND[a]	ND[a]	24.7	52.1	33.5	ND[b]	25.6	ND[a]	ND[a]	ND[a]	69.3
		000828-015	2708-S072	28-Aug-00	2.0	2.92 J	6.37	ND[a]	ND[a]	19.7	35.2	40.3	ND[b]	17.9	ND[a]	ND[a]	ND[a]	70.3
		000828-016	2708-S072	28-Aug-00	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-39	000828-004	2708-S071	28-Aug-00	0.2	1.43 J	5.05	ND[a]	ND[a]	18.9	22.	36.6	ND[b]	84.	ND[a]	ND[a]	ND[a]	82.7
		000828-005	2708-S072	28-Aug-00	3.0	1.42 J	4.86	ND[a]	ND[a]	15.1	14.9	15.7	ND[b]	12.5	ND[a]	ND[a]	ND[a]	55.6
		000828-006	2708-S072	28-Aug-00	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-40	000828-010	2708-S071	28-Aug-00	0.2	1.01 J	3.39	ND[a]	ND[a]	16.2	23.2	55.4	ND[b]	39.8	ND[a]	ND[a]	ND[a]	92.9
		000828-011	2708-S072	28-Aug-00	2.5	ND[a] UJ	2.69	ND[a]	ND[a]	13.1	12.2	2.27	ND[b]	15.6	ND[a]	ND[a]	ND[a]	36.9
		000828-012	2708-S072	28-Aug-00	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-41	000828-007	2708-S071	28-Aug-00	0.2	1.96 J	4.97	ND[a]	ND[a]	14.7	19.7	21.4	ND[b]	20.9	ND[a]	ND[a]	ND[a]	74.4
		000828-008	2708-S072	28-Aug-00	2.5	1.24 J	4.1	ND[a]	ND[a]	13.7	19.	24.6	ND[b]	21.1	ND[a]	ND[a]	ND[a]	57.9
		000828-009	2708-S072	28-Aug-00	9.5	ND[a] UJ	2.55	ND[a]	ND[a]	12.9	12.5	1.94	ND[b]	15.3	ND[a]	ND[a]	ND[a]	36.2
Retorts/Koppers	B-42	000828-020	2708-S071	28-Aug-00	0.2	1.16 J	ND[a]	ND[a]	ND[a]	ND[a]	4.3	ND[a]	ND[b]	ND[a]	ND[a]	ND[a]	ND[a]	27.5
		000828-021	2708-S073	28-Aug-00	1.0	ND[a] UJ	2.74	ND[a]	ND[a]	13.7	12.4	3.19	ND[b]	16.5	ND[a]	ND[a]	ND[a]	64.2
		000828-022	2708-S073	28-Aug-00	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-43	000829-050	2708-S075	29-Aug-00	0.2	3.76 J	3.04	ND[a]	ND[a]	22.3	40.9	94.6	3.23	19.8	ND[a]	ND[a]	ND[c]	226.
		000829-046	2708-S076	29-Aug-00	2.0	ND[a] UJ	2.89	ND[a]	ND[a]	11.4	11.8	2.44	0.105	17.3	ND[a]	ND[a]	ND[c]	35.9
		000829-047	2708-S076	29-Aug-00	2.0 (dup)	ND[a] UJ	2.93	ND[a]	ND[a]	12.3	11.8	1.97	ND[b]	15.5	ND[a]	ND[a]	ND[c]	36.8
		000829-048	2708-S076	29-Aug-00	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-
		000829-049	2708-S076	29-Aug-00	8.5 (dup)	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-44	000829-052	2708-S075	29-Aug-00	0.2	NDa UJ	3.4	ND[a]	ND[a]	12.6	12.5	1.76	ND[b]	14.6	ND[a]	ND[a]	ND[c]	37.9
		000829-051	2708-S076	29-Aug-00	3.5	ND[a] UJ	2.46	ND[a]	ND[a]	10.8	11.9	1.7	ND[b]	13.8	ND[a]	ND[a]	ND[c]	36.1
		000829-053	2708-S076	29-Aug-00	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 12 – Summary of Analytical Results for Soil Samples
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Total Metals by EPA Method 6010 and 7471						Analytical Results mg/kg (ppm)												
Area	Soil Boring	Sample Number (Prefix: 2708-)	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
					EPA PRGs for Industrial Soil [1] ==>	410.	1.6	1,900.	810.	450.	41,000.	750.	310.	2,000.	5,100.	5,100.	67.	100,000.
					Background Levels[2]==>	4.	7.	#	1.	42.	36.	17.	0.07	28.	2.	1.	#	86.
Retorts/Koppers (cont.)	B-45	000829-054	2708-S075	29-Aug-00	0.2	1.44 J	ND[a]	ND[a]	ND[a]	4.96	10.1	2.77	ND[b]	3.16	ND[a]	ND[a]	ND[c]	42.3
		000829-055	2708-S076	29-Aug-00	2.0	1.11 J	9.02	ND[a]	ND[a]	15.8	21.3 J	10.2 J	ND[b]	14.4	ND[a]	ND[a]	ND[c]	58.8
		000829-056	2708-S076	29-Aug-00	2.0 (dup)	1.02 J	5.52	ND[a]	ND[a]	16.5	70.7 J	31.1 J	ND[b]	18.9	ND[a]	ND[a]	ND[c]	60.4
		000829-057	2708-S077	29-Aug-00	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-46	000829-058	2708-S075	29-Aug-00	0.2	1.16 J	ND[a]	ND[a]	ND[a]	11.1	11.5	8.2	ND[b]	6.57	ND[a]	ND[a]	ND[c]	71.4
		000829-059	2708-S077	29-Aug-00	5.0	ND[a] UJ	2.75	ND[a]	ND[a]	12.5	11.5	1.65	ND[b]	13.3	ND[a]	ND[a]	ND[c]	35.7
		000829-060	2708-S077	29-Aug-00	10.5	ND[a] UJ	1.46	ND[a]	ND[a]	9.21	10.1	1.36	ND[b]	12.3	ND[a]	ND[a]	ND[a]	28.5
	SS-12	000829-061	2708-S075	29-Aug-00	0.2	ND[a] UJ	ND[a]	ND[a]	ND[a]	5.55	21.7	3.74	ND[b]	4.89	ND[a]	ND[a]	ND[c]	45.9
	SS-13	000829-062	2708-S075	29-Aug-00	0.2	ND[a] UJ	ND[a]	ND[a]	ND[a]	1.07	6.24	1.23	ND[b]	ND[a]	ND[a]	ND[a]	ND[c]	32.7
	SS-14	000829-063	2708-S075	29-Aug-00	0.2	1.34 J	ND[a]	ND[a]	ND[a]	3.21	5.41	4.17	ND[b]	2.08	ND[a]	ND[a]	ND[a]	55.1
	SS-15	000829-064	2708-S075	29-Aug-00	0.2	1.13 J	3.34	ND[a]	ND[a]	4.94	11.	132 J	0.578	5.78	ND[a]	ND[a]	ND[c]	58.5
		000829-065	2708-S075	29-Aug-00	0.2 (dup)	ND[a] UJ	ND[a]	ND[a]	ND[a]	5.47	6.73	4.33 J	ND[b]	3.02	ND[a]	ND[a]	ND[c]	37.9
Spent Oxide	B-1	950921-B1-01	2708-S009	21-Sep-95	0.2	ND[a]	6.6 J	ND[a]	ND[a]	26.	41.	60.	ND[b]	21.	ND[a]	ND[a]	4.1	140.
		950921-B1-02	2708-S009	21-Sep-95	0.2 (dup)	6.6	21. J	ND[a]	1.1	30.	60.	58.	ND[b]	26.	ND[a]	ND[a]	7.6	160.
		950921-B1-05	2708-S009	21-Sep-95	10.5	ND[a]	14.	ND[a]	3.4	11.	80.	130.	ND[b]	36.	ND[a]	ND[a]	3.	670.
	B-2	950927-B2-05	2708-S016	27-Sep-95	16.0	ND[a]	4.9	ND[a]	4.3	12.	20.	15.	ND[b]	31.	ND[a]	ND[a]	3.8	3,000.
	B-3	950921-B3-05	2708-S007	21-Sep-95	10.5	ND[a] UJ	7.	ND[a]	ND[a]	30 J	36 J	22.	ND[b]	41 J	ND[a]	ND[a]	5.	120 J
	B-36	000828-017	2708-S071	28-Aug-00	0.2	1.27 J	4.16	ND[a]	ND[a]	18.	29.7	40.2	ND[b]	14.4	ND[a]	ND[a]	ND[c]	82.8
		000828-018	2708-S072	28-Aug-00	3.5	1.59 J	4.89	ND[a]	ND[a]	15.2	18.9	47.	ND[b]	12.3	ND[a]	ND[a]	ND[a]	67.3
		000828-019	2708-S073	28-Aug-00	10.0	1.26 J	2.07	ND[a]	ND[a]	6.58	13.1	8.56	ND[b]	6.91	ND[a]	ND[a]	ND[a]	45.2
	B-37	000828-001	2708-S071	28-Aug-00	0.2	1.73 J	ND[a]	ND[a]	ND[a]	5.43 J	10.2	7.69	ND[b]	3.98	ND[a] UJ	ND[a]	ND[a] UJ	49.8
		000828-002	2708-S072	28-Aug-00	4.5	ND[a] UJ	3.2	ND[a]	ND[a]	13.5	10.3	2.61	ND[b]	16.1	ND[a]	ND[a]	ND[a]	51.9
		000828-003	2708-S072	28-Aug-00	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	MW-02-61	981007-M2-01	2708-S060	7-Oct-98	2.0	-	3.44	-	-	-	-	-	-	-	-	-	-	-
		981007-M2-02	2709-S060	7-Oct-98	5.5	-	4.	-	-	-	-	-	-	-	-	-	-	-
		981007-M2-03	2709-S060	7-Oct-98	32.0	-	3.	-	-	-	-	-	-	-	-	-	-	-

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Total Metals by EPA Method 6010 and 7471						Analytical Results mg/kg (ppm)												
Area	Soil Boring	Sample Number (Prefix: 2708-)	Chain of Custody Number	Sample Date	Sample Depth (feet bgs)	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
					EPA PRGs for Industrial Soil [1] ==>	410.	1.6	1,900.	810.	450.	41,000.	750.	310.	2,000.	5,100.	5,100.	67.	100,000.
					Background Levels[2]==>	4.	7.	#	1.	42.	36.	17.	0.07	28.	2.	1.	#	86.
Tar Pond	B-48	000828-030	2708-S071	28-Aug-00	0.2	1.57 J	ND[a]	ND[a]	ND[a]	5.01	12.9	3.78	ND[b]	5.44	ND[a]	ND[a]	ND[c]	54.4
		000828-031	2708-S073	28-Aug-00	5.0	1.03 J	ND[a] UJ	ND[a]	ND[a]	8.86	9.23	18.3	ND[b]	11.1	ND[a] UJ	ND[a]	ND[c] R	43.4
		000828-032	2708-S073	28-Aug-00	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-49	000828-036	2708-S071	28-Aug-00	0.2	1.62 J	ND[a]	ND[a]	ND[a]	9.26	9.62	6.93	ND[b]	4.7	ND[a]	ND[a]	ND>100	63.9
		000828-037	2708-S074	28-Aug-00	1.5	1.54 J	ND[a]	ND[a]	ND[a]	10.6	9.9	6.68	ND[b]	6.9	ND[a]	ND[a]	ND[c]	53.
		000828-038	2708-S074	28-Aug-00	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	B-50	000828-033	2708-S071	28-Aug-00	0.2	1.87 J	1.11	ND[a]	ND[a]	11.9	16.7	10.8	ND[b]	5.92	ND[a]	ND[a]	ND>100	67.2
		000828-034	2708-S073	28-Aug-00	1.0	1.52 J	ND[a]	ND[a]	ND[a]	10.2	10.7	11.1	ND[b]	8.65	ND[a]	ND[a]	ND[c]	62.6
		000828-035	2708-S073	28-Aug-00	6.0	1.59 J	ND[a]	ND[a]	ND[a]	10.	10.4	12.6	ND[b]	10.1	ND[a]	ND[a]	ND>100	61.4
	MW-04-101	981014-M4-01	2708-S063	14-Oct-98	2.0	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
		981014-M4-02	2708-S063	14-Oct-98	6.0	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
		981014-M4-03	2708-S063	14-Oct-98	10.5	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
	MW-05-175	981019-M5-01	2708-S065	19-Oct-98	5.0	-	1.1	-	-	-	-	-	-	-	-	-	-	-
		981019-M5-02	2708-S065	19-Oct-98	5.0 (dup)	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
		981019-M5-03	2708-S065	19-Oct-98	9.5	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
		981020-M5-09	-	20-Oct-98	71.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	MW-14-110	981014-M14-01	2708-S063	14-Oct-98	3.5	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
		981014-M14-02	2708-S063	14-Oct-98	6.0	-	ND[a]	-	-	-	-	-	-	-	-	-	-	-
		981014-M14-03	2708-S063	14-Oct-98	10.0	-	1.8	-	-	-	-	-	-	-	-	-	-	-
		981014-M14-07	2708-S063	14-Oct-98	43.5	-	1.8	-	-	-	-	-	-	-	-	-	-	-
		981016-M14-13	2708-S064	16-Oct-98	69.5	-	5.2	-	-	-	-	-	-	-	-	-	-	-
		981019-M14-20	2708-S065	19-Oct-98	106.0	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTE:
bgs = below ground surface
dup = field duplicate sample
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams per kilogram
J indicates an estimated value (validation qualifier)
UJ indicates an estimated reporting limit (validation qualifier)
R result is unusable due to serious deficiencies in meeting quality control criteria (validation qualifier)
Underline = Concentration exceeds default background level
Bold = Concentration exceedsEPA PRG for residential soil
Bold and Underline = Concentration exceeds default background level and EPA PRG for residential soil

ND = Not detected above detection limit indicated
ppm = parts per million
1 = Reference Levels are EPA Region 9 Preliminary Remediation Goals (PRGs) for Industrial Soil (Revised 10/2/2002)
2 = DEQ Default Background Concentrations for Metals (October 2002)
# = Reference level not established

a = detection limit is 1.00 mg/kg (ppm)
b = detection limit is 0.100 mg/kg
c = detection limit is 10 mg/kg

TABLE 13 – Summary of Analytical Results for Soil Samples: Physical Properties

Study Area	Soil Boring Number	Sample Number[1]	Chain of Custody Number	Sample Date	Depth (feet bgs)	Soil Description (surficial fill unit unless otherwise noted)	Analytical Results: EPA Method 160.3M Total Solids (%)	ASTM Method D4129-82M TOC (%)	ASTM Method E1109-86 Density (g/cm³)	ASTM Method D854-83 Specific Gravity	ASA Method 921-2.2 Porosity (% Pore Space)
FAMM	B-47	000829-042	2708-S076	29-Aug-00	11.5	Silty Sand	83.	0.35	1.04	1.8	42.
		000829-043	2708-S076	29-Aug-00	11.5 (dup)	Silty Sand	79.7	1.21	-	-	-
		000829-045	2708-S076	29-Aug-00	31.0	Sand (Alluvial)	84.6	2.47	-	-	-
	B-51	000828-025	2708-S073	28-Aug-00	8.5	Sand	92.6	0.85	1.05	2.	47.
	B-52	000828-028	2708-S073	28-Aug-00	10.5	Sand	82.6	0.44	-	-	-
		000828-029	2708-S073	28-Aug-00	10.5 (dup)	Sand	63.2	-	1.32	1.37	4.
Office	B-38	000828-016	2708-S072	28-Aug-00	8.5	Gravelly Silt	79.3	5.23	1.03	1.74	41.
	B-39	000828-006	2708-S072	28-Aug-00	9.5	Sand	90.	0.18	-	-	-
	B-40	000828-012	2708-S072	28-Aug-00	9.5	Silt (Alluvial)	75.3	0.8	-	-	-
	B-41	000828-009	2708-S072	28-Aug-00	9.5	Sand (Alluvial)	89.9	0.45	1.04	1.89	45.
Retort / Koppers	B-42	000828-022	2708-S073	28-Aug-00	7.5	Sand	90.	0.39	1.06	1.87	43.
	B-43	000829-048	2708-S076	29-Aug-00	8.5	Sand	93.1	1.49	-	-	-
	B-44	000829-053	2708-S076	29-Aug-00	10.0	Tarry Sand and Gravel	85.5	42.	-	-	-
	B-45	000829-057	2708-S077	29-Aug-00	8.5	Sand	93.4	3.85	-	-	-
	B-46	000829-059	2708-S077	29-Aug-00	5.0	Sand	93.7	0.26	1.17	2.04	43.
Spent Oxide	B-36	000828-019	2708-S073	28-Aug-00	10.0	Sandy Gravelly Silt	80.4	-	1.26	1.79	30.
	B-37	000828-003	2708-S072	28-Aug-00	11.0	Sand	94.6	0.22	1.13	2.22	49.
Tar Pond	B-48	000828-032	2708-S073	28-Aug-00	9.5	Tarry Sandy Gravel	81.7	17.9	-	-	-
	B-49	000828-037	2708-S074	28-Aug-00	1.5	Sandy Silty Gravel	87.7	4.56	-	-	-
	B-50	000828-035	2708-S073	28-Aug-00	6.0	Tarry Silty Sandy Gravel	76.2	27.9	1.01	1.56	35.
	MW-16-65	MW-16-65	-	19-Jul-04	multiple	See PTS Laboratories Physical Properties Data Tables and Charts included within Appendix I					

NOTE: ASA = American Standards Associaton
ASTM = American Society of Testing Materials
bgs = below ground surface

1 = Sample number prefix: 2708-

dup = field duplicate sample
EPA = U.S. Environmental Protection Agency
TOC = total organic carbon
g/cm³ = gram per cubic centimeter

TABLE 14
Summary of DNAPL Testing Results: Physical and Chemical

Parameter	Unit of Measure	Analytical Result			
		Well MW-6-32	Well MW-10-25	Well MW-11-32	Well MW-16-45
		Sample No.2708-981214-MW6-32-01	Sample No. 2708-981214-MW10-25-02	Sample No. 2708-981214-MW11-32-03	Sample No. 2708-041011MW-16-45-0il
Total Metals [1]	mg/kg (ppm)				
Arsenic		2.75	3.85	-	-
Barium		ND>0.500	0.700	-	-
Cadmium		ND>0.500	ND>0.500	-	-
Chromium		0.700	0.850	-	-
Lead		ND>10	ND>10	-	-
Mercury		0.059	ND>0.0500	-	-
Selenium		0.550	ND>0.500	-	-
Silver		ND>0.500	ND>0.500	-	-
Aromatic Hydrocarbons [2]	mg/kg (ppm)				
Benzene		589	14,400	2,740	ND>10.0
Ethylbenzene		2,220	5,320	1,760	34.4
1,2,4-Trimethylbenzene		-	-	-	54.9
1,3,5-Trimethylbenzene		-	-	-	16.2
Naphthalene		-	-	-	1,720
Toluene		ND>5.00	21,900	2,950	17.8
Xylene		1,240	19,500	4,400	66.1
PAHs [3]	mg/kg (ppm)				
Total PAHs		214,900	189,700	164,470	32,787
Total Carcinogenic PAHs		9,300	19,490	16,210	2,647
Petroleum Hydrocarbon ID [4]	None				
Gasoline-Range		Detected [12]	Detected [12]	Detected [12]	Not Detected
Diesel-Range		Detected [12]	Detected [12]	Detected [12]	Detected [12]
Heavy Oil-Range		Detected [12]	Detected [12]	Detected [12]	Detected [12]
Reactive Cyanide [5]	mg/kg (ppm)	ND>0.200	ND>0.200	-	-
Reactive Sulfide [6]	mg/kg (ppm)	434	ND>50.0	-	-
Specific Gravity [7]	gm/cc	1.05	1.05	1.09	1.084 @ 70F; 1.079 @100F; 1.080 @130F
Viscosity [8]	cSt	7.2	14.7	45.7	105 @ 70F; 40.1@100F; 18.7@130F
Ignitability [9]	degrees F	No Flash to 150 degrees F	94.0 degrees F	-	No Flash to 150 degrees F
Heating Value [10]	BTU/lb	9,230	12,230	12,280	-
pH [11]	pH unit	6.26	4.30	-	8.28

NOTE:

1 = EPA Method 6010/6020/7471
2 = EPA Method 8020A or EPA 8260B
3 = EPA Method 8270 SIM
4 = EPA Method 8015M or NW-TPH Methodology
5 = EPA Method 9010A
6 = EPA Method 9030
7 = SM 2710F
8 = ASTM Method D-445
9 = EPA Method 1010
10 = ASTM Method D2015
11 = EPA Method 150.1/9040A
12 = Laboratory reports that detected hydrocarbons have pattern and range consistent with creosotes

cc=cubic centimeter
cSt = centistokes
BTU = british thermal unit
DNAPL = dense non-aqueous phase liquids
EPA = U. S. Environmental Protection Agency
gm = gram
lb = pound
mg/kg = milligrams/kilogram
ND = not detected above detection limit indicated
ppm = parts per million

TABLE 15
Summary of DNAPL Testing Results:
PAHs by EPA 8270 SIM

Analytical Parameters	**Laboratory Analytical Testing Results** in mg/kg (ppm)			
Sample Location ==>	MW-6-32	MW-10-25	MW-11-32	MW-16-45
Sample Number ==>	MW-6-32-01	MW-10-25-02	MW-11-32-03	MW-16-45-oil
Sample Date ==>	14-Dec-98	14-Dec-98	14-Dec-98	11-Oct-04
Non-Carcinogenic PAHs				
Acenaphthene	25,800.	14,500.	9,140.	1,500.
Acenaphthylene	2,010. U	4,940.	7,480.	165.
Anthracene	16,200.	10,300.	9,810.	1,110.
Benzo (ghi) perylene	2,010. U	2,370.	2,630.	385.
Fluoranthene	25,700.	27,200.	25,000.	1,800.
Fluorene	13,000.	12,100.	10,100.	1,100.
Naphthalene	31,300.	13,300.	13,400.	15,600.
Phenanthrene	67,100.	58,200.	45,900.	6,200.
Pyrene	26,500.	27,300.	24,800.	2,280.
Carcinogenic PAHs				
Benzo (a) anthracene	4,030.	4,890.	4,060.	565.
Benzo (a) pyrene	2,010. U	4,000.	3,920.	508.
Benzo (b) fluoranthene	2,010. U	2,040.	2,010. U	289.
Benzo (k) fluoranthene	2,010. U	2,330.	2,790.	277.
Chrysene	5,270.	6,230.	5,440.	666.
Dibenz (a,h) anthracene	2,010. U	2,010. U	2,010. U	68.2
Indeno (1,2,3-cd) pyrene	2,010. U	2,010. U	2,010. U	274.
Total Carcinogenic PAHs	9,300.	19,490.	16,210.	2,647.2
Total PAHs	214,900.	189,700.	164,470.	32,787.2

Note:
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
PAHs = polynuclear aromatic hydrocarbons
ppm = parts per million
U = not detected above concentration indicated

TABLE 16
Summary of DNAPL Testing Results:
SVOCs by EPA 8270C

Analytical Parameters	**Laboratory Analytical Testing Results** in mg/kg (ppm)
Sample Location ==>	MW-16-45
Sample Number ==>	MW-16-45-oil
Sample Date ==>	11-Oct-04
Acenaphthene	1,570.
Anthracene	1,020.
Fluoranthene	1,780.
Fluorene	995.
2-Methylnaphthalene	5,500.
Naphthalene	15,400.
Phenanthrene	6,020.
Pyrene	2,210.
All Others	Not Detected

Note:
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams/kilogram
ppm = parts per million
SVOCs = semi-volatile organic compounds

Table 17 - Summary Of DNAPL Recovery Volume: Well MW-16-45

NW Natural
7900 NW St. Helens Road
Portland, Oregon

Project No. 2708

Date	DNAPL Recovered (per event)	Cumulative Volume Recovered	NAPL Thickness In Well (feet)
05-Oct-04	1.0	1	1.6
06-Oct-04	0.5	2	0.09
11-Oct-04	0.5	2	0.85
15-Oct-04	0.25	2	0.45
18-Oct-04	0.5	3	0.75
29-Oct-04	1.0	4	1.0
03-Nov-04	0.5	4	0.75
01-Dec-04	0.25	5	1.15

Notes: DNAPL = dense non-aqueous phase liquids

FIGURES

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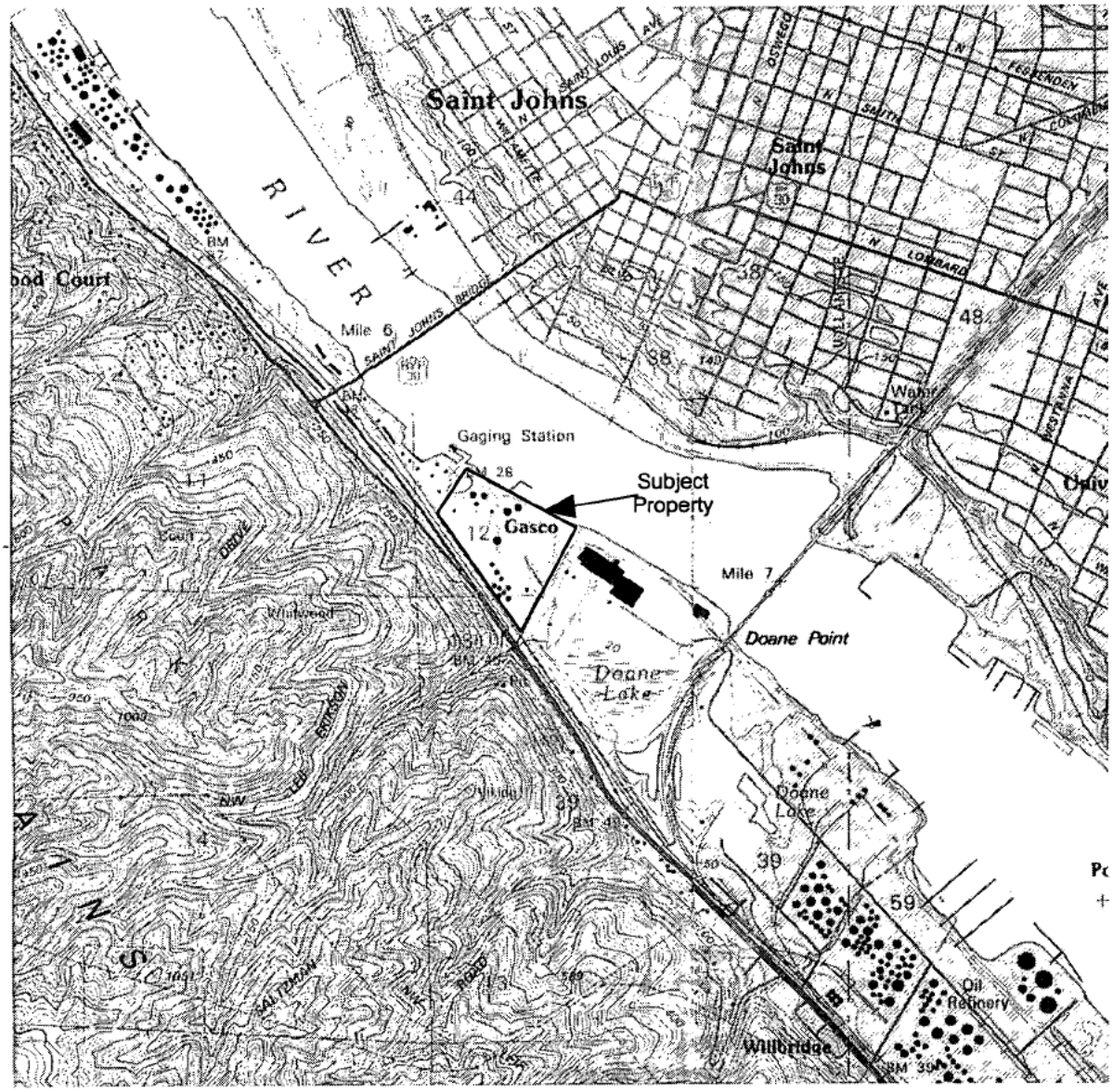


Note: Base Map from Linnton (1990) and Portland (1990), Oregon, USGS 7.5-Minute Quadrangles

N

0 2,000 4,000

Approximate Scale in Feet
Contour Interval = 10 feet

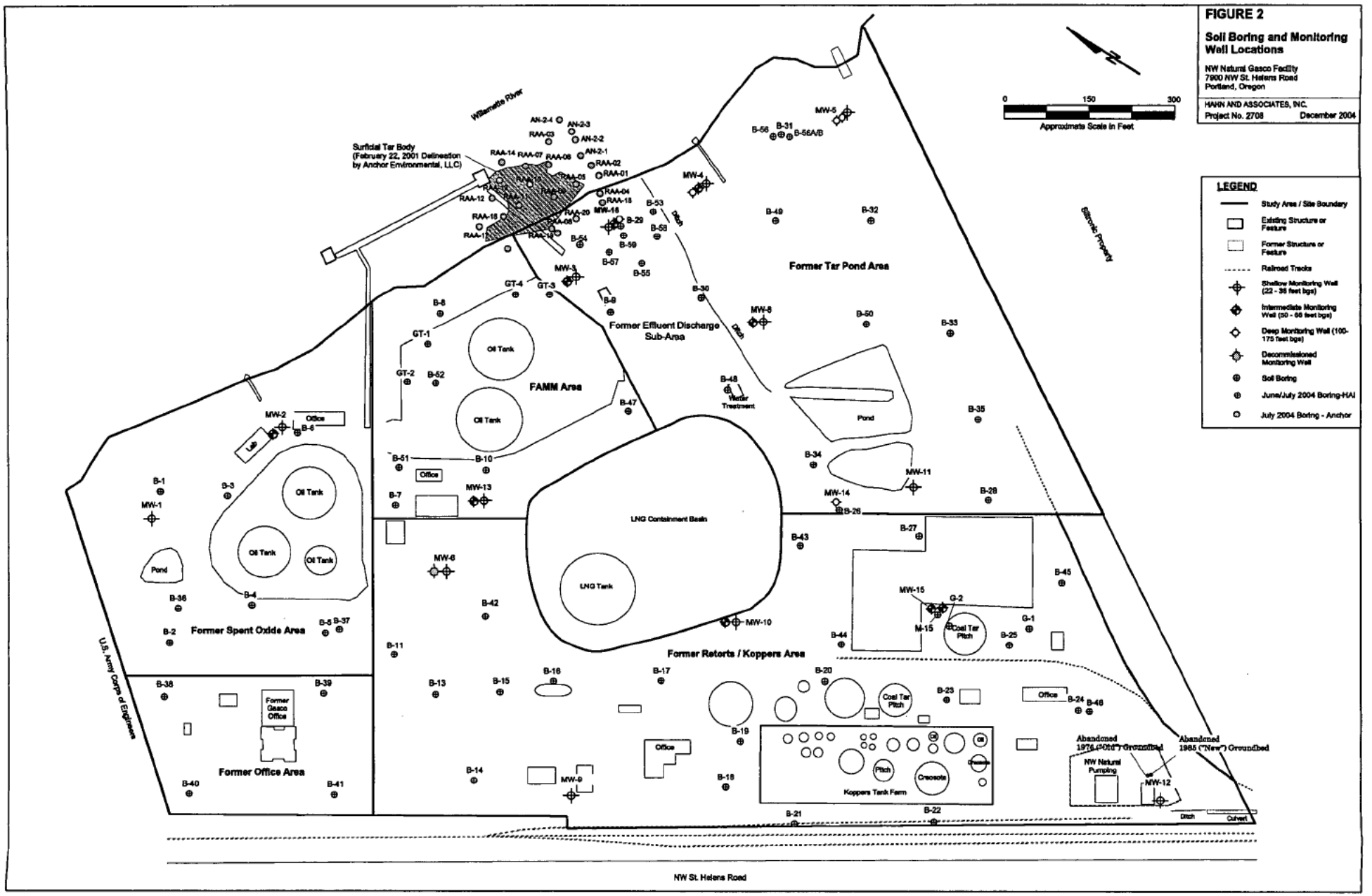
FIGURE 1

Location Map

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

HAHN AND ASSOCIATES, INC.
Project No. 2708 December 2004

File: 2708-01 Location Map



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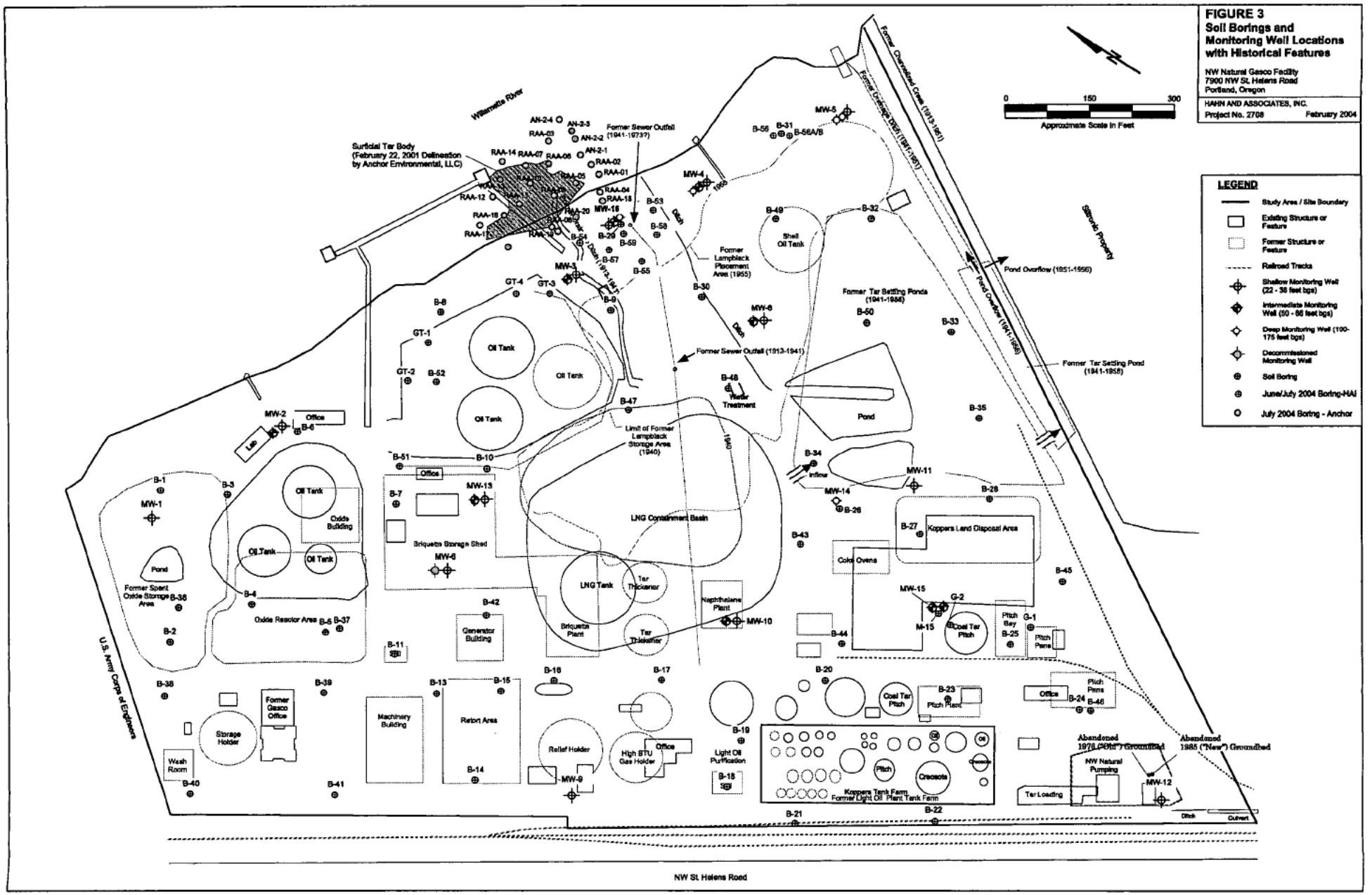

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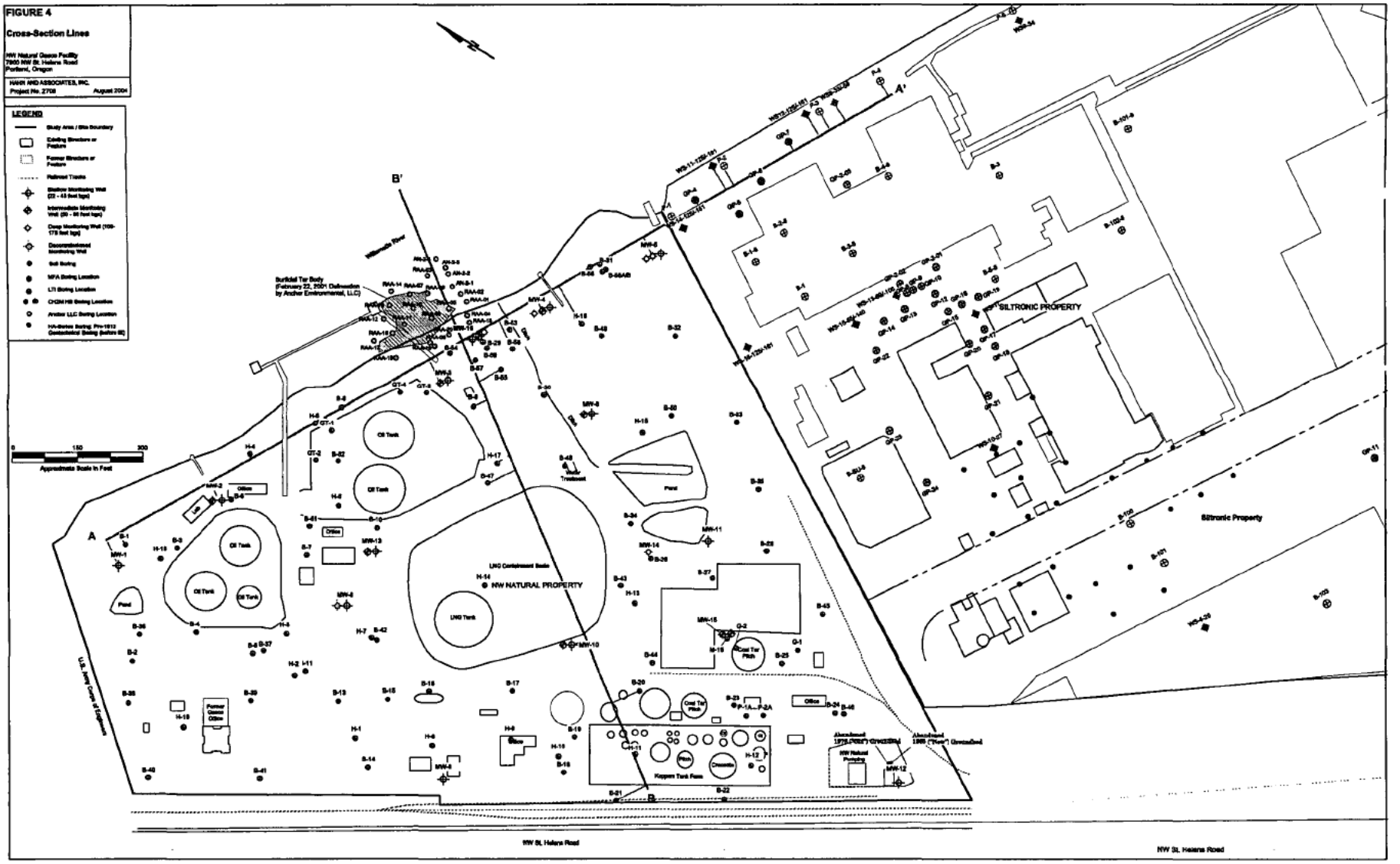

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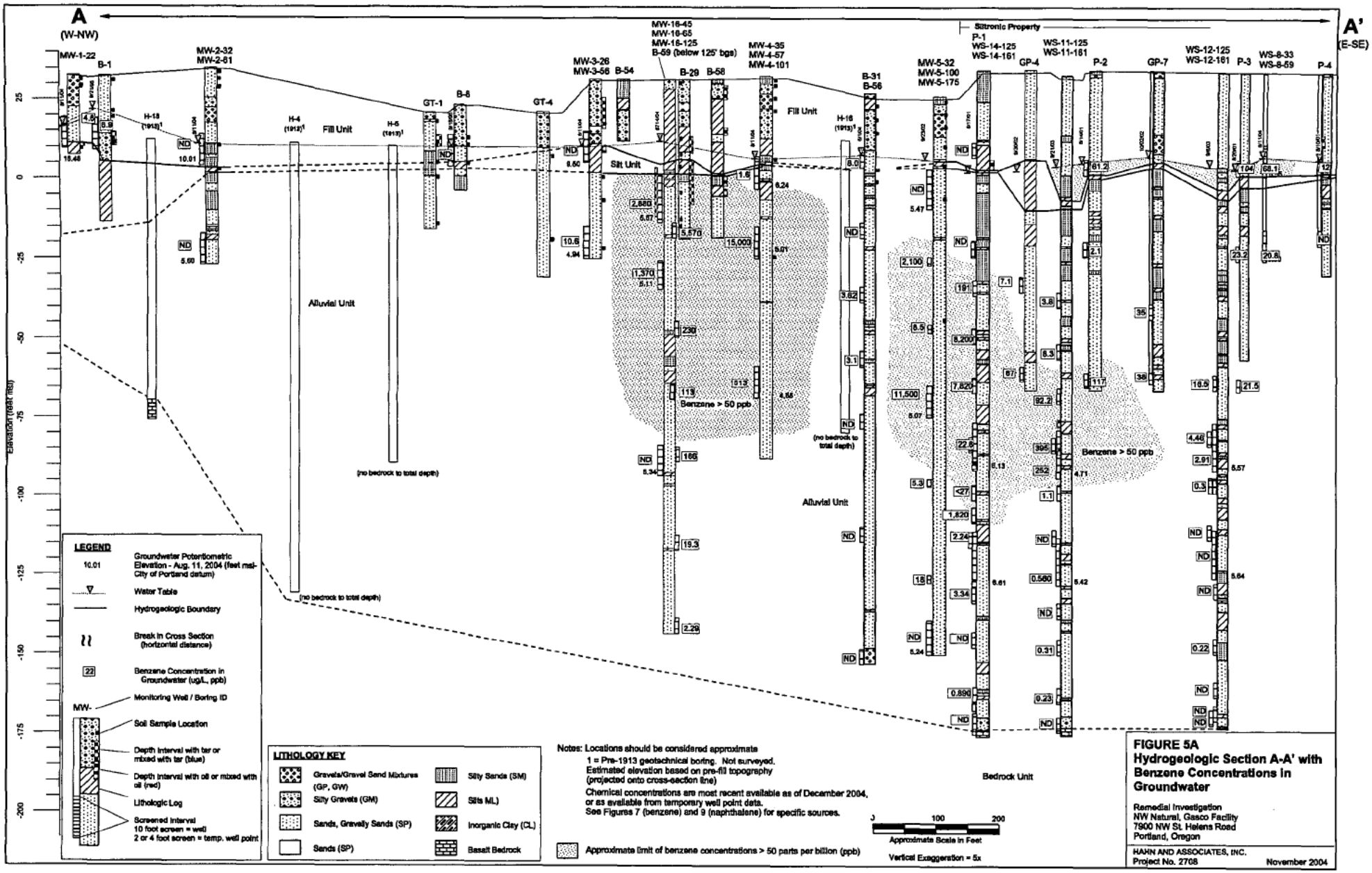

A
(W-NW)
A'
(E-SE)
Siltronic Property
MW-1-22
B-1
MW-2-32
MW-2-61
H-18 (1913)1
H-4 (1913)1
H-5 (1913)1
GT-1
B-8
GT-4
MW-3-26
MW-3-56
B-54
MW-16-45
MW-16-65
MW-16-125
B-59 (below 125' bgs)
B-29
B-58
MW-4-35
MW-4-57
MW-4-101
B-31
B-56
MW-5-32
MW-5-100
MW-5-175
P-1
WS-14-125
WS-14-161
GP-4
WS-11-125
WS-11-181
P-2
GP-7
WS-12-125
WS-12-161
P-3
WS-8-33
WS-8-59
P-4
Fill Unit
Silt Unit
Alluvial Unit
Bedrock Unit
(no bedrock to total depth)
Benzene > 50 ppb
Elevation (feet msl)
LEGEND
10.01 Groundwater Potentiometric Elevation - Aug. 11, 2004 (feet msl-City of Portland datum)
Water Table
Hydrogeologic Boundary
Break in Cross Section (horizontal distance)
22 Benzene Concentration in Groundwater (ug/L, ppb)
MW- Monitoring Well / Boring ID
Soil Sample Location
Depth interval with tar or mixed with tar (blue)
Depth interval with oil or mixed with oil (red)
Lithologic Log
Screened Interval
10 foot screen = well
2 or 4 foot screen = temp. well point
LITHOLOGY KEY
Gravels/Gravel Sand Mixtures (GP, GW)
Silty Gravels (GM)
Sands, Gravelly Sands (SP)
Sands (SP)
Silty Sands (SM)
Silts ML)
Inorganic Clay (CL)
Basalt Bedrock
Notes: Locations should be considered approximate
1 = Pre-1913 geotechnical boring. Not surveyed. Estimated elevation based on pre-fill topography (projected onto cross-section line)
Chemical concentrations are most recent available as of December 2004, or as available from temporary well point data.
See Figures 7 (benzene) and 9 (naphthalene) for specific sources.
Approximate limit of benzene concentrations > 50 parts per billion (ppb)
0 100 200
Approximate Scale in Feet
Vertical Exaggeration = 5x
FIGURE 5A
Hydrogeologic Section A-A' with Benzene Concentrations in Groundwater
Remedial Investigation
NW Natural, Gasco Facility
7900 NW St. Helens Road
Portland, Oregon
HAHN AND ASSOCIATES, INC.
Project No. 2708
November 2004

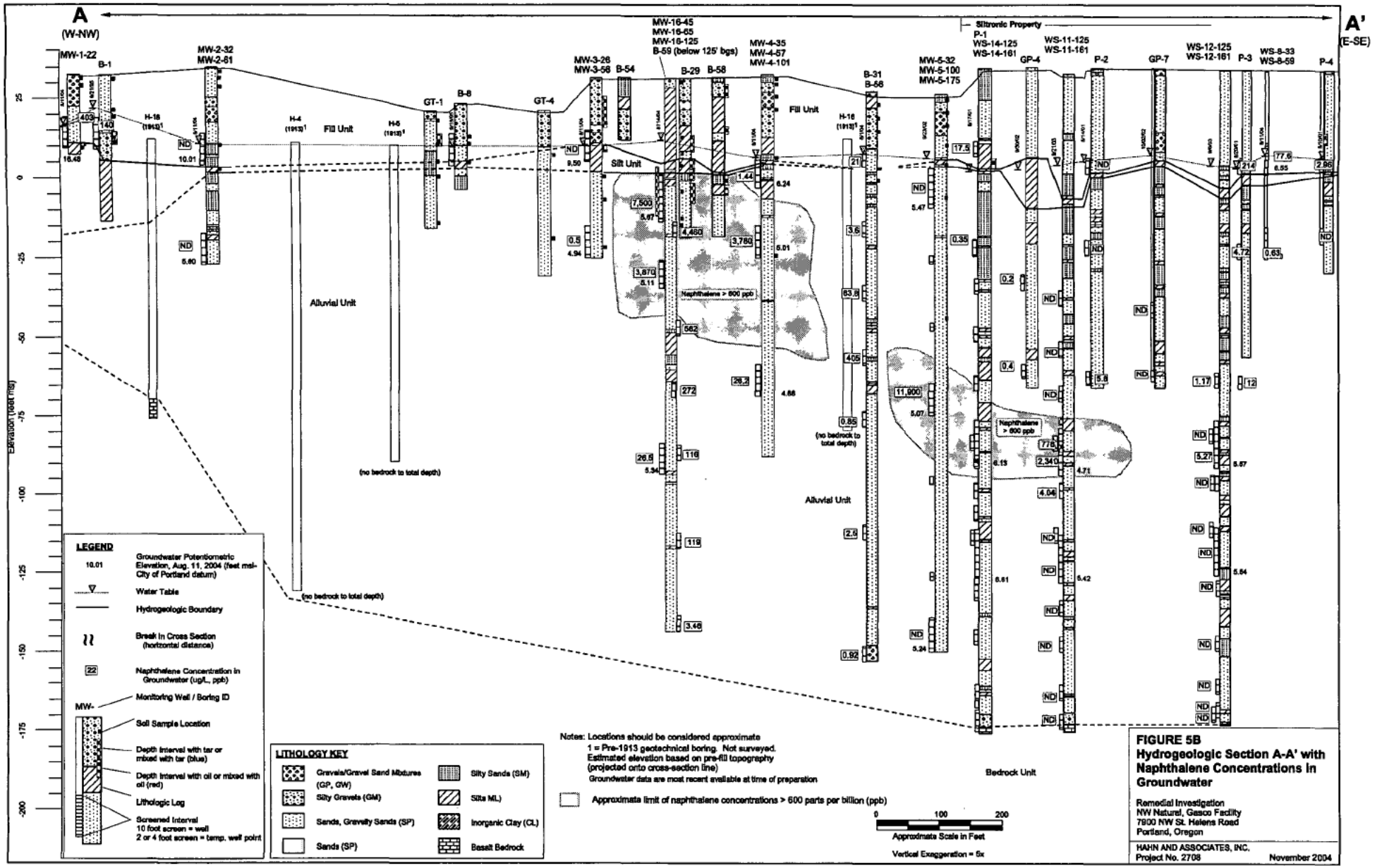


FIGURE 5B
Hydrogeologic Section A-A' with Naphthalene Concentrations in Groundwater

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

HAHN AND ASSOCIATES, INC.
Project No. 2708 November 2004

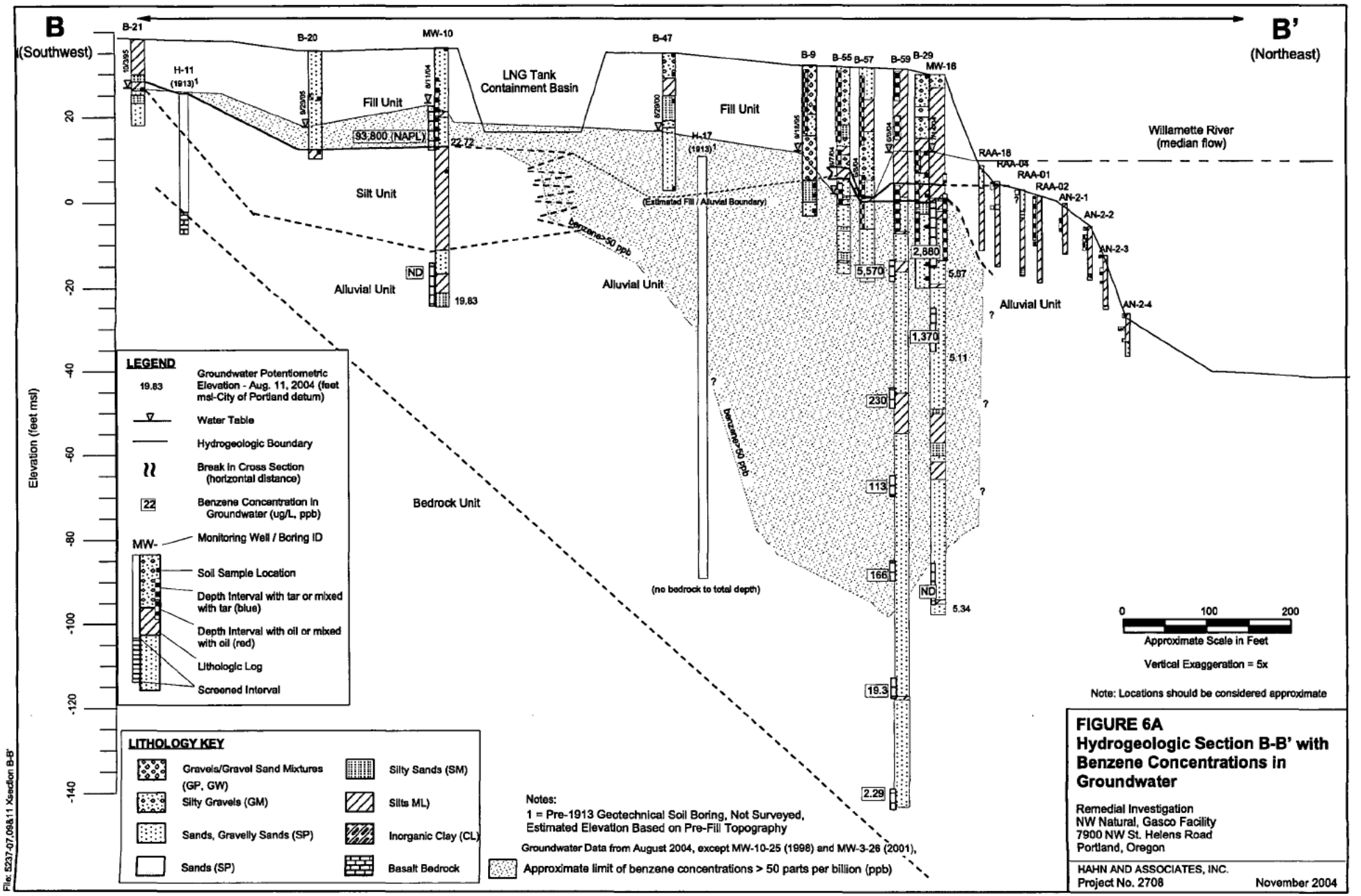


FIGURE 6A
Hydrogeologic Section B-B' with Benzene Concentrations in Groundwater

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

HAHN AND ASSOCIATES, INC.
Project No. 2708 November 2004

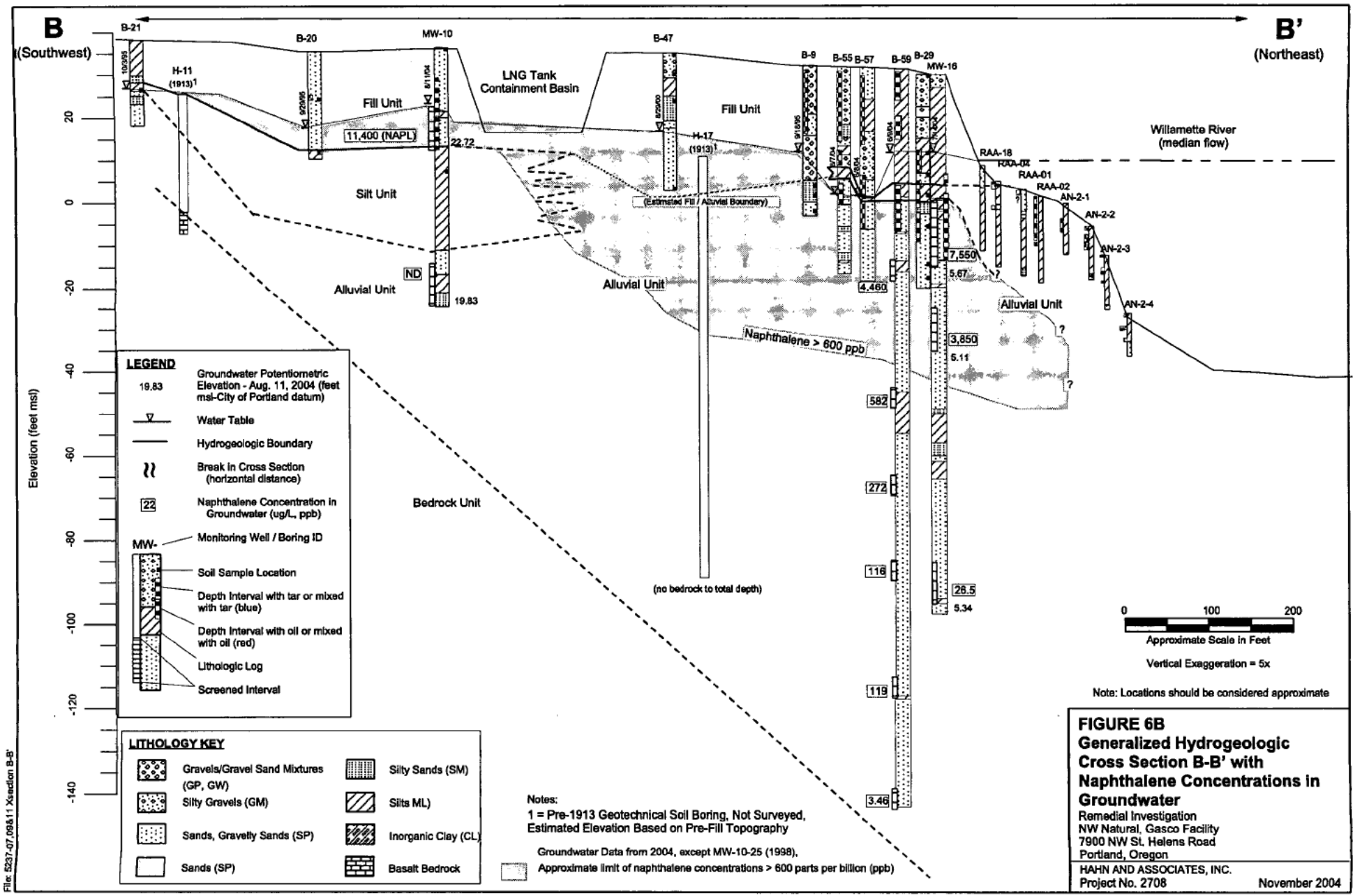
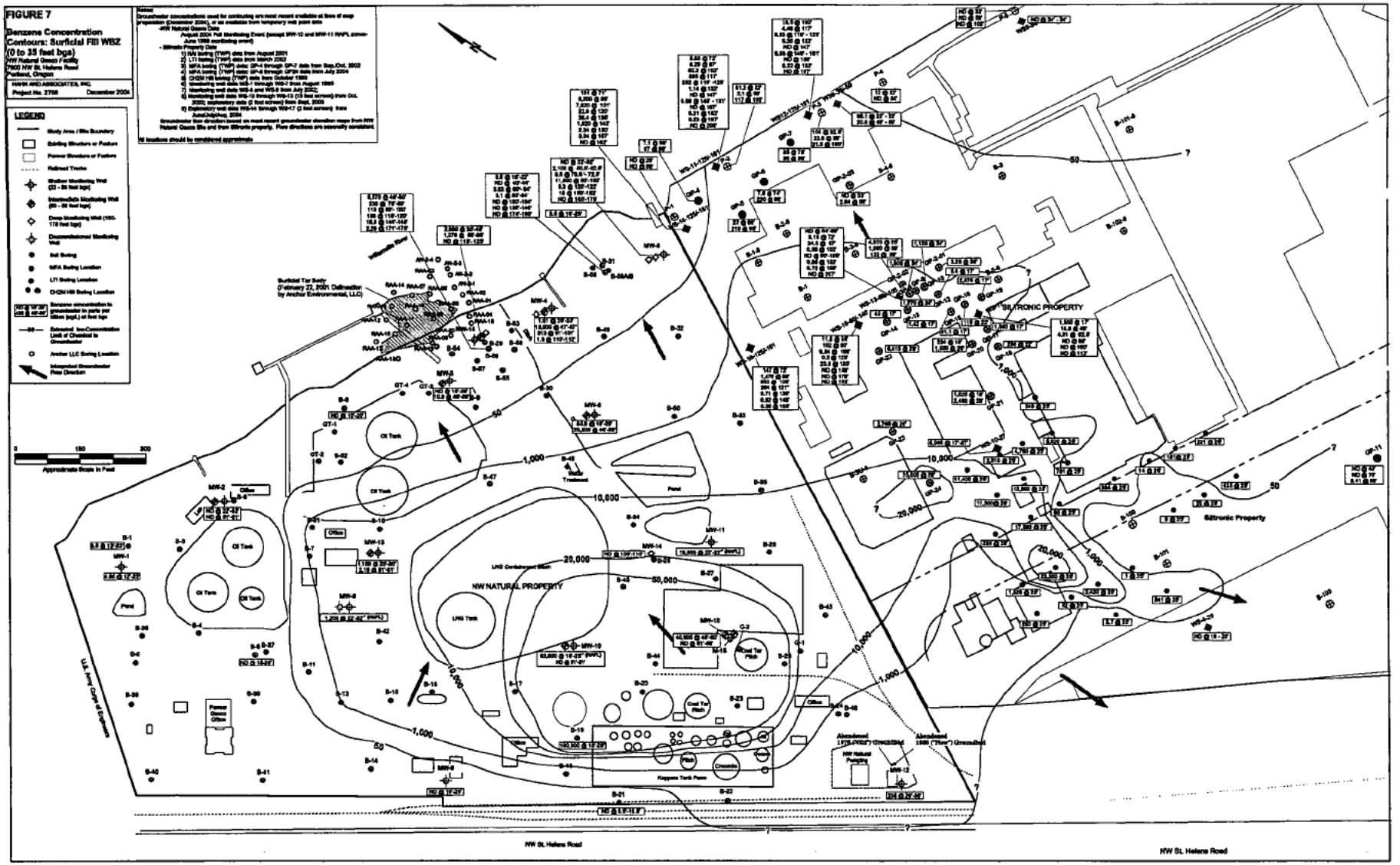


FIGURE 6B
Generalized Hydrogeologic Cross Section B-B' with Naphthalene Concentrations in Groundwater
Remedial Investigation
NW Natural, Gasco Facility
7900 NW St. Helens Road
Portland, Oregon
HAHN AND ASSOCIATES, INC.
Project No. 2708 November 2004



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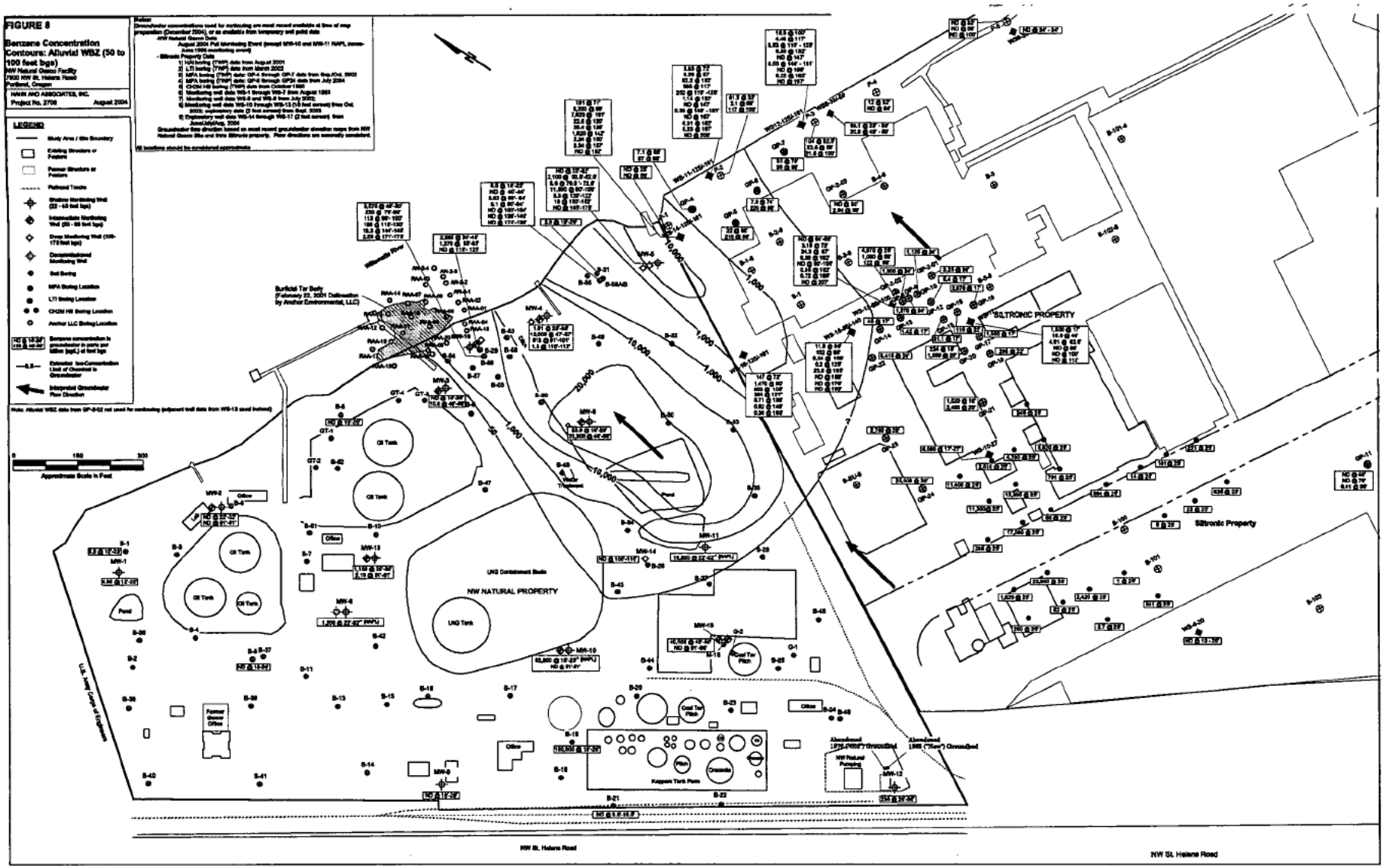

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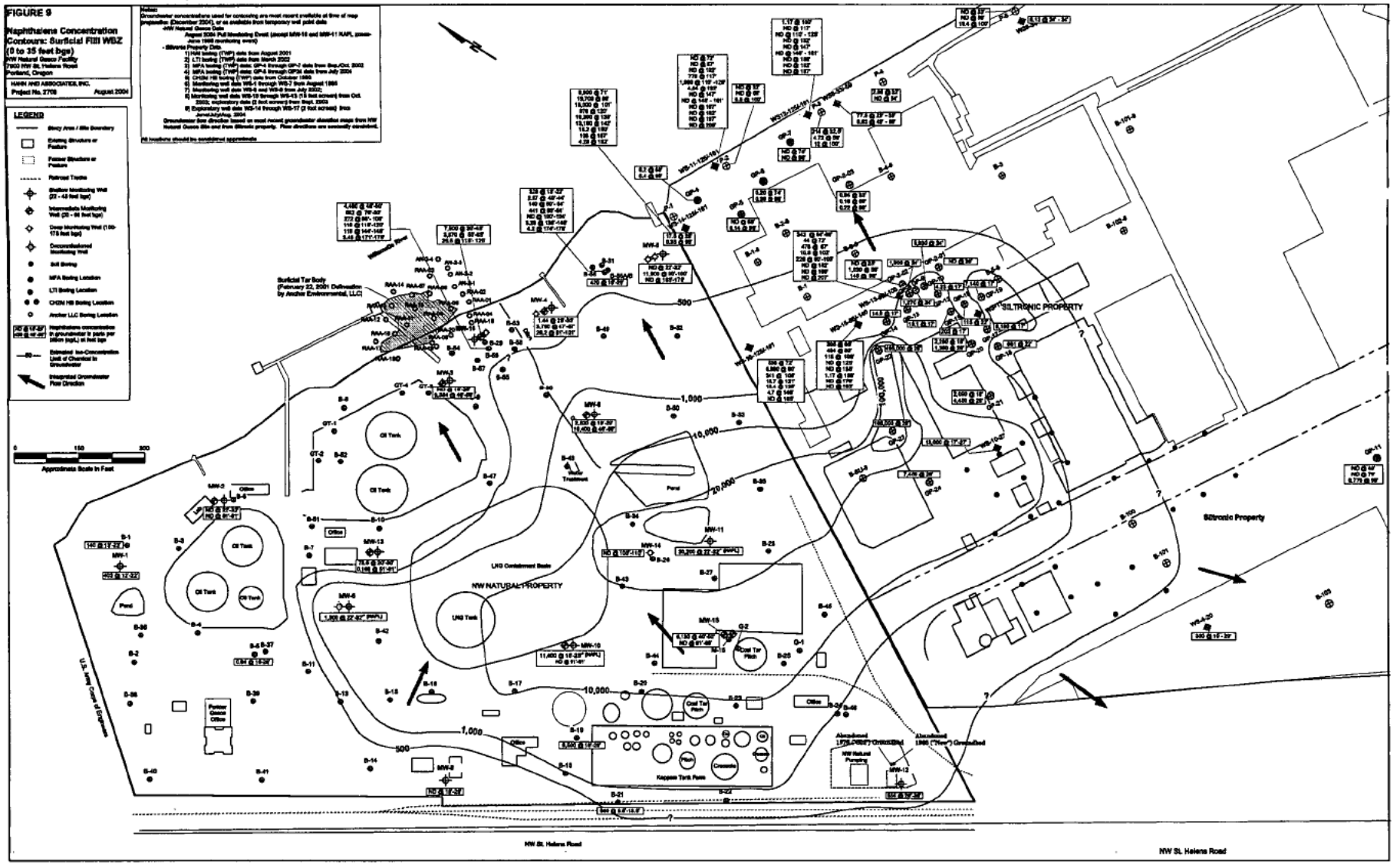

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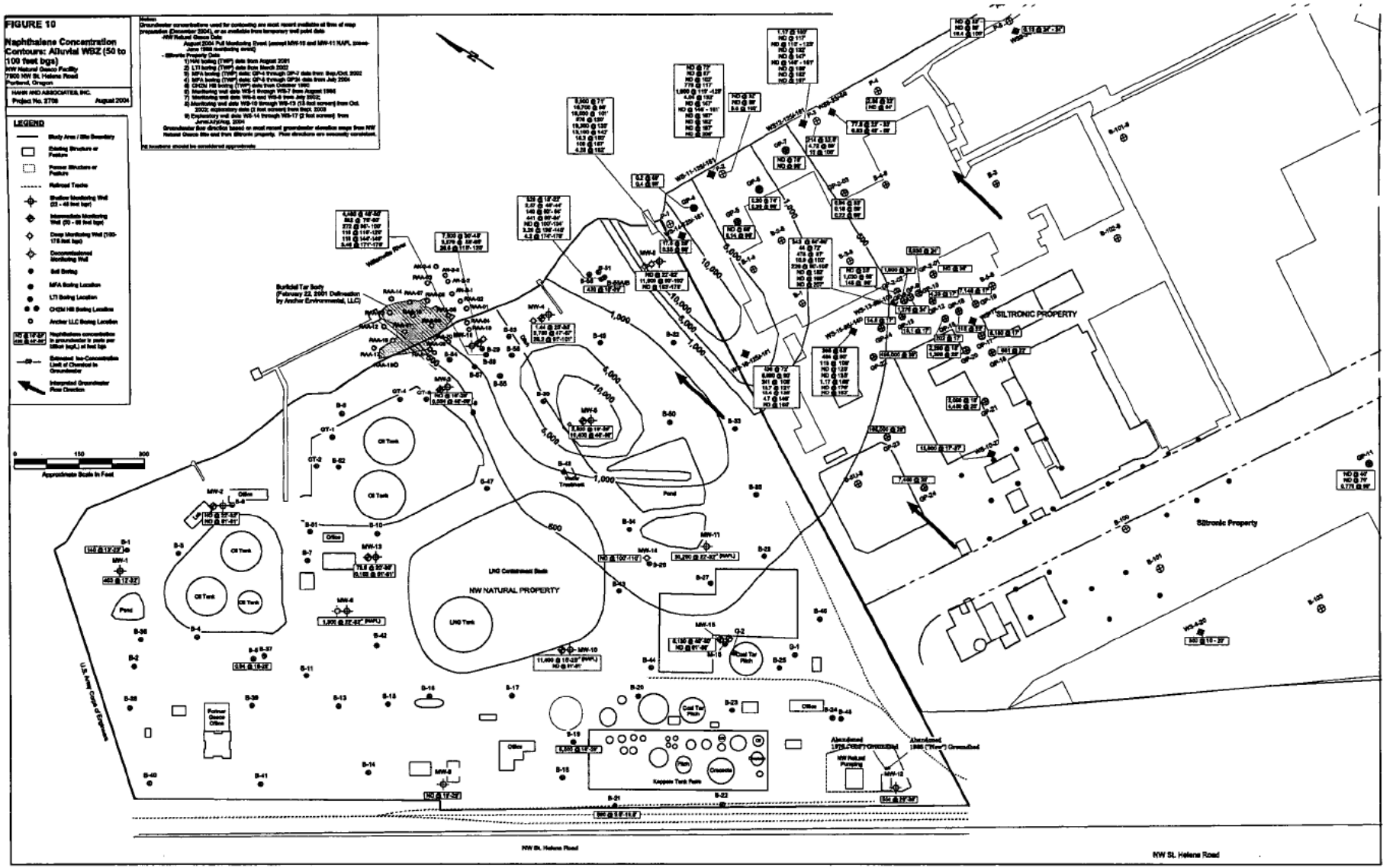

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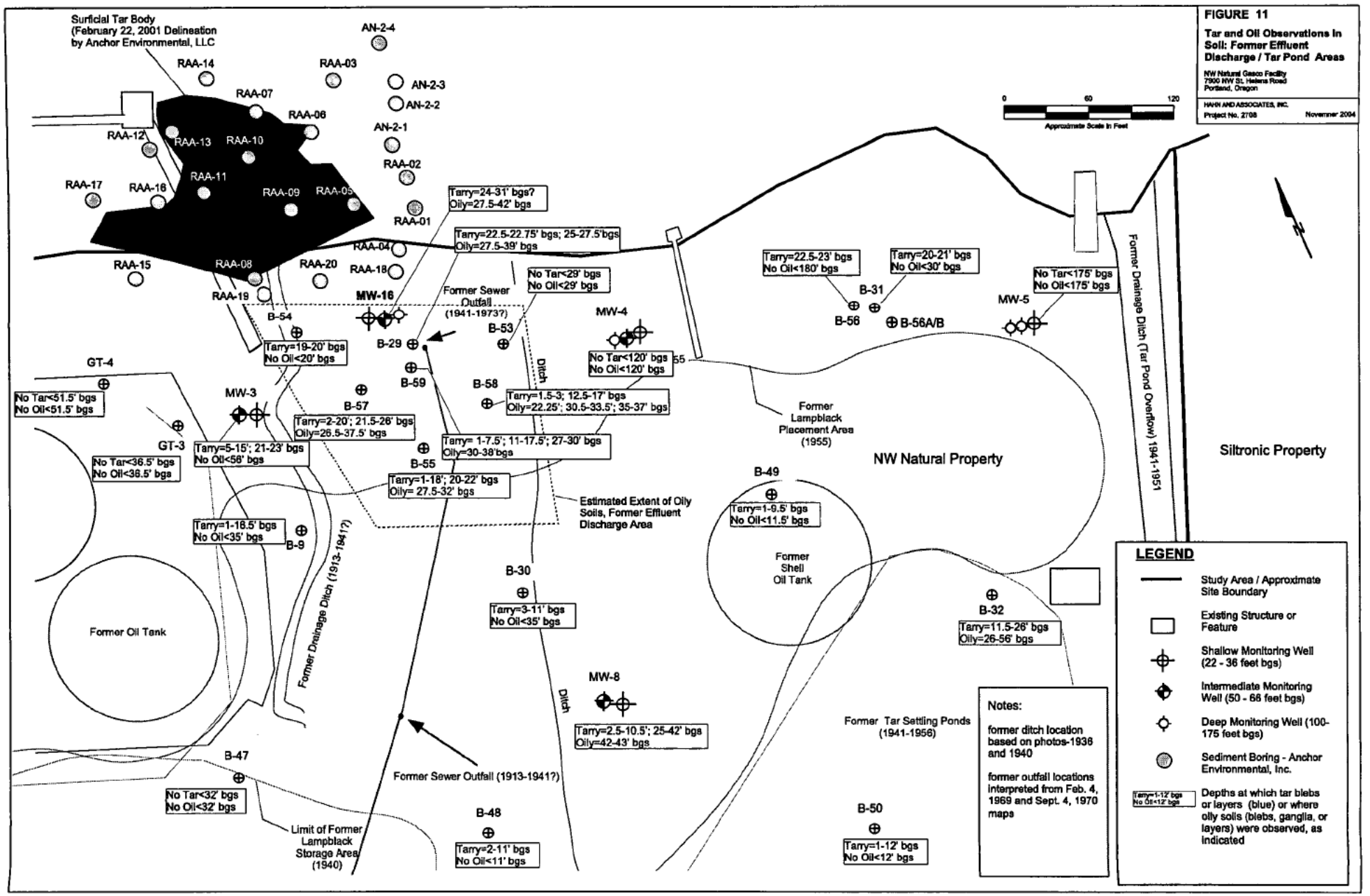

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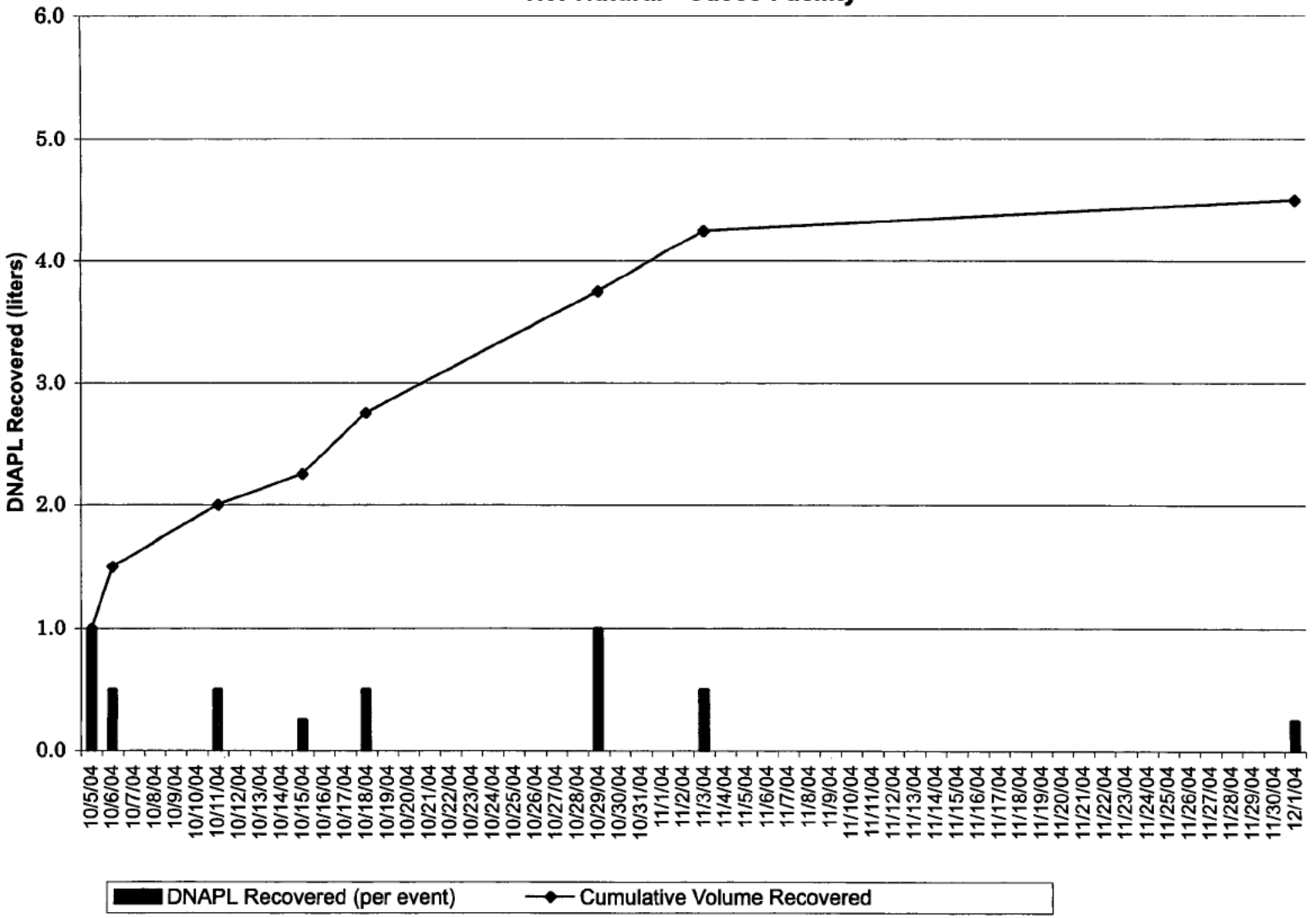
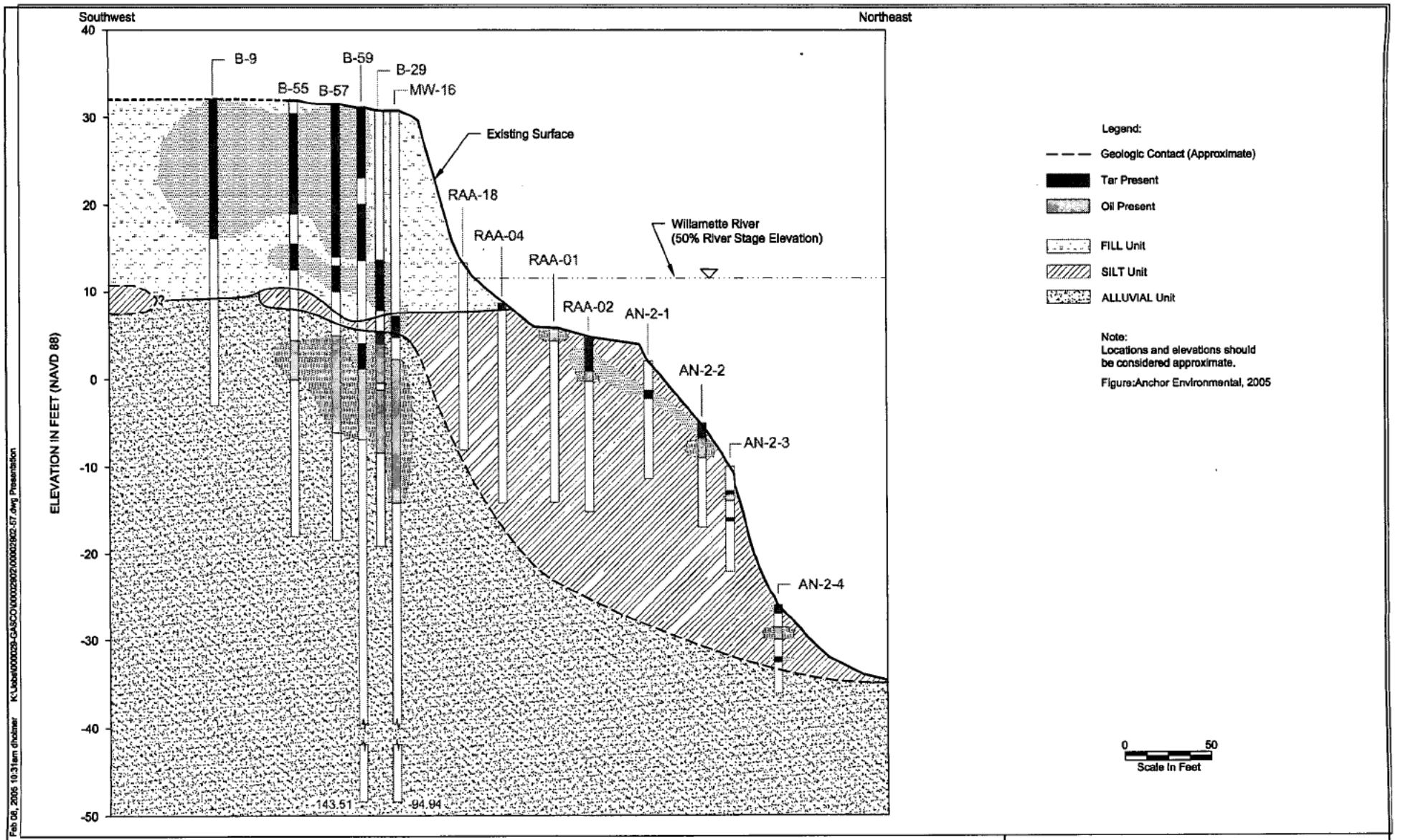
Figure 12
DNAPL Recovery Volume: Well MW-16-45
NW Natural - Gasco Facility



Updated: 3/11/05 RBE
File: 2708-12 DNAPL Recovery Chart-MW-16-45.xls/ Discharge Chart

HAHN AND ASSOCIATES, INC.
Project # 2976



ANCHOR ENVIRONMENTAL, L.L.C.

HAHN AND ASSOCIATES, INC.

ENVIRONMENTAL CONSULTANTS
434 NW 6th AVENUE, SUITE 203
PORTLAND, OREGON 97209

FIGURE 13
Schematic Cross-Section: Nearshore Area
NW Natural Gasco Site

Feb 08, 2005 10:31am dholmer K:\Jobs\000029-GASCO\00002902\00002902-57.dwg Presentation

UPDATED PHASE I SITE CHARACTERIZATION SUMMARY REPORT

Siltronic Corporation Property
7200 NW Front Avenue
Portland, Oregon

July 22, 2005

Project No. 5237

UPDATED
PHASE I SITE CHARACTERIZATION
SUMMARY REPORT

Siltronic Corporation Property
7200 NW Front Avenue
Portland, Oregon

July 22, 2005

Prepared for:

NW Natural
Portland, Oregon

Prepared by:

Hahn and Associates, Inc.
Portland, Oregon

HAI Project No. 5237

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1.0 EXECUTIVE SUMMARY

This report presents the findings of investigatory work conducted at the Siltronic site through 2004, including updates to the conceptual site model, in order to support a source control evaluation with regard to manufactured gas plant (MGP)-related contaminant migration from the Siltronic property to the Willamette River.

Research related to historical waste management and site filling activities, in conjunction with data collected and evaluated as part of this study, identified various contaminants of interest (COIs) and sources for those COIs at the Siltronic property. A summary of the main findings of this evaluation are provided below.

1.1 Contaminant Sources Attributable to MGP-Related Waste Management

Portland Gas & Coke (PG&C) operated an oil MGP on the Gasco property, north of Siltronic, from 1912 until 1956. PG&C owned a portion of the Siltronic property from 1939 until 1962, during which time waste management activities were conducted at three portions of the present-day Siltronic property, as follows:

Former 400-foot Wide Lowland Area: Immediately south of the common Siltronic/Gasco property line. This approximate 10-acre area received tar and tar/oil/water emulsifications from effluent pond overflow and from direct placement of MGP residuals between 1941 and 1956. Soil and groundwater impacts attributable to this feature are present at the Siltronic site. Estimates based on tar thickness measurements made in 1960 (2 to 6 feet of tar across much of the area) indicate approximately 40,000 cubic yards of tarry materials may have been present in this area subsequent to cessation of all MGP-related activities at the Gasco site, which occurred in 1956. It appears that materials were directed to this lowland area to minimize effluent discharges to the Willamette River. Contaminants of interest (COIs) related to this area include polynuclear aromatic hydrocarbons (PAHs), semi-volatile organic compounds (SVOCs), and monoaromatic hydrocarbons (e.g., benzene).

Former Depression or Excavation: South of the former lowland area, approximately 2 to 3 feet of tar was identified at the base of this approximate 0.5-acre apparent excavation when evaluated in 1960. This feature was first observed in aerial photographs dated 1955. Estimates based on tar thickness measurements made in 1960 indicate approximately 2,000 cubic yards of tarry materials may have been present in this area subsequent to cessation of all MGP-related activities at the Gasco site. The function of this depression / excavation is unknown. COIs related to this area include PAHs, SVOCs, and monoaromatic hydrocarbons.

Former Spent Oxide / Gas Purifier Waste Storage Pile: Company records indicate an estimated 34,000 cubic yard stockpile of spent oxide / gas purification wastes were formerly stored immediately south of the common Siltronic/Gasco property line near the western corner of the Siltronic property. Aerial photographs indicate the stockpile was present at this location between 1952 and 1966, several years after NW Natural sold the property. The final disposition of this material is unknown. COIs related to these materials include cyanide and metals (arsenic, chromium, copper, lead, nickel, zinc).

1.2 Other Contaminant Sources

Olympic Pipeline Petroleum Release(s): The Olympic Pipeline utilizes two product lines (diesel and kerosene; gasoline) within a utility corridor that traverses the central portion of the Siltronic property. Line failure resulting in product release and soil and groundwater impacts was identified near the western corner of the Siltronic facility in 1979, proximate to the 400-foot wide former lowland area. COIs related to this area include PAHs and monoaromatic hydrocarbons.

Western Transportation Petroleum Release(s): Western Transportation operated a petroleum fueling dock at the eastern corner of the Siltronic property between approximately 1930 and 1950. Possible surface staining was noted on a 1970 aerial photograph, and petroleum impacts to soil, likely attributable to these activities, have been identified. COIs related to this area include PAHs and monoaromatic hydrocarbons.

Siltronic-Related Releases: Trichloroethene (TCE) leaked from an underground storage tank system operated by Siltronic at the northern portion of the property resulting in soil and groundwater impacts. Related COIs include: TCE and degradation products; possibly tetrachloroethene (PCE) as an impurity within TCE. Other releases associated with Siltronic operations (1980-1997), also on the northern portion of the property, include chromium solution, acids, caustics, and organic wastewater releases or spills.

Off-Site Releases: Contaminants related to identified sources located south of the Siltronic property have been detected within groundwater at the Siltronic site, indicative of on-site migration. Off-site contaminants include: benzene, chlorobenzene isomers, dichlorobenzene isomers, MTBE, 2,4,5-TP, chloroform, TCE and degradation products.

Filling Activities: Site filling activities were conducted on the Siltronic property between 1966 and 1975. Filling involved placement of 1.5 million cubic yards of material on the property, including approximately 700,000 cubic yards of dredge spoils from unidentified locations and 800,000 cubic yards of material imported from a quarry. Depending upon origin, dredged sediments could reasonably have been impacted by many different sources of potential contamination, including ship traffic, industrial operations (such as MGP, wood treating facilities, shipyards, pesticide manufacturing, or petroleum terminals), agricultural activities, or urban run-off. During the time of filling activities, the property was owned by Mr. Victor Rosenfeld and Mr. H.A. Anderson.

In addition to possible sources of impact from the dredged sediments or other imported materials used as fill, observations of tar or oil during various investigations or construction activities at the Siltronic site, as well as dark soils visible in aerial photographs between 1967 and 1971, suggest the possibility that MGP-related wastes from the 400-foot wide lowland area may have been redistributed and combined with fill placed at various portions of the Siltronic property during filling activities (1966-1975), after NW Natural sold the property in 1962.

1.3 Hydrogeologic Framework

Groundwater occurs in three hydrologic zones beneath the Siltronic site: the unconfined surficial fill water-bearing zone (WBZ), the semi-confined alluvial WBZ, and the confined bedrock aquifers of the Columbia River Basalt Group.

Surficial fill consists of 700,000 cubic yards of dredge materials and 800,000 cubic yards of other imported materials. The surficial fill appears to have been impacted throughout the site by the placement of contaminated dredge spoils or other imported fill and/or by re-distribution of soils or other materials from the former lowland area at the northern end of the current Siltronic facility.

The overall groundwater flow direction within the surficial fill zone WBZ across a majority of the site is to the northeast, towards the Willamette River, where this zone becomes very thin to seasonally absent. A groundwater divide exists near the southern portion of the site, with flow within the surficial fill back to the south and toward North Doane Creek.

Responses to tidal fluctuations in the adjacent Willamette River are not expressed in the surficial fill WBZ, indicating this zone is isolated from the river. A downward hydraulic gradient between the surficial fill WBZ and the alluvial WBZ is typical, and groundwater in the surficial WBZ may migrate to the alluvial WBZ in areas where the intervening silt unit thins or otherwise does not impede downward flow.

Beneath the surficial fill WBZ, and defining the surface of the alluvial unit, is a laterally extensive fine-grained silt unit. The silt unit has been found to range in thickness from approximately 70 feet near the central portion of the site, thinning toward the river, where thicknesses of 1 to 3 feet are common at the riverbank. Beyond the riverbank, a thickening prism of silt has been identified extending 200 to 300 feet from the shoreline. It is expected that the fine-grained silt materials impede nearshore discharge of groundwater to the river. Vertical migration of contaminants through the silt unit has occurred at the northern portion of the Siltronic site (400-foot wide former lowland area), where the silt unit becomes thin and/or where the presence of rootlet zones has resulted in the fingering of non-aqueous phase liquid (NAPL) through the silt.

The alluvial WBZ consists of interbedded sands and silts underlying the silt unit, and ranges in thickness from 2 to 25 feet thick at the central and western portions of the site, to up to 175 feet near the northern corner of the site. Overall groundwater flow direction in the alluvial WBZ is to the northeast toward the Willamette River, with a more northern component of flow being present at the basal portions of the alluvial WBZ.

Water levels measured in offshore well points identified a predominant downward gradient throughout the alluvial WBZ beneath the Willamette River, indicating the river near the Siltronic property may be a losing reach. Further, distribution of COIs between the upland portion of the site and the Willamette River suggest a downward gradient below the river. Available vertical gradient data and contaminant concentration profiles adjacent to and beneath the river do not suggest the discharge of groundwater from intermediate to deep portions of the Alluvial WBZ to Willamette River sediments.

1.4 Subsurface Soils / Non-Aqueous Phase Liquid

Oil and tar, likely attributable to historical MGP waste management practices at the Siltronic site, have been identified near the base of the surficial fill unit and extending into, and beneath, the underlying silt unit within portions of the former 400-foot wide lowland area, where up to approximately 6 feet of oil have accumulated in a well screened to 85 feet below ground surface (bgs), and where oily soils have been observed as deep as 74 feet bgs. Further, dense non-aqueous phase liquid (DNAPL) has been identified in two alluvial WBZ wells screened to 125 feet bgs at a location between the former lowland area and the Willamette River. The area of deep DNAPL migration beneath, and down-gradient of, the former lowland area corresponds to the location of significant TCE concentrations in groundwater, suggesting the possibility of a co-solvency effect.

Oil or tar have not been identified beneath the silt unit at portions of the site beyond the 400-foot wide former lowland area. Further, no oil has been identified within the surficial fill unit or upper portions of the alluvial unit at any location between the former lowland area and the river sediments, and no evidence for the migration of oil or tar from the surficial fill unit to Willamette River sediments exists.

Direct observation of soil cores from upland and in-water borings indicate the upland DNAPL to be disconnected and separate relative to the shallow oily

sediments identified at off-shore locations. Further, due to the depth of the DNAPL near the shoreline (well below the base of the river); the specific gravity of the DNAPL; and the apparent presence of a downward hydraulic gradient beneath the river, the DNAPL does not appear to be a future migration threat with regard to Willamette River sediments.

Available observational data and historical research indicate oil or tar-bearing sediments off-shore of the northern portion of the Siltronic property are likely the result of historical overflow from the former effluent ponds at the southern end of the current Gasco property via the former ditch located near the current Gasco / Siltronic property boundary (1941 to 1951), and from possible discharges related to the former lowland area via the ditch formerly located approximately 400 feet upriver from the property boundary (1951 to 1956).

In addition to the 400-foot wide lowland area, oil and tar have been identified within the surficial fill unit at other portions of the Siltronic property. With exception of the former Western Transportation area, the identified oil or tar is likely a function of the import of contaminated fill onto the site and/or the incorporation/redistribution of contaminants into the fill at the time of placement. Oil identified in soils at the former Western Transportation area appears to be the result of spills of diesel or fuel oil to the former ground surface from previous fueling operations conducted in that area.

1.5 Groundwater Quality

Oil and tar historically placed within the former lowland area as a result of effluent pond clean-out and overflow are a source area for identified aromatic hydrocarbon (e.g., benzene), PAH (e.g., naphthalene), and semi-volatile organic compound (SVOC) impacts identified within the fill and alluvial WBZs beneath this area, with a sharp decline in contaminant concentrations to the south, beyond the limit of the former lowland area. Additionally, the Olympic Pipeline release area is present within this portion of the site, and appears likely to be contributing to the identified aromatic hydrocarbon concentrations in groundwater.

Benzene and naphthalene, key constituents with regard to evaluating contaminant distribution that may be related to the oil and tar, have been used, in part, to describe contaminant extent within groundwater beneath the Siltronic site. With this regard, the benzene plume extends to the Willamette River shoreline within the surficial fill WBZ only near the northern corner of

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the Siltronic site (down-gradient from the former lowland area), and then only at very low concentrations. The naphthalene plume does not extend to the Willamette River shoreline within the surficial fill WBZ at any location.

Vertical migration of petroleum hydrocarbon-related contaminants from the surficial fill WBZ to the underlying alluvial WBZ is limited to the northern portion of the Siltronic property, correlating to the area of deeper DNAPL (oil) penetration in the 400 foot wide lowland area. The hydrocarbon plume has been delineated laterally and vertically along the shoreline, extending across a depth interval of approximately 60 to 150 feet bgs, and laterally along the shoreline from a location north of the common property boundary with Gasco, to a location approximately 375 to 450 feet upriver of the property line, correlating with the location of the former lowland area.

Available data from in-water borings suggest the upland petroleum hydrocarbon plume is predominantly migrating beneath the river without discharge to shallow sediments, with the extent of the upland benzene and naphthalene plume components having been delineated in the upriver direction.

Directly impacted river sediments at certain areas off-shore of Siltronic appear to be acting as a primary source of dissolved phase naphthalene in the surface sediment porewater. These impacts, derived from placement of contaminated material at the surface, extend downward into the sediments, and based on the profile of decreasing concentrations with depth, may be a source of contamination to deeper groundwater. If groundwater discharging from the upland were the source of the observed porewater concentrations, concentrations would more likely increase, rather than decrease, with depth. Benzene and naphthalene impacts to groundwater at the southern and western portions of the Siltronic site are primarily limited to the surficial fill WBZ, with impacts extending to the south as a function of a localized southern component of flow toward North Doane Creek and North Doane Lake in this area. The source for the impacts identified at this portion of the site appears to be the presence of oily zones within imported fill.

Cyanide impacts to groundwater are present in the surficial fill WBZ across much of the Siltronic property, with the highest concentrations being identified at the central portion of the site and extending to the shoreline down-gradient of the former 400-foot wide lowland area. Within the underlying alluvial WBZ, concentrations greater than 0.5 parts per million (ppm) have been identified to depths of up to 100 feet bgs at the northern

portion of the Siltronic site. One potential source for the identified cyanide impacts could be spent oxide / purifier box wastes formerly stored at the northern end of the property. However, imported fill is another potential source for the cyanide, especially since the greatest cyanide concentrations in soil (greater than 1,000 ppm) were identified in fill at areas well away from the area where spent oxide was stored, and soils containing the highest cyanide concentrations did not contain field screening evidence of the presence of MGP-related materials (e.g., no wood chips, spent lime, prussian blue coloration, tar or oil).

1.6 Identification of Potential Contaminant Transport Pathways

Based on the preceding, potential contaminant transport pathways between the upland portion of the site and the Willamette River, to be further evaluated as part of an updated source control evaluation document, include the following:

- Groundwater Pathway
- Surface Water Runoff Pathway (e.g., Site Outfalls and City of Portland Outfall 22C)
- Catch-Basin Sediment Transport Pathway
- Soil Erosion Pathway (unarmored areas of embankment)

1.7 Preliminary Data Gap Identification

The following areas have been identified where additional data appear needed to fully support completion of a source control decision at the site with regard to former MGP-related waste management areas.

- Due to the potential for shallow groundwater to discharge to North Doane Creek and/or into the large diameter buried pipe leading to the Willamette River at City of Portland Outfall 22C, additional surface water investigation activities are currently being conducted as per a previously-approved work plan. Results of these investigation activities, as well as source control evaluation related to this feature, will be reported under separate cover.

- The lateral extent of the petroleum hydrocarbon plume beneath the river at the northern portion of the Siltronic property (former lowland area) has not been delineated in the down-gradient direction off-shore to the northeast, and it is not clear what the groundwater discharge/recharge regime may be with regard to this plume further into the main channel. It is anticipated that additional off-shore characterization will be necessary to satisfy these data gaps.

- Additional groundwater quality characterization down-gradient of the former depression/excavation area south of the former lowland area is warranted in order more completely to evaluate the potential for deep impacts (e.g., greater than 100 feet bgs) that may be attributable to this area.

- Additional investigation activities appear warranted with regard to the former spent oxide storage pile area to evaluate whether cyanide impacts from historic spent oxide storage may be contributing to the cyanide concentrations observed in groundwater at the site.

2.0 INTRODUCTION

2.1 Purpose

NW Natural retained Hahn and Associates, Inc. (HAI) to complete Focused Remedial Investigation (RI) activities at the Siltronic Corporation (Siltronic) property, 7200 NW Front Avenue, Portland, Oregon (Figures 1 and 2). Focused RI activities at the property have been completed as per a Unilateral Order (DEQ No. ECVC-NWR-00-27) issued jointly to NW Natural and Siltronic by the Oregon Department of Environmental Quality (DEQ), dated October 4, 2000. The purpose of the Order is to provide for completion of RI activities sufficient in scope to "determine the nature and extent of releases of hazardous substances to Willamette River sediments from certain property in Multnomah County, and to develop and implement source control measures, if necessary."

Based on the preceding, the objectives of the Focused RI activities completed by NW Natural at the Siltronic property have been established as follows:

- To identify, characterize, and estimate the magnitude of any ongoing un-permitted discharges of hazardous substances from the Siltronic site to the Willamette River sediments.
- To obtain sufficient information to allow for an evaluation of the need to implement source control measures at the site necessary to prevent the ongoing discharge of unacceptable levels of hazardous substances, if any, to Willamette River sediments.
- To characterize sources of identified ongoing unacceptable risk to Willamette River sediments for the purpose of evaluating, developing, and implementing source control measures sufficient in scope to provide for the mitigation of the identified unacceptable risk.

NW Natural is conducting those portions of the investigation relevant to possible manufactured gas plant (MGP)-waste management related impacts. Siltronic is conducting investigatory activities related to chlorinated solvent impacts identified during the Focused RI. NW Natural understands that

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activities related to Siltronic's chlorinated solvent-related investigation will be documented by Siltronic and will be submitted independently by Siltronic to the DEQ.

An earlier version of the *Phase I Site Characterization Report* was provided to DEQ on November 7, 2003 (HAI, 2003), as was a November 2003 *Source Control Evaluation Report* (Anchor, 2003). DEQ provided comments on the November 2003 *Phase I Site Characterization Report* in correspondence dated April 23, 2004 (DEQ, 2004). Accordingly, the *Updated Phase I Site Characterization Summary Report* has been revised in response to DEQ's comments. Further, because additional information was collected by Siltronic with regard to the characterization of soils and groundwater at the nearshore downstream portion of the site in 2003 and 2004, DEQ requested that NW Natural wait to complete the *Updated Phase I Site Characterization Report* until these results were available and could be incorporated. Results of these additional investigatory activities have been incorporated into this updated report. The updated information provided herein will form the basis for revisions to the November 2003 *Source Control Evaluation Report* completed for the subject property by Anchor.

2.2 Scope of Work

The Focused RI work activities summarized in this report, primarily carried out at the site between August 2001 and July 2002, were performed in accordance with a DEQ-approved document entitled *Final Focused Remedial Investigation Work Plan, Wacker Siltronic Corporation Property, 7200 NW Front Avenue, Portland, Oregon,* dated June 1, 2001 (HAI, 2001) and a March 7, 2002 *Supplemental RI Work Plan* (HAI, 2002). The overall scope of work for investigatory activities conducted by NW Natural at the Siltronic property included the following:

- Completion of a geophysical survey along the riverfront at inferred locations of former creek channels and utility corridors;
- Installation of 11 push probe borings (P-1 through P-11) for soil and/or groundwater sampling along the Willamette River shoreline down-gradient of potential contaminant source areas;
- Installation of 3 monitoring wells (WS8-33, WS8-59, and WS-9-34) along the Willamette River shoreline for the purposes of evaluating seasonal trends in water quality and groundwater elevations;

- Completion of rising-head aquifer slug tests on the 3 newly installed monitoring wells for the purpose of estimating hydraulic conductivities;
- Completion of a short-term (2-week) continuous measurement water elevation monitoring event at select Siltronic and NW Natural wells, and the Willamette River;
- Collection of 5 surface soil samples at the top of the embankment along the Willamette River shoreline;
- Collection of sediment samples from 2 stormwater catch basins;
- Collection of a soil sample from beneath the Fab 2 area stormwater outfall;
- Collection of stormwater samples from the Fab 1, Fab 2, and Administration Building outfalls;
- Laboratory analysis of soil, catch basin sediment, surface water, and groundwater samples for VOCs; SVOCs, metals, and cyanide;
- Discussion with Siltronic personnel regarding observations of soil and subsurface conditions during facility development and operation;
- Historical aerial photograph review and evaluation of potential waste placement activities;
- Compilation and evaluation of subsurface data available for the site as generated by others as part of numerous other investigations conducted at the site.

2.3 Report Organization

This report is organized as follows:

- Section 1 is the Executive Summary, which describes the primary findings and conclusions of the completed investigatory activities
- Section 2 provides a summary of the purpose, objectives, and scope of work for the investigation activities, as well as a description of the report's organization.
- Section 3 provides a summary of site background, including site description and a review of known potential contaminant sources, contaminants of interest, and identification of potential contaminant migration pathways to the Willamette River.
- Section 4 provides a summary of the site characterization activities conducted at the site by NW Natural and others.
- Section 5 describes the analytical testing and data validation conducted as part of the investigation.
- Section 6 provides a summary of investigation results, including discussions regarding site hydrogeology and contaminant distribution, as it relates to the project objectives.
- Section 7 provides conclusions based on the investigatory activities completed to date, as well as a summary of existing data gaps and recommendations for additional investigatory activities.

3.0 SITE BACKGROUND

A summary of the site history, physical setting, potential contaminant sources, contaminants of interest, and potentially complete contaminant migration pathways between the uplands and the river are presented within this Section. All historical aerial photographs referred to herein are included in Appendix A.

3.1 Site Location and Description

Siltronic operates a silicon wafer fabricating facility on an 85-acre site along the western bank of the Willamette River in a section of northwest Portland zoned by the City as "Heavy Industrial".

The property, situated immediately northwest of the Burlington Northern / Santa Fe (BNSF) railroad bridge, is generally rectangular in shape. Property boundaries include the Willamette River to the northeast; BNSF railroad berms to the southwest and southeast; and a property line shared with NW Natural and Koppers Industries, Inc. (KII) to the northwest (i.e., the former Gasco-facility property). US Highway 30 (NW St. Helens Road), an automobile storage facility, a former rock quarry, and the Tualatin Mountains lie beyond the BNSF right-of-way to the southwest. Beyond the southeastern BNSF right-of-way lie the Rhone-Poulenc/Aventis CropScience, ESCO Corp., Gould / NL Industries, and Elf Atochem North America properties, all of which are undergoing environmental investigation and/or cleanup.

Presently, the Siltronic site is approximately 50% to 60% developed with two silicon wafer fabrication plants (Fab 1 and Fab 2) and associated wastewater treatment plants and structures, as well as an administration building, storage buildings, parking facilities, and a Portland General Electric (PGE) substation (Figure 2).

Additional site features include a narrow greenway that has been created along the full riverfront portion of the property, as well as an approximate 100-foot wide City of Portland utility easement that divides the property from the northwest to the southeast (Figure 2). Underground utilities that exist

within the City of Portland easement include oil, gasoline, natural gas, water, and sewer pipelines, as well as electric and telephone cables.

3.2 Pre-Development Conditions

According to a Site History report prepared by the Portland Development Commission (PDC, 1985), with the exception of the adjacent railroad construction, the Siltronic site remained primarily undisturbed prior to 1900. The southern portion of the undeveloped property contained part of a small, shallow lake (reportedly less than 5 feet deep) known as Doane Lake, which was bisected by the present BNSF railroad bridge at the time of its construction in 1906 (see Figure 1 and the 1936 aerial photo). The remainder of the property consisted primarily of low lying wooded wetlands, prone to seasonal flooding. The PDC report indicates that a small creek traversed the property, with its source being the Tualatin Mountains immediately across NW St. Helens Road in what is now Forest Park. As depicted in aerial photographs of the site taken in 1936 and 1940, it appears that Doane Lake was an additional headwater for this creek.

Additionally, a 1906 elevation survey map (pre-development) of the adjacent Portland Gas & Coke Company (PG&C) property to the northwest of the present-day Siltronic site, depicts a small northwest-southeast trending creek situated approximately midway between the Tualatin Mountains and the Willamette River. Although the map does not extend its coverage to the present day Siltronic property, it would seem likely that this creek would be a drainage associated with the former Doane Lake located at the southwest corner of the Siltronic property. As evidenced by 1936 and 1940 aerial photographs, with the development and partial filling of the PG&C property (circa 1913), this creek was diverted to the northeast, flowing into the Willamette River near the present day NW Natural / Siltronic property line until 1951, at which time the creek was diverted approximately 400 feet further upstream (Figure 3).

3.3 Ownership, Filling and Site Development Activities

PG&C purchased the current NW Natural Gasco property (then undeveloped) in 1910. PG&C built and operated an oil gasification facility on the current NW Natural portion of the property between 1912 and 1956. Company records indicate that site preparation involved the filling of approximately 10 acres of low-lying land (south and western portion of the

current Gasco property) with 205,381 cubic yards of material dredged from the Willamette River. Pre-development site conditions, as well as site filling activities, are shown in photographs dated 1912 (Appendix A).

Based on a Title review conducted by the Portland Development Commission (1985), PG&C purchased a portion of the current Siltronic site from the Spokane, Portland, and Seattle Railroad in 1939. NW Natural sold the property in 1962 to Mr. Victor Rosenfeld and Mr. H.A. Anderson, who subsequently sold the property to the City of Portland, Portland Development Commission in 1978. Siltronic purchased the property from the City of Portland in 1978.

As provided within a Bridgewater Group report entitled *Supplement to DEQ's Strategy Recommendation for the Wacker Siltronic Facility* (Bridgewater Group, 2000), filling activities associated with the Siltronic property were initiated in May 1966 and were completed by December 1975. The property owners (Rosenfeld and Anderson) had an agreement with the Spokane, Portland, and Seattle Railroad to fill the property to a minimum elevation of 30 feet mean sea level (msl) by the end of 1973, and to construct industrial buildings on the property by the end of 1978 (PDC, 1985).

Approximately 1.5 million cubic yards of imported material were placed on the Siltronic property as part of filling activities (Bridgewater Group, 2000). The fill consisted of rock from a quarry located across Highway 30 immediately west of the site, as well as more than 700,000 cubic yards of material dredged from the river (from an unspecified location) by the Port of Portland (PDC, 1985). By 1967, as part of filling and site development activities, the channelized creek that formerly ran across the northern portion of the property had again been re-channelized to route water through a ditch and culverts around the southern edge of the Siltronic property, where it currently discharges to the Willamette River at an off-site location through City of Portland Outfall 22C, located between the property's southern boundary and the BNSF Willamette River rail crossing. A 1978 aerial photograph provides a view of the Siltronic site subsequent to filling and prior to building construction.

Construction of Siltronic's new plant began immediately after the property was purchased in 1978 with plant operations commencing in March 1980.

The facility infrastructure presently includes manufacturing, administrative, and storage structures, wastewater treatment facilities, parking, and an electrical substation. Facility-related underground utilities include water, natural gas, sewer, and electric. Site utilities that intercept, or nearly intercept, the river embankment are as follows (from down-stream to up-stream):

- Combined effluent outfall (Fab 1 area stormwater and treated process effluent);
- Fab 2 area stormwater outfall;
- 16-inch diameter abandoned natural gas pipeline (pre-development);
- Administration Building downspout outfall;
- 96-inch diameter abandoned concrete masonry sewer pipe (pre-development – a former City of Portland sewer line).

These utilities, as well as other site utilities (e.g., water, gas, sewer), are depicted on Figure 4.

3.4 Background - PG&C Operations and Waste / By-Product Generation

PG&C built and operated an oil gasification plant on the current NW Natural property, north of the Siltronic property, between 1912 and 1956. PG&C owned a portion of the Siltronic property from 1939 until 1962, during which time company records and aerial photograph review indicate waste management activities were conducted on the northern portion of the Siltronic property proximate to the current NW Natural / Siltronic property boundary. No MGP production areas were located on the footprint of the current Siltronic property.

In order to better understand the nature of MGP-related waste management areas historically located on the Siltronic property, PG&C historical operations, including a description of products, by-products, and wastes, are described herein.

An extensive description of the production methods used at the PG&C Gasco site as part of oil gas manufacture is provided within an August 1939 document entitled *Report on Portland Gas & Coke Company* (Ebasco Services, Inc. and PG&C Co.); a 1941 paper entitled *Aromatics, Gas and Coke from Heavy Petroleum* (Hall, 1941); and a 1952 paper entitled *Oil Gas Manufacture, A Staff-Industry Collaborative Report* (Hull and Kohlhoff, 1952). The following summary of historical MGP operations at the Gasco site was primarily obtained from review of these sources, as well as available historical company records.

Table 1 identifies by-products or wastes generated by the Gasco MGP, including a description of the material and the associated contaminants of interest.

The Gasco facility used the "Pacific Coast Oil Gas Process" throughout the plant's life. This process involved thermal cracking of oil at near atmospheric pressure in a cylindrical shell containing heated refractory checker brick. In this process, heavy oils were introduced to the gasified vessel after pre-heating the checker brick to 2,000°F. These oils were then thermally cracked as they moved downward through the gasifier producing gas, lampblack, and tar. The lampblack and tar were subsequently removed from the gas after which the gas passed through purifiers where sulphur and other impurities were removed. The lampblack was recovered in wash boxes or thickeners, dried, and then fed to a rotary press, producing cylindrical or pillow shaped briquettes.

In 1923, the gasification process was modified to optimize aromatic generation and light oil recovery for use as motor fuel. Tar recovery and refining were incorporated into the process in 1925 to provide tar for use as a road binder. In 1941 a coke oven was installed at the plant to generate electrode grade coke and high BTU oil gas from feedstock oil (PS-400) and lampblack for re-forming in the existing retorts. The coke ovens produced oil gas and the by-products coke, tar, light oil, and creosote oil.

In addition to the preceding by-products, spent oxide (also called purifier box wastes) was generated from the use of iron oxide (iron-impregnated wood chips) or lime as solid reactants for the removal of sulfur from the oil gas. Spent oxide is primarily a blend of iron sulfides, sulfur, iron oxides and wood substrate and/or lime, however spent oxide material may also contain hydrocarbons that passed through the upstream gas processing equipment, as well as metals (typically arsenic, chromium, copper, lead, nickel, and zinc)

and cyanides that would be removed from the gas along with the sulfur. Concentrations of cyanide gas, however, were of primary concern only within coal gas, and not at former oil gasification sites such as Gasco (Hayes, 1996).

Due to the large scale of operations at the Gasco site, economic recovery of many of the by-products typically wasted at other plants of this type was possible, thereby reducing the quantities of waste from this site. According to information provided within the 1952 Hull and Kohlhoff paper, gasification by-products were refined to produce the following products at the Gasco site:

- lampblack briquettes
- soft pitch
- specification tars and tar distillates
- specification creosote
- hard pitch
- electrode grade pitch
- crude naphthalene
- crude benzene
- motor fuel
- toluene
- xylene
- solvent naphtha

Appendix B provides a block flow diagram of products manufactured at Gasco in 1951. Also included in Appendix B are flow diagrams of various product refining and recovery processes, as obtained from a *Report on Generator Oil Gas Operations* presented by the Portland Gas & Coke Company to the American Gas Association in 1951 (PG&C, 1951).

Once natural gas became available in the 1950s, much of the MGP plant was shut down, with plant operations ceasing in 1956. With the arrival of

natural gas, PG&C changed its name to the Northwest Natural Gas Company, and is now known as NW Natural. The Northwest Natural Gas Company constructed a liquefied natural gas (LNG) plant at the site in the late 1960's, at which time most of the old gasification plant was demolished and associated underground utilities were removed. Appendix B includes a map of the MGP layout at the time of closure in 1956.

3.5 Potential Contaminant Sources

The Strategy Recommendation report prepared by DEQ in October 1999 (DEQ, 1999), and the follow-up Supplement to DEQ's Strategy Recommendation report (Bridgewater Group, 2000), contain detailed summaries of previously identified site contamination, as well as a description of known chemical releases reported to have occurred at the Siltronic site subsequent to site development. An extensive review of historical MGP-related records and aerial photographs available for the property has also been conducted to evaluate areas of interest on the subject property.

Based upon these sources of information, a description of potential contaminant sources at the Siltronic property, including a description of one-time spills or releases known to have occurred at the Siltronic site, are provided below. Historical aerial photographs referred to herein are provided in Appendix A.

3.5.1 MGP-Related Waste Management Areas

PG&C owned a portion of the Siltronic property from 1939 until 1962, during which time company records and aerial photograph review indicate waste management activities were conducted at three locations on the northern portion of the Siltronic property proximate to the current NW Natural / Siltronic property boundary, as described below:

3.5.1.1 Former 400-Foot Wide Lowland Area

The area of primary interest on the Siltronic property potentially impacted by PG&C historical operations is an approximate 400-foot wide strip of former low-lying property located immediately south of the present day NW Natural / Siltronic property boundary (see Figure 3 and the 1952 aerial photo). The low area was bounded by a berm and apparent natural rise in ground surface in the up-river direction (e.g., approximately 400 feet from the present property line with NW Natural), as well as a rise in ground surface between the lowland area and the Willamette River.

Based upon historic company records, as well as interpretations of aerial photographs, MGP waste management-related activities are known to have occurred within the former 400-foot wide lowland area described above (approximately 10 acres), including overflow from the Gasco property settling ponds and placement of tar/lampblack derived from cleanout of the effluent ponds onto the ground surface in the 400-foot wide lowland area. Additionally, aerial photographs suggest lampblack storage at the Gasco site may have extended onto the extreme northern corner of the 400-foot wide lowland area (Figure 3).

The Gasco effluent ponds, materials from which apparently overflowed to or were placed upon the lowland area, were constructed at the southeastern portion of the current Gasco site in the late 1930s and came on-line in 1941 (CDM, 1987). Aerial photographs taken between 1952 and 1961 show one large and one small effluent pond (Gasco property) and the adjacent lowland area (Siltronic property). The effluent settling ponds on the Gasco property received wastes from tar boxes and lampblack dryers (tar, lampblack, and oil-water emulsions), and were meant to reduce the discharge of effluent to the river. As shown on the aerial photographs, the smaller effluent pond partially extended onto the Siltronic property (Figure 3).

PG&C records indicate the larger effluent pond was designed to overflow via a weir into the western end of the small effluent pond. This pond, in turn, was designed to overflow via a weir on the eastern end into a channel that directed discharge to the Willamette River at a point near the current NW Natural / Siltronic property line (Figure 3). Records indicate the top of the berms surrounding the effluent ponds ranged in elevation from

approximately 21 to 26 feet msl (approximately 7 to 12 feet below the existing ground surface at Siltronic).

PG&C records further indicate that to maintain capacity within the effluent ponds and to minimize overflows into the river, the ponds were periodically cleaned-out. Effluent pond clean-out reportedly involved use of drag lines and trucks to place the "soft/tarry substance" on the ground surface immediately south of the ponds (i.e., the former adjacent low area at Siltronic). To further address effluent pond overflows to the river, in 1951 a surface water channel located immediately south of these ponds (at the current common property line between NW Natural and Siltronic) was relocated 400 feet further south with a berm constructed immediately north of the new channel. The southern effluent pond outlet that previously overflowed to the river near the NW Natural / Siltronic property line was blocked at that time, with effluent pond overflows instead being directed to the lowland area which roughly corresponds to the northern 400 feet of the present-day Siltronic property. As such, MGP effluents were directed to the northern portion of the present-day Siltronic property between 1951 and the time of MGP closure in 1956. Effluent overflows from the northern portion of the Siltronic site to the Willamette River during this timeframe, if any, would have likely occurred via the ditch at the southern end of the 400-foot wide lowland area. Figure 3 and aerial photographs from 1952 through 1964 depict the ponds and the adjacent lowland area and drainage ditch.

Facility records indicate that soundings taken by CH2M HILL with a 1.5-inch diameter probe in January 1960 identified between 0.6 feet to 14 feet of soft tar within the 400-foot wide lowland area (thickest in proximity to the small effluent pond located on the property line. Using these data, it is estimated that approximately 40,000 cubic yards of tar may have been present within the lowland area at that time.

As shown in aerial photographs, grading and filling of the lowland area on the Siltronic property began in 1966. Filling this portion of the Siltronic property appears to have taken place through 1973 (May and August 1973 aerial photographs). Fill material in the 400-foot lowland area included dredge material (1971 and May 1973 aerial photographs), and light-colored material that appears to have been imported by dump trucks (October 1966 and May 1973 aerial photographs).

3.5.1.2 *Former Depression or Excavation*

A 1955 aerial photograph depicts an approximate 150 foot diameter excavated area or depression surrounded by a dirt road in the east/central portion of the Siltronic property (Figure 3 and March 1955 aerial photograph). The dirt road appears to extend from the 400-foot wide lowland area to this depression (1955 and 1956 aerial photographs). The southern one-quarter of the depression is dark-colored (1956, 1961, and 1964 aerial photographs). Company records indicate that soundings within this depression taken by CH2M HILL in January 1960 show between 2 and 3 feet of tar on the ground surface, indicating that tarry wastes accumulated at this location. Based on the soundings data, it is estimated that approximately 2,000 cubic yard of tar may have been present within the depression subsequent to the cessation of all MGP-related activities at the Gasco site. The depression is not observed in photographs after 1964. The function of this depression / excavation is unknown.

3.5.1.3 *Spent Oxide/Purifier Box Wastes Storage Pile*

A stockpile of spent oxide/purifier box waste material was identified in aerial photographs of the site from the 1950s and 1960s, with the pile located near the southwestern end of the common property line currently shared between Siltronic and NW Natural. Company records indicate this pile contained an estimated 34,000 cubic yards of spent oxide material. The stockpile of dark-colored spent oxide material is first observed in 1952 (April and July 1952 aerial photographs), with most of the pile situated on the present-day Siltronic property. Aerial photographs indicate the stockpile was present at this location between 1952 and 1966, several years after NW Natural sold the property. The final disposition of this material is unknown.

3.5.2 *Other Contaminant Sources*

3.5.2.1 Former Western Transportation Terminal

Western Transportation, which operated a fueling dock at the southeast corner of the Siltronic Facility had two large above ground fuel tanks. The occurrence or manner of leaks, spills or waste disposal activities associated with the former Western Transportation facility are unknown; however, according to DEQ (1999), an EPA analysis of a 1970 air photo concluded that soils in this area were stained. The 1970 aerial photograph (Appendix A) indicates possible areas of discolored soils (partially obscured by shadows) within the immediate vicinity of the Western Transportation structures (Figure 3).

The specific types of fuel oil stored and dispensed at the Western Transportation facility are not known, but diesel oil or fuel oil would be typical for this type of operation. Diesel oil contains petroleum hydrocarbons, including benzene, toluene, ethylbenzene, xylene (BTEX) compounds, polynuclear aromatic hydrocarbons (PAHs), the bulk of which are of lower molecular weight, and PAH-related compounds such as methylnaphthalenes. Diesel oil may also contain trace amounts of metals (Potter and Simmons, 1998).

Site plans also indicate an abandoned pipeline in the vicinity of the former Western Transportation facility. Siltronic plans (Drawing P11054.A1, December 1978) depict a 16-inch diameter abandoned line labeled "G" that runs from the NW Natural property, across the Siltronic site, and to the embankment in the vicinity of the former Western Transportation facility. One other utility labeled as "G" on the Siltronic plan references an existing 10-inch diameter natural gas line. NW Natural maps, although they do not show the location of the 16-inch line on the Siltronic property, do indicate the installation of a 10¾-inch diameter natural gas line on the property in 1978, and the abandonment of a 16-inch natural gas line at the property in 1979. Based on the preceding, it appears reasonably likely that the utility line in the vicinity of the former Western Transportation facility carried natural gas. The location of this abandoned line is depicted on Figure 4.

3.5.2.2 *Olympic Pipeline*

The Olympic Pipeline utilizes two product lines within a utility corridor that traverses the central portion of the Siltronic property (Figure 2 and 4). Of these two pipelines, one is used to transport diesel and kerosene, while the other is used to transport gasoline. Based on previous activities associated with the pipeline as described herein, the Olympic Pipeline is a potential source of petroleum hydrocarbons in soil and groundwater in the western portion of the Siltronic facility (Figure 3). Diesel and gasoline contain BTEX and other monoaromatics. Diesel and kerosene contain PAHs, the bulk of which are of lower molecular weight, and PAH-related compounds such as methylnaphthalenes. Diesel oil may also contain trace amounts of metals (Potter and Simmons, 1998).

In February 1979, Siltronic discovered the presence of petroleum while excavating the foundation for a clarifier in the Fab 1 wastewater treatment plant area. An initial sample of impacted soil from the excavation was found to contain hydrocarbons that matched a sample of diesel fuel obtained from one of the pipelines, although a second sample apparently did not match the Olympic Pipeline product (DEQ, 1999).

Olympic Pipeline subsequently exposed its pipelines. Holes in the pipeline were found and floating oil product was identified within the utility corridor to the northwest and southeast of the Siltronic clarifier excavation. Olympic Pipeline replaced the leaking section of pipe, removed floating product from the excavation, and removed residual oil stained soils in the bottom of the clarifier excavation (Bridgewater Group, 2000). The approximate location of the Olympic Pipeline release is depicted on Figure 3.

During pre-construction activities in 1990, Siltronic discovered petroleum hydrocarbons in proximity to Olympic Pipeline's pipelines (MFA, 2002). In October 1990 on behalf of Siltronic, CH2M Hill conducted a groundwater and soil gas investigation in the vicinity of the pipelines (Figure 3). Temporary well points were installed at 29 locations (GW-1 through GW-29) and groundwater samples were collected from just below the water table. The samples were analyzed in a field laboratory. CH2M Hill concluded that the concentrations of BTEX detected in the groundwater samples are typical of those associated with a gasoline spill or leak. The highest detected concentrations of BTEX and TPH were located adjacent to the utility corridor, indicating that the source of BTEX contamination may be located in that area (CH2M Hill, 1990).

Data from the 1990 investigation was provided to DEQ and Olympic Pipeline. In 1991, Olympic Pipeline pressure-tested the pipelines. One of the pipelines ruptured during the test. Both pipelines were replaced and the old pipelines were abandoned in-place (Bridgewater Group, 2000).

In summary, there is a confirmed release from the Olympic pipeline at the Siltronic property. The location of the release is proximate to the 400-foot former lowland area, thereby resulting in the likely commingling of contaminants, with benzene both from the pipeline release and potentially from MGP-residue placement, being collocated at this area.

3.5.2.3 Fill Material

As discussed in Section 3.3, filling activities associated with the Siltronic property were initiated in May 1966 and were completed by December 1975. Approximately 1.5 million cubic yards of imported material were placed on the property as part of filling activities (Bridgewater Group, 2000). The fill consisted of rock from a quarry located across Highway 30 immediately west of the site, as well as more than 700,000 cubic yards of material dredged from the river (from an unspecified location) by the Port of Portland (PDC, 1985). The dredged sediments and potentially materials from other offsite sources may have contained hazardous constituents that have impacted the Siltronic property.

As observed on 1967 and 1968 aerial photographs, coincident with on-going filling activities, dark-colored areas are shown extending across the western and central portions of the Siltronic property (Figure 3). Although the nature of the dark-colored material is not documented, it may be indicative of the placement or re-distribution of impacted soils or dredge materials as fill at the site. As described above, 1.5 million cubic yards of imported fill of unknown quality were placed at the site. Depending upon origin, dredged sediments could reasonably be impacted by MGP, wood treating, shipyard, pesticide, or petroleum terminal-related impacts. During the time of filling activities, the property was owned by Mr. Victor Rosenfeld and Mr. H.A. Anderson (Section 3.3). No documentation regarding any filling activities at the Siltronic property was identified within NW Natural company records.

In addition to possible sources of impact from the dredged sediments used as fill, observations of tar or oil during various investigations or construction activities at the Siltronic site also suggest the possibility that MGP-related wastes from the 400-foot wide lowland area may have been redistributed

and combined with fill placed at various portions of the Siltronic property during filling activities (1966-1975) after it had been sold by NW Natural in 1962.

Evidence of petroleum-impacted fill at the site was first described within geo-technical borings installed at the at the Siltronic property in 1977 (CH2M HILL borings B-1 through B-3), prior to the purchase of the property by Siltronic. Further, impacted soils have been observed during construction activities conducted at the site.

According to Mr. Tom McCue, Environmental Manager for the Siltronic site, during construction of the Fab 2 building and related structures (e.g., wastewater sump) in 1995, Siltronic encountered soil impacted by petroleum hydrocarbons, tar residue, and high-carbon solids. Visually-impacted soils were reportedly encountered in the Fab 2 areas as shallow as 6 feet bgs, with soils appearing black with apparent black patches of oil. Mr. McCue further indicated that visually-impacted soils were similarly identified during construction of the site's wastewater treatment sump (near monitoring well WS-10), with black soils extending across a depth interval of 12 feet to 24 feet bgs (McCue 2004, pers. comm.).

As described in a document entitled *Petroleum Contaminated Soils Treatment Report* (Deaver Environmental Group, Inc., 1995), during construction of the Fab 2 structure, approximately 5,490 tons of contaminated soil were segregated and thermally treated on-site consistent with Petroleum Contaminated Soil Treatment Permit No. PCSLA-NWR-95-004 (the PCST Permit) obtained from the DEQ. Data from the report indicate the impacted soils contained benzene (prior to treatment) ranging in concentration from non-detect to 8.2 parts per million (ppm) and diesel-range petroleum hydrocarbons ranging in concentration from 60 to 30,000 ppm.

Finally, on July 29, 2000, an oil sheen was created on the Willamette River at a location immediately adjacent to the Siltronic site as silt was being dredged as part of bank repair work being conducted by Siltronic. Analysis of sediment samples identified gasoline (7.5 to 69 ppm), diesel (399 to 5,810 ppm), and heavy oil (293 to 2,970 ppm) petroleum hydrocarbons. In total, approximately 115 tons of sediments were disposed as petroleum-contaminated waste (Bridgewater Group, 2000). The location of the dredging-induced sheen, located upstream of the former channelized creek discharge (1951-1967), is depicted on Figure 3.

As discussed in the previous sections, primary potential sources for petroleum-contaminated soils encountered during site development activities are impacted fill placement, Olympic Pipeline petroleum release(s), and the relocation and use of MGP materials for fill after NW Natural sold the property in 1962.

3.5.2.4 Siltronic Operations-Related Chemical Releases

Siltronic has reported several hazardous substance releases in connection with its operations, as follows:

1980 Chromium Release

On December 16, 1980, chromic acid was found within the Siltronic wastewater treatment plant concentrated acid system. An estimated 5.5 pounds of chromium was captured and taken to the Arlington hazardous waste landfill for disposal. Although no chromic acid was reportedly released to soil underlying the wastewater treatment plant, an estimated 1.3 pounds of chromium was discharged to the Willamette River through the combined effluent outfall near the northern corner of the property (Figure 4). According to Bridgewater Group (2000), Siltronic conducts permitted discharges of chromium to the Willamette River of up to 11 pounds per year.

1981 Chromic and Nitric Acid Leak

Approximately 6,000 gallons of acid etch solution and rinse water were spilled at the Materials Characterization Production Area (Fab 1 Building) at the Siltronic site in 1981, with some of the spilled material being collected within a sump, while the remainder was reportedly collected within the overfilled above-ground storage tank's secondary containment. No release to underlying soil or surface water was documented as a result of this spill (Bridgewater Group, 2000). The approximate location of this release is depicted on Figure 3.

1984 Trichloroethene Spills and Underground Storage

According to Bridgewater Group (2000), spills at the Siltronic facility's trichloroethene (TCE) stripper unit (immediately west of the Fab 1 Building) occurred on December 3, 1984 (0.33 gallons) and again on December 31, 1984 (11.6 gallons). As a result of these spills, Siltronic removed 128 cubic yards of soils, with the removed soils transported to a hazardous waste landfill in Arlington, Oregon. Confirmation soil samples indicated the presence of less than 1 part per million (ppm) TCE remaining in the soil. No groundwater sampling was conducted. Siltronic received a letter of "No Further Action" regarding the TCE spill from the DEQ in 1985. Siltronic ceased the use of TCE at the facility in 1988 (Bridgewater Group, 2000). The approximate location of the TCE spills / area of soil removal are depicted on Figure 3.

As documented in a December 2002 report prepared by Maul Foster & Alongi, Inc. (MFA, 2002b), between 1981 and 1984, Siltronic utilized an underground solvent recovery system for TCE reclamation. This solvent recovery system included three underground storage tanks (USTs) which were physically removed in 1985 after start-up of the above-ground TCE stripper referenced above. No sampling was conducted as part of UST removal activities. Subsequent investigatory activities conducted by MFA on behalf of Siltronic have identified the former solvent UST system to be a source area for TCE impacts identified at the site (MFA, 2004). Investigatory activities conducted by MFA have identified TCE and associated degradation products within groundwater beneath the UST source area at the northern portion of the site, with the plume extending toward, and beneath, the Willamette River. Siltronic is currently evaluating the TCE-related impacts with regard to potential source control implementation. The location of the former UST system is depicted on Figure 3

1987 Organic Wastewater Overflow

Approximately 2,000 gallons of weak detergents and surfactants from the organic wastewater system overflowed onto a gravel yard and roadway on the Siltronic property in June 1987. The overflow entered a stormwater catch basin, with subsequent discharge to the Willamette River from the combined effluent outfall located near the northern corner of the property. Soil sampling in the spill area did not identify the presence of contaminants, and no cleanup was performed.

1988 Pentachlorophenol Detection in Wastewater

On January 11, 1988, pentachlorophenol (PCP) was identified within one of Siltronic's wastewater effluent samples at a concentration of 0.2 ppm. Follow-up sampling conducted on January 27, 1988 indicated the presence of PCP in a combined effluent sample at a concentration of 0.004 ppm. Further follow-up testing of the combined effluent in February, March, and April 1988, did not identify the presence of PCP at concentrations greater than the analytical detection limit of 0.005 ppm (Bridgewater Group, 2000). The source for the PCP identified within the wastewater effluent was not ascertained.

1991 Weak Acid Storage Tank Leak

Approximately 4,000 gallons of weak acid (spent, deionized rinse water) was released to the ground at the wastewater treatment plant area on September 11, 1991. Siltronic blocked all storm drains in order to contain the spilled material, after which approximately 1,000 gallons of the acid were recovered. DEQ concluded that the release was not a hazardous waste, did not exceed a reportable quantity, that no National Pollution Discharge Elimination System (NPDES) effluent limits were exceeded, and that further investigation would not be necessary (Bridgewater Group, 2000).

1997 Caustic Rinse Water Release

On April 28, 1997, caustic rinse water from an ion-exchange regeneration unit, containing an estimated 50 pounds of caustic (pH reportedly ranging from 7.4 to 11.3), was accidentally sprayed onto bare ground west of the Fab 1 building (Figure 3). The spilled caustic solution was neutralized, then recovered with a vacuum truck. Soil samples collected from the spill area indicated the presence of soils with a pH of up to 11.6, greater than the control sample pH of 7.6. Based on these results, the upper 6 inches of soil were scraped off. Re-sampling indicated remaining soils to have a pH similar to the control sample (Bridgewater Group, 2000).

3.5.3 Summary of Potential Contaminant Sources

Potential sources of contamination at the Siltronic property, based on reviews of the operational history of the site, facility plans, and aerial photographs, as described in the previous sections, are as follows (Figure 3):

<u>MGP—Related Waste Management Areas:</u>

- Tar and oil/water emulsions / lampblack placed by settling pond clean-out (1941 to 1956) or discharged by Gasco effluent pond overflow to the former lowland area extending approximately 400 feet south of the existing NW Natural/Siltronic property boundary (1951-1956);
- Tar placed within a small excavated area or depression south of the effluent pond overflow area as observed present in aerial photographs between 1955 and 1964 and in company records from 1960.
- Spent oxide storage (1952 to 1966) at the western corner of the Siltronic property.

Other Potential Contaminant Sources

- Incorporation of impacted soils/dredge material as a component of fill and/or redistribution of MGP residues from the 400-foot lowland area as part of site filling activities between 1966 and 1975, after NW Natural sold the property in 1962;
- Undocumented spills and waste management practices associated with the Former Western Transportation fuel terminal (1930-1950);
- Olympic Pipeline-related release area (1979 -1991);
- Releases and spills associated with Siltronic operations (1980-1997), all located within the northern portion of the Siltronic property (i.e., TCE, chromium, acids, caustics, and organic wastewater releases or spills);

3.6 Contaminants of Interest

Contaminants of Interest (COIs) for the Siltronic Focused RI were identified as follows:

- Polynuclear aromatic hydrocarbons (PAHs);
- Semi volatile organic compounds (SVOCs), including carbazole, dibenzofuran, 2-methylnaphthalene, and phenols;
- Volatile organic compounds (VOCs), including monoaromatic hydrocarbons [benzene, toluene, ethylbenzene, xylenes (BTEX)], tetrachloroethene (PCE), trichloroethene (TCE) and associated degradation products;
- Cyanide;
- Metals (antimony, arsenic, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, titanium, vanadium, and zinc)

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PAHs and other semi-volatile organic compounds (SVOCs) are present in the by-products and residues of the oil gasification process, including heavy oils, tar, and lampblack. PAHs would also be a component of diesel fuels present within the Olympic pipeline and fuels historically stored at the Western Transportation Terminal. These constituents are also commonly present within fill materials imported from industrialized locales. Volatile aromatic hydrocarbons (e.g., BTEX) are present within motor fuels and light oils that were produced at the adjacent Gasco facility, as well as within fuels present within the Olympic Pipeline. Metals, particularly arsenic, chromium, copper, lead, nickel, and zinc, as well as cyanide are COIs relative to spent oxide / purifier box wastes, while chromium is also a COI because of Siltronic's use of chromium and a reported Siltronic chromic acid release. TCE and its degradation products have been included as COIs due to Siltronic's historical management of TCE and because these constituents have been identified in soil and groundwater at the Siltronic property. PCE has been included because it has been detected at several locations in soil and groundwater at the Siltronic site. No known use of PCE has been documented at either the Siltronic or the adjacent Gasco properties.

In addition to the preceding, other metals have been included as COIs because they were identified within the Strategy Recommendation Report (DEQ, 1999) as being present within sediments adjacent to the Siltronic site at concentrations considered to exceed the Portland Harbor baseline maximum values (e.g., cobalt, iron, manganese, selenium, silver, titanium, and vanadium), and/or because they have been used in Siltronic's fabrication process (e.g., antimony and chromium).

Conversely, herbicides, pesticides, and phthalates, identified within the DEQ Strategy Recommendation document as being present within adjacent sediments at concentrations exceeding the Portland Harbor Baseline, are not considered COIs for the purpose of this focused RI. Herbicides, pesticides, and phthalates are not contaminants of interest related to Siltronic operational or MGP-related contaminant sources.

3.7 Potential Contaminant Pathways to the Willamette River

Based on available site information, as described herein, potential contaminant migration pathways to the river, necessitating characterization and review as part of Phase I site characterization / source control evaluation activities, are as follows:

- Dissolved phase flux of chemicals to pore water or surface water via groundwater plume migration
- Dense Non-Aqueous Phase Liquid (DNAPL) migration to sediments/river
- Surface water runoff (from site outfalls) to sediments/river
- Erosion of embankment soils to sediments/river
- Preferential migration of chemicals to sediments or surface water along man-made features (utilities) or as groundwater discharge to North Doane Creek with subsequent flow to the City of Portland Outfall 22C.

4.0 FIELD ACTIVITIES

4.1 Geophysical Survey

On August 3, 2001, GeoPotential, Inc. of Gresham, Oregon, under contract to HAI, conducted a geophysical survey using a Mala RAMAC2 GPR (ground penetrating radar) system and 100 and 250 megahertz (MHz) antenna. The GPR survey had an effective depth of resolution to approximately 10 feet bgs.

The survey was conducted along a majority of the Siltronic riverfront including suspected locations of two former creek channels and known or suspected locations of numerous utility lines that extend to, or beneath, the river embankment. The purpose of the survey was to accurately determine the nature and spatial position of these features so follow-up soil borings could be optimally located to evaluate the possibility that these features act as preferred zones of contaminant migration. Approximate locations of major utility lines at the Siltronic property are shown on Figure 4.

Results of the geophysical survey indicated the location of the two active stormwater sewer lines that extend to outfalls on the embankment at the southern portion of the property, as well as the combined stormwater / process effluent line that extends across the river embankment near the northern property boundary. Each of these sewer lines was found to correspond with previously identified locations as provided on facility drawings. Two abandoned utility lines depicted on facility drawings as extending to the river across the southern portion of the property, were not identified by the GPR survey. Because these lines pre-date site filling activities, it is inferred that they are buried too deeply to be detected by GPR. Specifically, in some of the GPR survey areas the depth of fill is typically 25 to 35 feet-thick (e.g., 32.5 feet-thick at boring P-3) and therefore it is unlikely that the GPR survey, with an effective depth of resolution of about 10 feet, would be likely to directly identify the buried creek channels.

In addition to the preceding, the GPR survey identified a shallow zone of disturbed soil along the central portion of the embankment. A subsequent boring (P-11) through this area did not reveal any significant features. Based on a conversation with Mr. Ken Kemper of Siltronic, the area of

disturbed soil was later inferred to be the result of previous walkway repair in this area.

Finally, two additional zones of disturbed soils were identified that coincided with locations for the two former creek channels (Figure 3). These disturbed soil zones were interpreted to possibly be the result of subsidence in the embankment fill caused by settling within the underlying buried stream/ditch channel. In order to extend the effective depth of penetration for the GPR survey by avoiding much of the surficial fill, an additional survey was conducted at the base of the river embankment at the estimated location of the 1941 to 1957 channelized creek discharge (e.g., boring P-3 vicinity).

Results of the survey conducted by GeoPotential, including a map of the GPR profile locations and GPR profiles, are included in Appendix C.

4.2 Surface Soil Sampling Activities

To evaluate the potential for contaminant migration into the Willamette River adjacent to the Siltronic site via overland flow and erosion, on August 21, 2001 HAI collected soil samples at select locations along the top of the river embankment. Because a February 6, 2001 riverbank inspection conducted by HAI found the embankment slope to be heavily reinforced with rip-rap and the top of the slope to be covered with well established vegetation (a grass lawn), no areas of localized preferential surface water run-off / erosion into the river were identified. Based on the proceeding, five surface soil samples (S-1 through S-5) were collected at default locations correlating with every other push probe boring installed along the shoreline (i.e., borings P-1, P-3, P-5, P-7, and P-9), as depicted on Figure 4.

All surface soil samples were collected from the upper 3 inches of the ground surface below the vegetative layer. Detailed field methods employed to collect the surface soil samples are included in the Sampling and Analysis Plan, Appendix G of the RI Work Plan (HAI, 2001).

4.3 Catch Basin Sediment Sampling Activities

To evaluate potential impacts attributable to stormwater-related discharges, the RIWP proposed collection of sediment samples from three select on-site stormwater catch basins. The three catch basins selected for sampling were in proximity to former spills and/or chemical storage areas. Specifically, of these catch basins, one was located in the vicinity of the facility wastewater

treatment plant (CB1); one was located in facility process area (CB2), including the area of the 1997 caustic solution spill and the 1984 TCE spill; and one was located adjacent to a bulk chemical storage area (CB3).

On June 14, 2001, representatives of Siltronic, NW Natural, and the DEQ conducted a reconnaissance of the Siltronic property to evaluate, in part, the stormwater catch basins designated for sampling. Based on these observations, NW Natural and the DEQ agreed to eliminate the sampling of the catch basin CB1 located adjacent to the facility's wastewater treatment plant. This basin was eliminated from the sampling program since it was visually apparent that this basin was being flushed with treated effluent from the wastewater treatment plant, and would therefore not likely yield a sample representative of stormwater runoff or spills from the surrounding area. Further, based on inspection of the surrounding area, it did not appear catch basin CB1 would be in an area likely to receive impacts from spillage of hazardous substances.

On June 18, 2001, Ms. Cathryn Young of Siltronic notified NW Natural that routine maintenance of site stormwater catch basins was ongoing, and that this maintenance would include clean-out of sediment from within the catch basins to be sampled as proposed within the RI Work Plan. Because NW Natural had not yet arranged legal access to conduct sampling activities, Ms. Young agreed that Siltronic would implement the catch basin sampling activities at CB2 and CB3 prior to clean-out.

Siltronic's catch basin sampling activities occurred on June 19, 2001, with oversight from Mr. Eric Blischke of the DEQ. All sampling activities were reportedly conducted in accordance with Section 9.3.2 of the RI Work Plan. Locations of the catch basins are depicted on Figure 4.

4.4 Stormwater Outfall Sampling Activities

One-time grab samples of stormwater discharge representative of each of the three facility outfalls were collected by HAI on August 22, 2001, as described below.

Sampling of the combined process water/stormwater outfall was conducted within a manhole located west of the Fab 1 structure (Figure 4). This sample location was selected based on information provided by Mr. Ken Kemper of Siltronic indicating water passing through this manhole would contain only stormwater, with no contribution from the wastewater treatment plant.

Sampling of the Fab 2 area stormwater outfall and the Administration Building roof drain outfall was conducted at the end of the discharge pipes immediately above the river embankment (Figure 4).

All samples were collected on August 22, 2001 during a storm event that resulted in 0.64 inches of precipitation, as reported by the National Weather Service for the Portland International Airport. The previous measurable precipitation event was 21 days earlier, on July 30, 2001, when 0.20 inches of rain were recorded.

In addition to the preceding, to further evaluate potential historical and/or ongoing releases attributable to on-site stormwater catch basins, a sample (no. -173) of surface soils located immediately below the existing on-site "Fab 2 Area" stormwater outfall, which discharges to the river embankment, was collected by HAI on September 19, 2001. The sample was collected in a wet soil covered area surrounded by a rip-rap berm and a rip-rap covered slope immediately below the concrete outfall pipe. Although proposed, no sampling adjacent to the Administration Building roof drain outfall was possible, as the surface underlying this outfall was completely covered with rip-rap.

Detailed field methods employed to collect the surface soil samples are included in the Sampling and Analysis Plan, Appendix G of the RI Work Plan (HAI, 2001).

4.5 Push Probe Boring Installation Activities

Eleven push probe borings (P-1 through P-11) were installed under the direction of HAI by Geo-Tech Explorations, Inc. to depths ranging from 20 to 100 feet bgs at select locations along the Siltronic shoreline between August 2, 2001 and August 20, 2001 (Figure 3). These borings were installed to evaluate subsurface hydrogeologic conditions and for collection of depth-discrete soil and groundwater samples.

With regard to an evaluation of zones of potential preferential contaminant migration between the upland portion of the site and the Willamette River, push probe borings P-1 and P-3 were placed at each of the two locations of the historical on-site channelized creek, while P-1 also provided for an evaluation of subsurface conditions adjacent to the utility corridor associated with the combined sewer effluent pipe. Other zones of potential preferential contaminant migration between the upland portion of the site and the Willamette River that were evaluated included the Fab 2 storm sewer utility corridor (P-6), the abandoned natural gas utility corridor (P-8), the abandoned concrete masonry pipe corridor (P-9), and the Administration Building downspout storm water drain line (P-10).

In addition to the preceding, boring locations were selected with an emphasis on portions of the site down-gradient of the former effluent ponds / filled lowland area (P-1 through P-3), and the former Western Transportation fueling facilities (P-7 and P-8). Furthermore, push probe boring locations P-1 through P-5 also provided coverage down-gradient from historical Siltronic operational-related spills (i.e., TCE and various acid spills), all of which occurred either in the vicinity of the Fab 1 Building or the wastewater treatment plant area.

Soil samples were collected from all push probe boring locations with the exception of P-11, where soils were screened solely for the purpose of identifying the origin of a "disturbed soil zone" identified as part of the geophysical survey (Section 4.1).

Depth discrete groundwater samples were collected from temporary well points installed within borings P-1 through P-9 (Figure 3). The groundwater samples were collected from multiple depth horizons ranging from 24 feet bgs to 100 feet bgs. All screen intervals are listed on Table 2. The

temporary well point data were collected for vertical profiling of contaminant concentrations in groundwater, and to help select screen intervals for subsequent monitoring well installation work (Section 4.6).

Field methods employed to install, screen soils, and sample the push probe borings and temporary well points are included in Appendix G of the RI Work Plan (HAI, 2001). A summary of push probe construction is included on Table 2. Boring logs that describe the soils encountered and temporary well point construction details, are included in Appendix D.

4.6 Monitoring Well Installation and Sampling Activities

With the completion of groundwater and soil sampling activities associated with the push probe boring component of the RI in August, 2001 (Section 4.5), and the receipt of preliminary analytical results from the investigation, a meeting with representatives of NW Natural and DEQ was conducted on September 7, 2001 such that locations and depths of monitoring wells could be agreed upon. Expedited DEQ approval of proposed monitoring well locations was provided via this meeting in order to facilitate completion of well installation activities during the week of September 10, 2001, a time-frame requested by Siltronic since it would coincide with a shut-down of Siltronic's crystal growing plant. As agreed in the meeting, five monitoring wells would be constructed at the Siltronic site. Of these five wells, three (WS-8-33, WS-8-59, and WS-9-34) were to be constructed along the riverfront, while two (WS-10 series wells) were to be constructed up-gradient of the WS-8 series wells in the immediate vicinity of the former TCE spill / soil removal area.

Monitoring wells WS-8-33 and WS-8-59, screened within the surficial fill water-bearing zone (WBZ) and the alluvial WBZ, respectively, were installed under the direction of HAI by Geo-Tech Explorations, Inc. on September 12, 2001. Well WS-9-34, screened within the surficial fill WBZ, was installed on September 13, 2001. Siltronic refused NW Natural access with regard to installation of the WS-10 series wells, and therefore these wells were not installed at that time. Monitoring well locations are depicted on Figure 3.

Wells WS-8-33, WS-8-59, and WS-9-34 underwent development with a submersible pump on September 19, 2001. One year of quarterly groundwater quality and elevation data were obtained from these wells subsequent to installation. Specifically, groundwater sampling events at the three monitoring wells were conducted on October 9, 2001, December 13,

2001, April 3, 2002, and July 10, 2002, coincident with sampling at the adjacent Gasco site.

Details of the field methods employed to install the monitoring wells, and soil and groundwater sampling protocols, are included in Appendix G of the RI Work Plan (HAI, 2001). Boring logs that describe the soils encountered and well construction details, are included in Appendix D. A summary of the monitoring well construction details is included on Table 2. A summary of available water level measurements and groundwater elevations obtained from site and nearby wells are summarized on Table 3a (Siltronic wells); and Table 3b (Gasco wells), and 3c (area-wide, multi-party well event). Tables 4a and 4b include vertical gradient calculations for well clusters at the Siltronic and Gasco sites, respectively.

4.7 Aquifer Slug Testing Activities

On February 20, 2002, HAI conducted rising-head aquifer slug tests on monitoring wells WS-8-33, WS-8-59, and WS-9-34 to provide an approximation of hydraulic conductivity of the aquifer in the vicinity of these wells. The slug tests were performed by lowering a PVC slug into each well to displace the groundwater column. After the displaced water returned to the approximate original static water level, the slug was quickly removed from the well, simulating the instantaneous removal of a slug of water from the well. The water level recovery data was measured with the use of a pressure transducer placed near the base of each well and recorded with an electronic data logger. Two to four individual slug tests were conducted at each well location.

The recovery data were analyzed by the Bouwer and Rice (1976) solution method to calculate preliminary estimates of hydraulic conductivity using Aquifer Test Toolbox spreadsheet software from Creative Software Applications, Inc.

Slug test data and analysis sheets for the Bouwer and Rice analysis for wells WS-8-33, WS-8-59, and WS-9-34 are included within Appendix E.

4.8 Continuous Short-Term Water Level Monitoring Event

A continuous short-term groundwater elevation monitoring event was completed by HAI at the Siltronic and adjacent Gasco site over a two-week period from July 24, 2002 through August 7, 2002. This short-term groundwater elevation monitoring event involved measurement of water levels on a 15-minute frequency for the duration of the test using pressure transducers / data loggers placed within selected wells. Further, water levels were simultaneously recorded in the Willamette River to compare to the measured groundwater levels. River level measurements were collected using a pressure transducer placed in a temporary stilling well placed on a docking structure near the MW-4 well cluster immediately down-river of Siltronic at the NW Natural Gasco facility.

Finally, site-specific rainfall and barometric pressure data were collected during the course of the test from an existing weather station located on the adjacent NW Natural Gasco property. Sampling points included within the short-term continuous water level monitoring test are identified below, and are shown on Figure 3.

Monitoring Point	Water-Bearing Zone
WS-8-33 (Siltronic)	Surficial Fill
WS-8-59 (Siltronic)	Alluvial
WS-9-34 (Siltronic)	Surficial Fill
MW-4-56 (Gasco)	Alluvial
MW-8-29 (Gasco)	Surficial Fill
MW-8-61 (Gasco)	Alluvial
Willamette River (Gasco)	-

Hydrographs depicting river and groundwater elevations, as well as rainfall events, measured during the monitoring event, are included in Appendix F.

4.9 Other Investigations

A number of investigatory activities other than those completed by NW Natural as per the Joint Order have been completed at the Siltronic site to date. These investigations relate to both geo-technical as well as environmental evaluations. A description of the pre-Joint Order investigations was previously provided within the RI Work Plan (HAI, 2001), and as such, this information is not repeated herein.

Siltronic is conducting an investigation of chlorinated solvents in groundwater down-gradient of the Fab 1 structure:

- In March 2002, Limno-Tech, Inc. (LTI) installed 3 push probe borings (GP-2-01, GP-2-02, and GP-2-03) to depths of 100 feet bgs and collected soil and groundwater samples (MFA, 2002b).
- In September and October 2002, MFA installed 4 push probe borings (GP-4 through GP-7) to depths of 100 feet bgs and collected soil and groundwater samples (MFA, 2002b).
- In July 2003, MFA installed 4 push probe borings (GP-8 through GP-11) to depths ranging from 25 feet bgs to 96.5 feet bgs and collected soil and groundwater samples (MFA, 2003).
- In September and October 2003, MFA installed 7 groundwater monitoring wells at the site (WS-10-27, WS-11-125, WS-11-161, WS-12-125, WS-12-161, WS-13-69, and WS-13-105) using rotosonic drilling methods. Screening level exploratory groundwater quality samples were collected with use of a packer assembly in the initial deep borehole for each well or well cluster. Of the monitoring wells installed, 1 well (WS-10-27) was installed within the surficial fill unit to a depth of 27 feet bgs, while the remaining 7 wells were installed within the alluvial unit to depths ranging from 69 feet bgs to 161 feet bgs (MFA, 2003).
- In June and July 2004, MFA installed 13 shallow push probe borings (GP-12 through GP-24) within the surficial fill unit to depths ranging from 20 to 30 feet bgs with the collection of soil and groundwater samples (MFA, 2004a).

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- In July and August 2004, MFA installed 8 groundwater monitoring wells at the site (WS-14-125, WS-14-161, WS-15-85, WS-15-140, WS-16-125, WS-16-161, WS-17-52, and WS-17-94) using rotosonic drilling methods. Screening level exploratory groundwater quality samples were collected with use of a packer assembly in the initial deep borehole for each well or well cluster. Of the monitoring wells installed, all were installed within the alluvial unit to depths ranging from 52 feet bgs to 161 feet bgs (MFA, 2004b).

- In October 2004, MFA installed 8 push probe borings (GP-25 through GP-32) to depths ranging from 110 to 160 feet below the mudline within the Willamette River at locations down-gradient of the TCE plume, with collection of sediment and groundwater samples (MFA, 2005).

Locations of borings and monitoring wells installed by HAI, LTI , MFA and others at the Siltronic property, in addition to borings/wells at the adjacent Gasco property, are depicted on Figure 3. Available boring logs that describe the soils encountered at the boring locations located on the Siltronic property are included in Appendix D. A summary of the available construction details for all boring locations at the Siltronic property are included within Table 2.

5.0 ANALYTICAL TESTS

Soil and water samples collected by HAI and LTI as part of Focused RI activities at the subject site were shipped with chain-of-custody documentation in sealed and chilled containers to Environmental Services Laboratory, Inc. (ESL) of Portland, Oregon for analysis. Samples collected by Siltronic (stormwater catch basin sediment), were shipped with chain-of-custody documentation to Coffey Laboratories, Inc., Portland, Oregon for analysis. Samples collected by MFA were shipped with chain-of-custody documentation to Columbia Analytical Services, Inc. of Kelso Washington for analysis.

With regard to HAI activities, all samples were collected and analyzed in accordance with the Soil and Water Sampling and Analysis Plan included in the *RI Work Plan* (HAI, 2001). Samples collected by MFA were collected and analyzed in accordance with a September 2002 work plan (MFA, 2002a).

Soil and water samples collected by HAI and LTI were analyzed as follows:

- PAHs by U.S. Environmental Protection Agency (EPA) Method 8270 SIM;
- SVOCs by EPA Method 8270C;
- VOCs by EPA Method 8260B;
- Total cyanide by Method 9010;
- Select metals (antimony, barium, chromium, cobalt, iron, magnesium, mercury, nickel, selenium, silver, titanium, vanadium, and zinc) on a total basis by EPA Methods 6010 and 7470;
- Hydrocarbon identification (HCID) of total petroleum hydrocarbons (TPH) by Northwest Method TPH-HCID, with follow-up, as necessary for diesel- and oil-range petroleum hydrocarbons by NW Method TPH-Dx (soil only);

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- Select samples were analyzed for chloride (EPA Method 325.3) and total organic carbon (D4129-82M).

Select soil and water samples collected by MFA were analyzed for PAHs by EPA Method 8270 SIM, SVOCs by EPA Method 8270, VOCs by EPA Method 8260B, and cyanide by EPA 9010.

The results of the above-described analytical testing for soil samples (surface, subsurface, and catch basin) collected by HAI, LTI, and MFA are summarized in Tables 5 through 9. Stormwater sampling results are included in Table 10. The results of groundwater sample analyses collected from temporary well points collected by HAI, LTI, and MFA are summarized in Tables 11 through 14. Results of quarterly groundwater monitoring activities for samples collected from Siltronic monitoring wells are summarized on Tables 15 through 18.

Analytical results for all samples collected by HAI underwent an independent EPA Level III validation, the results of which were provided within *Data Validation and Data Quality Assessment Reports*, prepared by Ms. Kathy Gunderson, dated June 11, 2002, and September 23, 2002 (Gunderson, 2002 a,b). These reports have previously been submitted to the DEQ and are not included herein.

6.0 SITE CHARACTERIZATION RESULTS

6.1 Geologic Setting

The geologic units of interest at the subject site can be subdivided as follows, from the ground surface downward:

- Surficial fill deposits
- Alluvial deposits

  Willamette river deposits

  Catastrophic flood deposits
- Columbia River Basalt Group (CRBG)

The site stratigraphy is depicted in nine generalized cross-sections (Appendix I) constructed across a majority of the subject property and extending to off-site locations both to the north and south. The locations for the nine cross-sections are shown on Figure 5.

6.1.1 Surficial Fill Deposits

It is estimated that approximately 1,500,000 cubic yards of imported material were placed on the Siltronic property as part of filling activities (1966 to 1975) (Bridgewater Group, 2000). The fill consisted of rock from the quarry located across Highway 30 immediately west of the site, as well as more than 700,000 cubic yards of poorly graded sands with gravel and silty sands dredged from an unknown portion of the Willamette River by the Port of Portland (PDC, 1985). In places the fill has been found to contain impacts potentially attributable to re-distribution of MGP residues at the site, and/or as a function of a multitude of sources that may have impact dredged sediments prior to placement on the site (e.g., current/former ship maintenance, pesticide manufacture, wood treatment, MGP, and petroleum transfer facilities are all located along the river in proximity to the site). All fill-related activities were conducted by others after NW Natural sold the Siltronic parcel in 1962.

A map depicting the thickness of the surficial fill unit across the Siltronic and adjacent Gasco sites is included as Figure 6. The thickness of the surficial fill unit across the site ranges from approximately 10 to 25 feet near the Tualatin Mountains (MW-12 to RP-3-61) to a maximum of 35 to 42 feet in the central – northern portion of the site, as observed at boring locations for wells WS-15 and WS-17. Along the bank of the Willamette River, the surficial fill unit ranges in thickness from approximately 24 to 34 feet at the Siltronic site. Fill identified adjacent to the river was predominantly found to consist of fine- to coarse-grained sand and gravelly sand, with occasional concrete, brick, or glass fragments. However, at several locations (i.e., borings P-1, P-7, P-10, RP-01, and RP-07), a much finer-grained material, predominantly a sandy silt to silt with occasional gravel, was identified.

With regard to tar or oil identified in fill adjacent to the river embankment, as depicted on cross-section E-E' (Appendix I), a 2.5 foot thick layer of tar was identified at the base of the fill at the P-1 boring location (former effluent pond overflow area), while a zone of oily fill (sand with gravel) was identified across a depth of 20 to 24 feet bgs at the P-4 boring location. Further, 1.5 feet of oily soils (patchy) were identified at the base of the fill (possible former ground surface) at the P-7 boring location (former Western Transportation fuel storage area). The nature of the tar or oil identified within the surficial fill unit at the Siltronic site is fully described in Section 6.4.

6.1.2 Alluvial Deposits

Underlying the surficial fill at the site are Quaternary-Age alluvial deposits, composed of unconsolidated sands and silts, that range in thickness from approximately 35 feet near St. Helens Road to a thickness of 170 to 175 feet (borings WS-12, WS-13, and WS-14) adjacent to the Willamette River near the northern corner of the Siltronic site. Additionally, the alluvial deposits thin towards the eastern corner of the site, where they were found to be 21 feet thick at the RP-1 boring location (cross-section E-E', Appendix I). These alluvial deposits have been differentiated by Geraghty & Miller (1991), into the Catastrophic Flood Deposits and Willamette River Deposits. The conceptual site model provided herein groups the two units together and refers to them as undifferentiated alluvial deposits. As the silt unit typically defines the top of the alluvial unit / base of the fill unit, the silt surface is

considered to express the ground surface of the site prior to site development and filling activities.

The uppermost unit of the undifferentiated alluvial deposits in the vicinity of the site has been identified as a clayey silt by Camp, Dresser & McKee, Inc. (CDM, 1987), while Geraghty & Miller (1991) identified both silt and clay facies associated with the upper zone of the alluvial deposits. Borings installed at the Gasco and Siltronic properties have similarly identified a laterally extensive fine-grained silt unit, with minor clay content, at the upper portion of the Alluvial Deposits. Although laterally extensive across a majority of the Siltronic and Gasco areas, the silt unit has been found to be absent below some upland near-shore areas at the adjacent Gasco site (Figure 7). The silt unit is typically found to exhibit coloration ranging from olive gray to green, with some areas of orange-brown mottling, with small sand lenses and vertical rootlet zones present within portions of the silt unit.

Figure 7 provides elevation contours for the surface of the silt unit using all available data from both the Siltronic and the adjacent Gasco properties. As depicted on Figure 7, the surface of the silt unit generally slopes from all directions to the central portion of the Siltronic and Gasco sites, with the overall low being identified on the Siltronic property in the central portion of the former 400 foot-wide lowland area at the north end of the Siltronic property, where the top of silt was identified at an elevation of approximately -8 feet msl (boring WS-15). The silt surface rises from the WS-15 area in a riverward direction, reaching a crest beneath the Fab 1 building (at 9 to 12 feet msl), beyond which the surface slopes back down towards the river, with an elevation of between 2 and 6 feet msl identified adjacent to the riverbank at the northern portion of the property (cross-section B-B', Appendix I). Further, at the south-central portion of the property, the surface of the silt unit slopes to an apparent localized low point at the boring WS-3 area, where the top of silt is present at an elevation of -2 feet msl.

With regard to the riverbank area, as depicted on Figure 7 and cross-section E-E' (Appendix I), the surface of the silt unit was identified between depths of 25 to 35 feet bgs, with the surface rising approximately 10 to 12 feet higher across the upstream half of the property (e.g., south of boring P-5).

A map depicting the thickness of the upper silt unit across the Siltronic and adjacent Gasco sites is included as Figure 8. As depicted on Figure 8, the thickness of the upper silt unit is greatest throughout the central portion of the Siltronic property, where thicknesses of 67 feet (WS-10), 69 feet (B-104),

and 56 feet (WS-3-81) were identified, and extending to the northwest where thicknesses of up to 43 feet (MW-14) have been identified on the Gasco site. The thickness of the silt unit at both the Siltronic and Gasco sites decreases in the direction of the Willamette River, where thicknesses of between 1 and 3 feet are common, or in some cases, the silt appears locally absent and/or transitions into a silty sand towards the shoreline (cross-section EE', Appendix I), becoming thicker at the shoreline and offshore of the shoreline (cross-sections A-A' and B-B', Appendix I)

Beneath the silt unit, the alluvial deposits are found to typically consist of sand with interbedded lenses of silt, sandy silt, or silty sand. The sands within the alluvial unit are described as grey in color with localized areas of brown coloration, fine-grained, well sorted / poorly graded, sub-round to angular, and locally micaceous. The silt / sandy silt lenses identified within the sand were typically grey in coloration, and typically contained rootlets and shell fragments. A thin layer consisting of medium to coarse-grained sandy gravel has been observed at the base of the alluvial deposits at both the Siltronic and adjacent Gasco sites.

6.1.3 Columbia River Basalt Group

The oldest and lowermost geologic unit of interest at the site consists of the Columbia River Basalt Group. The Miocene-age Columbia River Basalt Group, composed of a series of individual lava flows, generally forms the base (bedrock) of the Portland Basin and outcrops immediately to the southwest of the site in the Tualatin Mountains. The confined bedrock aquifers in the Columbia River Basalts have historically been of significance regionally.

A significant amount of bedrock surface elevation data are available for the former Gasco site, immediately to the northwest of the Siltronic property. Figure 9 provides elevation contours for the surface of the bedrock using available data from both the Siltronic and Gasco properties. These data indicate the basalt surface dips steeply to the northeast, with the top of the basalt occurring at a depth of approximately 36 feet bgs near the western corner of the Siltronic site (boring MW-12-36), to depths of 215 feet bgs near the northern corner of the Siltronic site (boring B-1-8). Although, in general, the bedrock surface is anticipated to dip steeply from the Tualatin Hills towards the Willamette River, undulations in the surface are observed.

Investigatory activities conducted by Geraghty & Miller (1991) near the southern corner of the Siltronic property, as well as results of investigatory activities completed by URS Greiner Woodward Clyde (URS) along the southeastern Siltronic property boundary, indicate the presence of a bedrock high, with the bedrock surface occurring at a depth of 108 to 115 feet bgs near the locations of wells RP-7 and WS-3, and rising towards the east corner of the Siltronic site adjacent to the Willamette River, where bedrock was encountered at a depth of 63 feet bgs at boring RP-1 (Figure 9).

6.2 Hydrogeologic Setting

Groundwater occurs in three principal hydrologic zones beneath the site, which from top to bottom include:

- the unconfined surficial fill WBZ,
- the semi-confined alluvial WBZ, and
- the confined bedrock aquifers in the CRBG.

6.2.1 Surficial Fill WBZ

As described in Section 6.1, the base of the surficial fill WBZ is typically defined by a fine grained alluvial silt unit. Although present across virtually the entire site, this silt unit becomes thin to locally absent approaching the shoreline at portions of the Siltronic and adjacent Gasco sites (Figure 8 and cross-section E-E', Appendix I), becoming thicker at the shoreline and riverward of the shoreline (cross-section A-A' and B-B'). The hydraulic conductivity of the silt unit at the Siltronic site, as determined from slug testing at well MW-3I, was previously calculated as 3.22×10^{-5} centimeters per second (cm/sec), indicating that the silt unit is not very conductive (Geraghty & Miller, 1991). The lack, or significantly attenuated, concentrations of COIs in groundwater beneath the silt unit across much of the Siltronic and Gasco properties (Section 6.5) supports the finding that the silt unit is of low conductivity, but as described later in this report, the silt unit does not completely confine the underlying alluvial WBZ across the entire site.

The saturated thickness of the surficial fill WBZ ranges from between 1 and 5 feet at locations adjacent to the river, to between 10 and 25 feet at the central and western portions of the site (cross-sections A-A', C-C', and I-I', Appendix I). Slug testing (Section 4.7) at the WS-8-33 and WS-9-34 locations (adjacent to the river) resulted in an estimated hydraulic conductivity for the surficial fill WBZ ranging from 2.3×10^{-4} to 5.4×10^{-4} cm/sec.

Based on observations made during push probe drilling activities related to the Focused RI, the occurrence of saturated conditions within the surficial fill unit at certain locations of the site appear seasonally dependent. Specifically, no saturated conditions were noted adjacent to the river within the surficial fill unit in August 2001 at boring locations P-6, P-7, or P-10, or at boring locations GP-4 through GP-7 in late September and early October 2002 (cross-section E-E', Appendix I).

As depicted on groundwater elevation maps (Appendix G), the overall groundwater flow direction across a majority of the Siltronic site within the surficial fill WBZ is northeast, toward the Willamette River. However, localized variability with regard to flow direction exists, most notably near the southern portion of the Siltronic property (WS-1 and WS-2 area), where an apparent groundwater divide is present within the fill. As depicted on the groundwater flow direction map from the April 2, 2002 area-wide event (Appendix G), groundwater south of the divide appears to flow to the south and southwest towards North Doane Lake and the southwest drainage ditch (North Doane Creek).

The horizontal hydraulic gradient within the surficial fill WBZ, as measured between wells WS-10-27 and WS-9-34 during the November 24, 2003 event is calculated to be approximately 0.017 (toward the river). The flow direction and gradient within the surficial fill WBZ at this portion of the site appears consistent through time.

A downward hydraulic gradient between the surficial fill WBZ and the alluvial WBZ is typical at the Siltronic and Gasco properties (Tables 4a and 4b), with a downward vertical gradient of between 0.025 and 0.042 measured at Siltronic between monitoring well WS-8-33 (fill unit) and WS-8-59 (upper alluvial unit) between August and November 2004. As such, groundwater in the surficial fill WBZ may be expected to migrate to the alluvial WBZ in areas where the underlying silt unit thins or otherwise does not impede downward flow. Based on COI distribution (Section 6.5.2.2), migration of petroleum

constituents from the surficial fill WBZ to the alluvial WBZ has predominantly been limited to the northern corner of the Siltronic property (northern corner of the former 400 foot-wide lowland area) corresponding to areas where the DNAPL has migrated through the silt unit and into the alluvial WBZ.

Results of continuous short term water level monitoring within the surficial fill WBZ as depicted on hydrographs (Appendix F) did not identify a relationship between tidal fluctuations of the Willamette River and water levels within the surficial fill WBZ. However, long term, seasonal fluctuations in river level (Appendix H) were generally matched by similar longer term fluctuations of groundwater level within the surficial fill WBZ wells. The lack of tidal fluctuations of groundwater levels in the fill suggests isolation between the surficial fill WBZ, the river, and between the surficial fill WBZ and the alluvial WBZ (which does show tidal influence). The isolation may be a function of being perched above underlying silt as well as a degree of isolation with the river as a function of a thickening prism of shallow off-shore native silts located beyond the river embankment (cross-sections A-A', B-B', Appendix I).

6.2.2 Alluvial WBZ

The unconsolidated sands and silts of the alluvial WBZ across the Siltronic property range in thickness from approximately 2 to 25 feet near the west and central portions of the site, to approximately 175 feet near the northern corner of the site (see cross-sections A-A', C-C', and I-I', Appendix I). Although interbedded silts and sandy silts are present across various depth intervals within the alluvial WBZ, boring log data do not suggest the presence of separate hydrostratigraphic zones within the alluvial WBZ. Because monitoring wells are screened in various portions of the alluvial WBZ, for the purpose of groundwater flow evaluation, the alluvial WBZ has been arbitrarily subdivided into upper- (typically shallower than 100 feet bgs); intermediate- (typically 100 to 140 feet bgs); and lower-(typically greater than 140 feet bgs) intervals. As depicted on groundwater elevation maps (Appendix G), the overall groundwater flow direction within the alluvial WBZ across the Siltronic and adjacent Gasco sites is to the northeast, towards the Willamette River. Although the limited number and distribution of lower alluvial WBZ wells restricts the interpretation of flow direction within this zone, the groundwater potentiometric surface map for this depth interval (Appendix G), as well as the presence of COIs originating from the Rhone-Poulenc / Aventis project area to the south (Section 6.5), indicates that this

zone may have more of a northerly component than the shallower alluvial zones.

Horizontal gradients for the upper alluvial WBZ depict a gradient of approximately 0.02 (toward the river) across the central portion of the Gasco/Siltronic properties during August 2004, as calculated between the MW-15-60 (Gasco) and WS-15-85 (Siltronic) locations. The horizontal gradient decreases substantially, with a minor reversal noted, within 400 feet of the river where a very flat, tidally influenced, gradient of 0.0002 (away from the river) was calculated between the WS-15-85 and WS-8-59 locations in August 2004. The estimated hydraulic conductivity (slug test) for the upper Alluvial WBZ ranges from 9.7×10^{-5} to 1.4×10^{-4} cm/sec at the WS-8-59 location.

Horizontal gradients within the intermediate-depth and lower portions of the alluvial WBZ as calculated for August 2004 were approximately 0.005 toward the river between WS-13-105 and WS-12-125 (intermediate), and 0.0004 toward the river between WS-15-140 and WS-11-161 (lower). Horizontal gradients and flow direction within the alluvial WBZ tend to be relatively consistent (e.g., same orders of magnitude) through time.

With regard to vertical gradients, a downward gradient ranging from 0.03 to 0.12 has been calculated between the upper-alluvial and intermediate-alluvial depth intervals at the WS-17 location, while a consistent -0.03 upward gradient has been identified at the WS-13 location. Upward vertical gradients tend to predominate between the lower and intermediate-depth intervals within the alluvial WBZ, with upward gradients of approximately -0.005 (WS-16 location) and -0.04 (WS-12 location) being relatively consistent through time, while vertical gradients at the WS-11 location tend to be an order of magnitude less and fluctuate between -0.0008 upwards and 0.0006 downwards (Table 4).

Based on the preceding, water levels collected from the Siltronic site suggest that the overall vertical groundwater gradient in the alluvium is predominantly downward within the upper portions of the alluvial WBZ, and upward across the lower portions of the alluvial WBZ (Table 4a), with the greatest horizontal gradient identified at locations further away from the river and at intermediate depths (e.g., 100 to 125 feet bgs) within the alluvial WBZ.

Results of continuous water level monitoring (Section 4.8), as depicted on hydrographs included within Appendix F, indicate the presence of a direct and rapid response to tidally-influenced changes in Willamette River elevation within the shoreline alluvial WBZ wells WS-8-59 (Siltronic), MW-4-57, and MW-4-101 (Gasco), while a similar, but subdued and delayed response to Willamette River tidal fluctuations was observed at a greater distance from the river in interior alluvial WBZ well MW-8-56 (Gasco). Specifically, the crest to crest time delay between peak river level and peak groundwater elevation at well WS-8-59 (adjacent to the shoreline) was approximately 15 to 30 minutes, while the delay at well MW-8-56 (250 feet upland from the shoreline) was approximately 4.5 hours. The preceding suggests hydraulic communication between the Willamette River and the alluvial WBZ, with river stage playing an important role with regard to groundwater transport, with brief periods of flow reversal observed at the peak of most high tide cycles.

A relatively thick (>10 foot) layer of silt is present in nearshore sediments adjacent to the Gasco and Siltronic sites, extending 200 to 300 feet from the shoreline (MFA 2005, Anchor 2004). It is expected that the fine-grained silt materials impede nearshore discharge of groundwater to the river from both the surficial fill and the upper portions of the alluvial unit.

Water levels measured offshore during the 2004 in-water investigation (MFA 2005) identified a predominant downward gradient throughout the alluvial WBZ beneath the Willamette River. These data suggest that the river near the Siltronic and Gasco properties may be a losing reach. Further, distribution of COIs between the upland portion of the site and the Willamette River (Section 6.5) provide evidence of a downward migration proximate to the river, suggesting that deeper groundwater in the area of Siltronic may be a component of a flow system with limited or no local discharge to the Willamette River.

6.3 Soil Testing Results

6.3.1 Surface Soils

The soils at all surface sample locations (S-1 through S-5) were found to consist of brown gravelly silty sand. No field screening evidence of potential impact (i.e., discoloration, suspect odor, or sheen) was observed at any surface soil sample location. All surface soil sampling locations (Figure 4) were well landscaped (grass ground-cover) with a lack of erosional features.

Results of laboratory analyses of surface soil samples, included on Tables 5 through 9, are summarized as follows:

- Total petroleum hydrocarbons were not identified at concentrations greater than method reporting levels at any surface soil sampling location.
- Total PAH concentrations ranging from 0.71 ppm to 2.14 ppm were identified in surface soils at locations S-1 through S-3, while no PAHs were identified at concentrations greater than method reporting levels at the S-4 and S-5 sampling locations. No SVOCs were identified at any surface soil sampling location with the exception of S-3, where 0.0707 ppm 2-chlorophenol and 0.077 ppm phenol were identified.
- Cyanide was not identified at concentrations greater than method reporting levels at any surface soil sampling location.
- With regard to metals, relatively consistent concentrations were identified at all sampling locations. Where possible, and as provided on Table 9, a comparison between identified soil concentrations and default background metals concentrations was conducted. The comparison was made utilizing DEQ default background concentrations for metals (DEQ 2002), and a Washington Department of Ecology (DOE) document entitled *Natural Background Soil Metals Concentrations in Washington State* (DOE 1994). Results of this comparison indicates that zinc, identified at a concentration of 104 ppm at the S-1 sample location, slightly exceeds the default background concentration of 86 ppm for this metal. No other metals concentrations

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were identified in surface soil samples at concentrations exceeding default background concentrations.

6.3.2 Stormwater Catch Basin Sample

Samples of accumulated soils / sludge within two process-area stormwater catch basins (CB2 and CB3) at the Siltronic property were collected and composited by representatives of Siltronic as described in Section 4.3. Results of laboratory analyses of the composited sample, included on Tables 5 through 9, are summarized as follows:

- 9,000 ppm oil-range petroleum hydrocarbons were identified in accumulated soils/sludge within the sampled catch basins. Further, 2.6 ppm total PAHs, 10 ppm toluene, and 0.4 ppm total cyanide were identified within these soils. No VOCs (other than toluene) or SVOCs (other than PAHs) were identified within these soils.

- With regard to metals, zinc was identified at a concentration of 360 ppm, exceeding the 86 ppm default background concentration for soil, while silver was identified at a concentration of 1.3 ppm, slightly exceeding the default background concentration of 1.0 ppm for soil.

6.3.3 River Embankment – Fab 2 Outfall Soil Sample

A soil sample (-173) from the embankment beneath the Fab 2 stormwater outfall was collected by HAI as described in Section 4.4. The soil sample, which was wet and contained a possible natural organic decay odor, displayed no field screening evidence of impact. Results of laboratory analyses of the sample, included on Tables 5 through 9, are summarized as follows:

- 3,720 ppm diesel-range petroleum hydrocarbons and 4,700 ppm oil-range petroleum hydrocarbons were identified in the soil sample. Further, 91.2 ppm total PAHs and 13,900 ppm total cyanide were identified within this soil sample. No VOCs, including benzene, or SVOCs (other than PAHs) were identified at concentrations greater than laboratory reporting levels.

- With regard to metals, a comparison of identified metals concentrations with default background concentrations was conducted (see Table 7). The comparison indicates that copper, lead, and zinc, identified at

concentrations of 286 ppm, 31.7 ppm, and 846 ppm, respectively, were present at concentrations exceeding default background concentrations of 36 ppm, 17 ppm, and 86 ppm, respectively.

6.3.4 Subsurface Soils

Results of laboratory analyses of subsurface soil samples, included on Tables 5 through 9, are summarized as follows:

- PAHs and SVOCs: Soil samples with the greatest overall concentrations of petroleum-related contaminants directly correlate with zones where field screening evidence of impact (e.g., oil or tar presence) was identified (Table 5). With this regard, the greatest total PAH and SVOC concentrations identified in soil samples collected from shoreline borings were identified at a depth of 30 feet bgs at the P-1 boring location, correlating to a sample containing weathered tar. At this location, 35,432 ppm total PAHs were identified, as were 2,180 ppm 2-methylnaphthalene, 413 ppm carbazole, and 230 ppm dibenzofuran. The PAH concentrations identified at this location were approximately one order of magnitude higher than identified elsewhere, likely due to the fact that this sample consisted almost entirely of weathered tar (e.g., no soil). As described in Section 6.5.2, no detectable levels of benzene, and only low levels of PAHs, were identified in groundwater across this zone. Further, no SVOCs (e.g., 2 methylnaphthalene, carbazole, dibenzofuran) were identified in groundwater at the P-1 location.

- Benzene: The greatest overall benzene concentrations identified in soil as part of Focused RI activities (shoreline and interior borings) were on the west side of the Fab 1 structure, where 218 ppm benzene was identified in an oily sample collected from a depth of 20 feet bgs at the GP-10 location. As summarized on Table 5, the greatest benzene concentrations in soil were typically identified in samples containing visual evidence of oil or tar.

  With regard to near-shore areas, the greatest benzene concentration identified within shoreline borings was 8.63 ppm at a depth of 30 feet bgs in a tar-containing sample collected from the surficial fill at boring P-1.

- Cyanide: Detectable concentrations of total cyanide were identified in subsurface soils at concentrations ranging from 0.1 ppm to 15,000 ppm (Table 5). The greatest concentration of cyanide (15,000 ppm) was identified at a depth of 2 feet bgs at the P-8 boring location. The soil at this depth was described as brown silty sand containing a possible petroleum odor. No petroleum hydrocarbons were identified in this soil sample. No elevated metals concentrations, which would be an indicator of possible MGP-related spent oxide or purifier box wastes, were identified in this soil sample.

  Soils at locations with total cyanide concentrations greater than 1,000 ppm were all identified within the surficial fill unit and were described as sand with gravel, silty sand with gravel, or sandy silt with gravel. The elevated cyanide concentrations did not appear correlated with the presence or absence of field screening evidence of impact (i.e., tar or oil). No blue coloration (i.e., "prussian blue"), which is often typical of the presence of MGP-related spent oxide or purifier box wastes, was observed in any soil samples. No total cyanide concentrations greater than 16.4 ppm were identified within borings installed as part of LTI's investigation activities conducted at further upland locations (GP-02-01 through GP-02-03).

  One potential source for the identified cyanide impacts in soil would be spent oxide / purifier box wastes, should such materials have been incorporated into fill at the Siltronic property. However, imported fill is another potential source for the cyanide, especially since the greatest cyanide concentrations (greater than 1,000 ppm) were identified in fill at areas well away from the area where spent oxide was stored, and soils containing the highest cyanide concentrations did not contain field screening evidence of the presence of MGP-related materials (e.g., no wood chips, spent lime, prussian blue coloration, tar or oil). Further, the maximum total cyanide concentrations identified in the fill materials at the Siltronic property (up to 15,000 ppm) do not correlate with concentrations identified in soils at the adjacent Gasco site, where cyanide impacts likely attributable to spent oxide / gas purifier wastes have been identified at concentrations of no greater than 518 ppm.

- Metals: With regard to metals, relatively consistent concentrations were identified at all sampling locations. Where possible, and as provided on Table 9, a comparison between identified soil concentrations and default background metals concentrations was conducted. The preceding indicated the presence of five metals at concentrations exceeding default background concentrations at the P-2, P-4, P-9, and P-10 boring locations. Specifically, cadmium, copper, lead, nickel, and zinc were elevated above default background values at the P-2 boring location, while lead and zinc were both elevated above default background values at the P-4 and P-9 boring locations, and lead was elevated above default background values at the P-10 boring location.

6.4 Oil and Tar Observations

With regard to field screening or observation of subsurface soils, references to bitumen, tar, or oil were noted on geotechnical soil boring logs for borings installed at the site in 1977, prior to Siltronic's purchase of the property. Further, oil and tar have reportedly been identified by Siltronic personnel within the surficial fill unit during development activities associated with the Siltronic property (Section 3.5.2), and have been further identified within the surficial fill unit, and in a more limited area (i.e., the northern corner of the property) oil has been observed within the alluvial unit at the site.

A summary and description of all borings at the Siltronic site where visual occurrence of oil or tar has been noted within subsurface soil logs is included in Table 19. This table was prepared based on HAI's review of boring logs. Also, cross-sections for the subject property (Appendix I) depict locations and depth intervals where oily or tarry soils have been identified at the site, with cross-sections A-A' through C-C' extending to in-water borings installed beneath the river near the northern corner of the property by MFA in October 2004 (MFA, 2005).

Figures 10 through 12 depict the estimated extent of tarry or oily (NAPL) soils across different subsurface horizons at the Siltronic property based on boring log descriptions (Table 19), interpretation between boring locations, and descriptions provided by site personnel. Specifically, Figure 10 depicts the estimated lateral extent of oily and tarry soils within the surficial fill unit;

Figure 11 depicts locations where oily soils or DNAPL have been identified in borings or wells within the underlying alluvial WBZ at any depth shallower than 100 feet bgs; and Figure 12 depicts locations where oily soils or DNAPL have been identified at any depth within the alluvial WBZ greater than 100 feet bgs. Because the base of the river is at a depth of approximately 80 feet bgs (relative to the surface at Siltronic), the DNAPL as identified in Figure 12 (i.e., greater than 100 feet bgs) does not have a complete exposure pathway to the river.

With regard to the presence of DNAPL in monitoring wells at the Siltronic property, DNAPL (oil) has been identified within one surficial fill WBZ well, located at the north central portion of the Siltronic site (WS-10-27). This well is located approximately 900 feet upland from the Willamette River shoreline. Thickness of DNAPL accumulation in this well is approximately 1 to 2 feet.

With regard to DNAPL penetration into the alluvial WBZ (Figure 11), oil has been observed at the Siltronic site within soils collected from beneath the silt unit at borings B-1-8, WS-11, WS-14, WS-15, and WS-16, all in the former 400-foot wide lowland area located at the northern end of the current Siltronic property.

The deepest NAPL directly observed on Siltronic property has been identified in the 400 foot-wide former lowland area at borings B-1-8 and WS-16, where NAPL has been logged to depths of up to 74 feet bgs (WS-16).

In 2004, MFA identified DNAPL near the northern corner of the Siltronic property at nearshore well locations WS-11-125 and WS-14-125. Based on screened intervals for the wells, the DNAPL identified at these locations (0.5 to 3 feet at the base of each well) would be present across some fraction of the depth range between 110 and 125 feet bgs. Further, MFA identified approximately 6 feet of DNAPL within well WS-15-85, an 85 foot deep alluvial WBZ well located further upland from the WS-11-125 and WS-15-125 locations, within the former lowland area (McClincy, Pers. Comm., 2005).

Neither DNAPL, or elevated petroleum-related COI concentrations have been identified in wells screened across depths of 145 to 160 feet at either the WS-11 or WS-14 locations, or across depths of 125 to 140 feet bgs at the WS-15 location.

The identification of DNAPL within alluvial WBZ within wells constructed at the northern portion of the Siltronic property supports the conceptual model of NAPL penetration beneath portions of the former lowland area near the northern corner of the Siltronic property (Figures 11 and 12). The depth of the NAPL identified at the WS-11-125 and WS-14-125 locations, which are proximate to the river embankment (Figure 12), indicate it to be present across a zone that is below the base of the river, and it therefore is not likely to migrate to the river (cross-section E-E', Appendix I). NAPL was not observed in push probe borings installed by Siltronic off-shore of this area, except as limited to near surface / shallow sediments (Table 19), which would appear to have been directly placed onto the sediments.

Analytical testing of the oily DNAPL recovered from well WS-11-125 was conducted by Siltronic in 2004. Results of this testing indicates the DNAPL has a specific gravity of 1.09, is primarily composed of diesel-range hydrocarbons (593,000 ppm), and contains a high fraction of PAHs, with naphthalene having the highest concentration (68,000 ppm). Additionally, carbazole (1,340 ppm), dibenzofuran (858 ppm), and TCE (59.6 ppm) were identified in the DNAPL, as was 271 ppm benzene (MFA, 2004). The TCE is apparently present as a function of the commingling of the heavy oil occurrence with the Siltronic TCE occurrence. TCE, a solvent, may be expected to entrain or otherwise increase dissolution and mobility of DNAPL in areas where commingling occurs.

Based on the preceding, it appears that the DNAPL (oil) below the silt unit at the Siltronic property is attributable to a source within the former 400 foot-wide lowland area. As previously described, petroleum wastes may have overflowed from the Gasco effluent ponds to the former ground (e.g., silt unit) surface between 1951 and 1956, with NAPL subsequently migrating vertically into the alluvial WBZ through rootlet zones within the silt unit beneath the northern portion of the lowland area (Figures 11 and 12, and cross-Section A-A' in Appendix I). The greatest vertical DNAPL penetration appears to have occurred proximate to an area where the silt surface is found to thin (WS-15/B-1-8 area), and where the greatest TCE concentrations are present.

With regard to other shoreline area borings at the Siltronic site, borings P-1, P-4, P-5, P-7, GP02-01, and GP-02-02 identified the presence of thin (0.5 to 1.5 feet thick) zones of weathered tar or oil within the fill (Figure 10). At borings P-1, GP02-01, and GP02-02, the weathered tar or oil was identified

at the base of the fill, on what was likely the pre-fill ground surface. As such, this tar or oil is likely attributable to former effluent pond overflows or direct placement.

Oily soil identified at the P-7 location correlates with the area of possible discolored soils, as identified in 1970 aerial photograph of the site, as being present in the immediate vicinity of the former Western Transportation structures (Figure 3). The low concentrations of PAHs in the oily soil identified at P-7 (total PAHs are less than 2 percent of the TPH), as well as its location relative to the suspected historical surface staining, suggest that the impacts at this location are likely diesel or fuel oil related, and appear to be associated with the former Western Transportation fueling operations. At the P-4 and P-5 boring locations, the oil / tar was found mixed within the sand or sand and gravel fill, and did not correlate with the former ground surface. At the P-5 location the tarry zone correlated with the presence of brick fragments. Based on these observations, it appears that the oil and tar identified at borings P-4 and P-5 is a function of incorporation of oil and tar into the fill during placement (1966-1975). Due to the nature of this source (mixing into fill), it is possible that other discontinuous zones of oil or tar may exist throughout this portion of the site.

In addition to the preceding, as depicted on Figure 10, oil has been identified within the fill unit elsewhere at the Siltronic property. Specifically, borings located at the undeveloped southern corner of the site have identified the presence of oily soils within the fill, with observations of oil identified below a depth of 10 feet bgs, with the thickness of oily zones ranging from 1 foot or less (WS-6, B-6, B-102), to up to 10 feet (WS-1, WS-2).

Data concerning the presence or absence of tar or oily soils are not available for the portion of the site east of the Olympic pipeline in the parking / undeveloped portion of the site. Based on review of historical aerial photographs, and based on observations of fill at other portions of the site, it is possible that fill placed at this portion of the site also may contain tar and/or oil, which, if present, would have been incorporated into the fill in this area during the 1966 to 1975 timeframe.

With regard to the DNAPL identified at shoreline wells WS-14-125 (cross-section A-A') and WS-11-125 (cross-section B-B'), direct observations of soil core indicate these areas to be wholly disconnected and separate relative to the shallow oily sediments identified at off-shore locations. Specifically, borings installed offshore of WS-11 and WS-14 through the entire thickness

of the alluvial unit did not identify the presence of DNAPL across horizons that would be indicative of subsurface transport. Further, due to the depth of the DNAPL (greater than 100 feet bgs); the density of the DNAPL (greater than 1.0); and the apparent presence of a downward hydraulic gradient beneath the river, the DNAPL does not appear to be a future migration threat with regard to the river.

Based on the preceding, the oily sediments off-shore of the northern portion of Siltronic are likely the result of direct discharges from the former Gasco effluent ponds via the former ditch located near the current Gasco / Siltronic property boundary (1941 to 1951) or direct discharges from the former 400-foot wide lowland area at the Siltronic property via the ditch formerly located approximately 400 feet upriver from the property boundary (1951 to 1956), rather than through the erosion of bank or surface soils. or the migration of contaminated groundwater or NAPL to surface water.

6.5 Water Sampling Results

6.5.1 Stormwater – Fab 1, Fab 2, and Administration Building Outfalls

Stormwater samples from the Fab 1 outfall sampling point, and from the end of pipe at the Fab 2 and Administration Building outfalls, were collected by HAI as described in Section 4.4. Results of laboratory analyses of the samples, included on Table 10, are summarized as follows:

- Benzene, PAHs, SVOCs, and cyanide were not identified in stormwater samples collected from any of the three outfalls. With regard to detected VOCs, acetone [34.4 parts per billion (ppb)] and chloroform (2.69 ppb) were both identified in the stormwater sample collected at the Fab 1 sampling outfall.

- Metals, which are naturally-occurring in the environment, were identified in unfiltered water samples collected from all three stormwater outfall sampling locations. Specifically, the metals barium, copper, iron, magnesium, manganese, titanium, vanadium, and zinc were identified at all sample locations, while lead was identified only at the Administrative Building outfall.

6.5.2 Groundwater

Results of groundwater sampling activities conducted as part of NW Natural's Focused RI activities at the Siltronic site are described herein. Siltronic's investigations into chlorinated solvent impacts at the site are described in reports submitted to DEQ separately by Siltronic and are not summarized here.

Results of all identified and available laboratory analyses of groundwater samples collected from monitoring wells and temporary well points at the Siltronic property are summarized on Tables 11 through 18. The most recent available data for the Siltronic site, as summarized on these Tables, were used to prepare contaminant plume maps for key COIs [benzene (Figures 13 and 14), naphthalene (Figures 15 and 16), and total cyanide (Figures 17 and 18)] within both the surficial fill and alluvial WBZs.

Groundwater quality data from the Siltronic property that are posted on the referenced figures were obtained from results of investigatory activities conducted by HAI for NW Natural, and LTI, MFA, and others for Siltronic. Primary sources for the Siltronic property data include a 2003 HAI report (HAI, 2003), as well as reports prepared by MFA (MFA 2003, 2004a,b, 2005), and a 1990 report prepared by CH2M HILL, Inc. (CH2M HILL, 1990). Further, the most recently available groundwater quality data for each monitoring point at the adjacent Gasco site (HAI, 2005), and recently obtained groundwater quality data from temporary well points installed beneath the Willamette River near the northern corner of the Siltronic property (MFA, 2005), were used in preparation of these plume maps. The Siltronic property data are summarized herein on Tables 11 through 18.

Hydrogeological cross-sections included within Appendices I and J depict groundwater sampling intervals, location of identified mixed tar or oily soils, as well as benzene concentrations (Appendix I) or naphthalene concentrations (Appendix J), with plume contours depicting the interpreted extent of impact.

Descriptions of the distribution of key COIs, selected as key indicators relative to the distribution of all COIs, are provided in the following sections.

6.5.2.1 *Surficial Fill WBZ*

Benzene

As depicted on Figure 13, the highest concentrations of benzene within the surficial fill WBZ at the Siltronic property are identified beneath the western portion of the site (Olympic Pipeline release area), where up to 25,000 ppb were identified (GP-24).

The distribution of benzene within the surficial fill WBZ (Figure 13) suggests that both the Olympic Pipeline and MGP-residues may be sources of benzene impact at Siltronic, with commingling occurring as a function of the benzene plume from the Olympic release migrating across an area containing historically placed MGP wastes within the 400 foot lowland area.

With regard to nearshore wells, benzene concentrations in the surficial fill WBZ are less than 50 ppb across a majority of the Siltronic site and across all of the Gasco site (Figure 13). Specifically, benzene concentrations greater than 50 ppb are limited to approximately 400 feet of shoreline immediately upriver of the Siltronic/Gasco property line (e.g., the former lowland area), where concentrations of between 61.2 ppb (boring P-2) and 104 ppb (boring P-3) have been identified. Cross-sections A-A' through E-E' (Appendix I) depict the extent of benzene concentrations in groundwater within the surficial fill adjacent to the Willamette river.

As depicted on these cross-sections, and as depicted on Figures 13 and 14, with regard to the Siltronic property, vertical migration of benzene from the surficial fill WBZ through the silt unit and to the underlying alluvial WBZ is limited to the northern corner of the Siltronic property.

With regard to the areas proximate to North Doane Creek (i.e., southern and southwestern portions of the Siltronic property), with the exception of one location (WS-6), concentrations attenuate from the apparent source areas, with no benzene concentrations greater than 50 ppb being identified within the surficial fill WBZ at inferred down-gradient locations. With regard to the sample collected from well WS-6, located near the southern corner of the property, 614 ppb benzene was identified in groundwater. Shallow groundwater in this area may discharge to North Doane Creek, which in turn discharges to the Willamette River at the City Outfall 22C location. Outfall

22C is the discharge point for 1,008 acres of drainage that includes several industrial properties, city streets and other transportation right-of-ways. Cross-sections G-G' through I-I' (Appendix I) depict identified benzene concentrations in groundwater across this portion of the site.

Naphthalene

The distribution of naphthalene in the surficial WBZ is similar to that described above for benzene, with the exception that the areas of highest concentration are shifted northeast, corresponding to a low area on the top of the silt unit at the former 400 foot wide lowland area at the Siltronic site (495,000 ppb at GP-22)(Figure 15). Based on the preceding, a primary source for the naphthalene in groundwater at Siltronic appears to be oily soils present within the former lowland area. Cross-section G-G' (Appendix J) depicts naphthalene concentrations in groundwater parallel to the river across Siltronic and a portion of the adjacent Gasco site at a location proximate to the suspected source areas.

No naphthalene concentrations greater than 500 ppb have been identified within the surficial fill at any shoreline locations at either the Siltronic or the adjacent Gasco site. Cross-sections A-A' through E-E' (Appendix J) depict the extent of naphthalene concentrations in groundwater within the surficial fill adjacent to Willamette river bathymetry. As with benzene, described above, and with regard to the Siltronic property, vertical migration of naphthalene impacts from the surficial fill WBZ through the silt unit and to the underlying alluvial WBZ is primarily limited to the northern corner of the Siltronic property. With regard to the southern portion of the site, up to 2,100 ppb naphthalene have been identified within the surficial fill WBZ (WS-6 well location), with the patchy zones of oil identified within fill in this area (Figure 10) apparently acting as a source for lower level impacts to shallow groundwater. Shallow groundwater in this area may discharge to North Doane Creek, which in turn discharges to the Willamette River at the City Outfall 22C location. Outfall 22C is the discharge point for 1,008 acres of drainage that includes several industrial properties, city streets and other transportation right-of-ways. Cross-sections G-G' through I-I' (Appendix J) include identified naphthalene concentrations (and the relationship to identified oily soils) in groundwater across this portion of the site.

Cyanide

Concentrations of total cyanide greater than 0.05 ppm are present in the surficial fill WBZ across a majority of the Siltronic site (Figure 17), with the highest concentrations being identified at the northern portion of the Siltronic site south of the former lowland area (4.41 ppm at GP-2-01).

At shoreline locations, the greatest concentrations of cyanide (greater than 0.5 ppm) were limited to within the 400 feet of shoreline immediately upriver of the Siltronic/Gasco property line where concentrations of up to 0.726 ppm have been identified (well WS-8-33). As described in Section 6.3.4, the source(s) for the identified cyanide appear to be related to the surficial fill, but are otherwise not well understood.

Other Chemicals

With regard to VOCs, low levels of styrene (up to 7 ppb at the WS-10-27 location), trimethylbenzene isomers (up to 156 ppb at the GP-24 location), as well as low levels of butylbenzenes, propylbenzenes, and 1,2-dichloroethane were identified sporadically in groundwater samples collected from the surficial fill WBZ at the northern portion of the Siltronic property. With exception of styrene, these organic compounds are common components of petroleum and their presence in groundwater impacted with benzene or naphthalene, as described above, is typical. Styrene, although manufactured from a petroleum source, is used as a component of plastics, rubber, latex, and polyester resins. The source of the low level styrene detections identified sporadically at the site is not known.

Certain SVOCs, including several phthalates, carbazole, dibenzofuran, and 2-methylnaphthalene, were identified in groundwater collected from shore-line push probe sample locations P-1, P-2, P-3, P-5, P-8, P-9, and GP-4, with the greatest nearshore concentrations identified within the surficial fill WBZ at the P-3 / WS-8-33 location. Specifically, with regard to monitoring well WS-8-33, concentrations of carbazole (18.3 ppb), dibenzofuran (3.05 ppb), and 2-methylnaphthalene (41.9 ppb) were identified during the final sampling event conducted in July 2003, while no SVOCs were identified at the WS-9-34 location. Further upland from the shoreline, within the former 400-foot wide lowland area, the greatest detected concentrations of carbazole, dibenzofuran, and 2-methylnaphthalene were 338 ppb, 25.2 ppb,

and 510 ppb, respectively (WS-10-27). The identified SVOCs are COIs with regard to oil and tar, and their presence, especially at locations such as WS-10-27, completed within oily soils, is expected.

The low level detection of these constituents does not appear to represent a unique source or distribution relative to the depicted benzene and naphthalene plumes, so further discussion of these constituents are not included herein.

6.5.2.2 Alluvial WBZ

Benzene

With regard to the alluvial WBZ, as depicted on Figure 14, benzene impacts greater than 50 ppb are limited to the northern corner of the Siltronic property (i.e., former lowland area) and the eastern corner of the adjacent Gasco property (former effluent pond / discharge area). Because only very low concentrations of benzene were detected in vertical groundwater quality profiling at the B-56 location at the Gasco shoreline, it appears that there are two separate areas of contaminant entry through the upper silt unit into the alluvial WBZ. Of these two areas, one appears to have been a source to relatively shallow impacts as identified in a downriver direction from boring B-56 at Gasco (e.g., MW-4-56 and MW-16-45 well locations), while the other appears to have resulted in deeper impacts as identified near the eastern corner of Gasco (MW-5-100) and extending in an upriver direction across the northern portion of the Siltronic property (e.g., WS-14-125 and WS-11-125 well locations).

With regard to Siltronic, the deeper benzene plume extends along the shoreline from a location proximate to the Gasco/Siltronic property boundary (well MW-5-100 at Gasco), approximately 375 to 450 feet upstream to a location on the Siltronic property between the WS-11-125 and WS-12-125 well locations (cross-section E-E', Appendix I). Vertically, benzene concentrations greater than 50 ppb at the shoreline along the Siltronic property extend from between approximately 60 to 70 feet bgs to approximately 140 feet bgs (cross-section A-A', Appendix I).

Within this plume, the greatest benzene concentrations are identified at depths greater than 80 feet bgs at the shoreline proximate to the Siltronic /

Gasco property line, where 11,500 ppb have been identified in groundwater from 90 to 100 feet bgs at well MW-5-100 (Gasco), and 8,200 ppb have been identified at 86 feet bgs at the adjacent WS-14 location (Siltronic). Laterally, this plume attenuates significantly over a short distance with a maximum of 3.62 ppb identified in a downriver direction from MW-5 along the shoreline at the B-56 location, and with a maximum of 536 ppb identified immediately upstream of WS-14 along the shoreline at the WS-11 well cluster location. The extent of the plume is further delineated upstream along the shoreline at the WS-12 well cluster location, where benzene concentrations across all zones have typically been non-detect to less than 20 ppb, although the November 2004 sampling result at this location (Table 15) indicated the presence of 446 ppb benzene across a depth interval of 145 to 160 feet bgs. Because the previous three sampling events at this location, as well as temporary well point data from across this depth interval (Table 13) indicate less than 0.6 ppb benzene, this most recent result appears anomalous.

This deeper plume, which extends from the eastern corner of the Gasco site approximately 400 feet across the Siltronic property line (e.g., MW-5, WS-14, and WS-11), appears to be the result of deeper DNAPL migration near the northern limit of the former effluent ponds in vicinity of the Gasco/Siltronic property boundary (e.g., borings B-32 / B35) and/or within the former 400 foot wide lowland area (B-1-8 / WS-15-85). Cross-sections A-A' through G-G' within Appendix I depict the vertical profile of the plume, including inferred location of where DNAPL and associated dissolved phase impacts have penetrated into the alluvial WBZ, based on available soil descriptions and groundwater quality data.

Results from in-river boring work conducted by MFA for Siltronic (borings GP-25 through GP-32) indicate that the benzene plume has not moved upward to shallow sediments beneath the river within the area of investigation (cross-section A-A' through C-C', Appendix I). The few locations where shallow benzene concentrations exceed 50 ppb (99.2 ppb at GP-27, 103 ppb at GP-32), appear to be related to the presence of oily and/or tarry zones within sediments coinciding with the sample locations.

The lack of upward plume migration is supported by MFA's findings that a downward hydraulic gradient predominates below the river, and that this section of river may predominantly be a losing reach (MFA, 2005). Laterally, the benzene plume is defined in the upriver direction. To the north, in the

apparent down-gradient direction, the plume appears to extend towards a location off-shore of the adjacent Gasco site, with the apparent down-gradient extent not fully delineated.

Naphthalene

The distribution of naphthalene within the alluvial WBZ closely matches the vertical and lateral distribution of benzene as described above, with concentrations greater than 500 ppb extending across the northernmost 300 feet of shoreline at Siltronic, and across a depth interval of 60 to 150 feet bgs. Similarly, areas of naphthalene migration into the alluvial WBZ from the overlying surficial fill WBZ appear to coincide to areas where benzene migration has occurred, being limited to the northern corner of the Siltronic site, and eastern corner of the Gasco site (cross-section A-A' through G-G', Appendix J).

As with benzene, results of MFA in-water work (MFA 2005) suggest that the upland-sourced naphthalene plume is migrating beneath the river without discharge to shallow river sediments (cross-section A-A' and B-B', Appendix J). However, as further depicted on cross-section B-B' and on Figure 16, it appears that historical direct deposition impacts to sediments offshore of the Siltronic site (e.g., as observed in borings GP-27 and GP-29) may be acting as an independent source of contaminants to surface porewater and deeper groundwater, with the highest concentrations identified from 0 to 2 feet below mudline and decreasing with depth through the entire thickness of the alluvial WBZ. Such a concentration profile is entirely consistent with impacts from the surface placement of material and inconsistent with a plume coming from dissolved phase transport from the uplands (in which case the concentration gradient would be the reverse of what is observed). As with benzene, the plume as it extends beneath the river is delineated in the upriver direction, but the down-gradient extent (to the north and offshore of the Gasco site) has not been defined.

Cyanide

With regard to data available in proximity to the river (Figure 18), cyanide concentrations greater than 0.5 ppm have been identified near the northern corner of the Siltronic property.. Vertically, cyanide concentrations greater than 0.5 ppm have been identified within the alluvial WBZ at Siltronic to depths of approximately 100 feet bgs (e.g., GP-4, GP-6, P-3), while concentrations greater than 0.05 ppm have been identified to the base of the alluvial WBZ (e.g., WS-15 and WS-16).

As depicted on Figure 18, the greatest total cyanide concentrations identified in the alluvial WBZ at the Siltronic site were identified at a location corresponding to the highest concentrations identified in the surficial fill WBZ (Figure 17). Specifically, 1.01 ppm cyanide was identified in the upper alluvial WBZ at the GP-2-01 location (54-58 feet bgs), while 4.04 ppm total cyanide was detected in the overlying surficial fill WBZ at this location.

As described in Section 6.3.4, the source(s) for the identified cyanide appear to be related to the surficial fill, but are otherwise not well understood.

Other Chemicals

Methyl-tert-butyl-ethane (MTBE), chlorobenzenes, and dichlorobenzenes (and at certain locations low levels of benzene and TCE), 2,4,5-TP (silvex), and chloroform, COIs relative to site investigation activities occurring on the Rhone-Poulenc / Aventis property to the south of Siltronic (AMEC, 2003), were identified in groundwater samples collected from within the Alluvial WBZ both at the southern portion of the property (e.g., wells GP-11, RP-1-51, RP-1-65, RP-6-87, RP-7-84, RP-7-119, as well as at the northern portion of the Siltronic property (WS-11 through WS-17). The identification of the off-site COIs at the northern portion of the Siltronic property were all identified near the basal portion of the alluvial WBZ, typically well below the petroleum or chlorinated solvent-related impacts derived from sources located at the northern portion of the Siltronic property. The presence of these off-site southward originating COIs near the northern corner of the site, supports the general flow direction interpretation for the basal alluvial WBZ,

which depicts a more northerly component of flow than within the upper portions of the alluvial WBZ.

PCE has been identified at a low concentration within the alluvial WBZ in a sample collected from the WS-13-69 well location (3.26 ppb), and within a sample collected at a depth of 80 feet bgs from the boring for well WS-15 (0.87 ppb). PCE is not a COI with respect to known potential sources of impact at Siltronic or the adjacent Gasco site. Although the source of the PCE is not known, locations where it was identified had significant concentrations of TCE (e.g., 198,000 ppb at WS-13-69 and 243,000 ppb at WS-15). The coincidence of these two chlorinated solvent constituents would suggest that the low level PCE concentrations are possibly present as the result of impurities within the TCE, as opposed to the presence of a unique on-site or off-site source.

7.0 SUMMARY OF FINDINGS

The primary objective of the Phase I Site Characterization Report is to present the findings of investigatory work conducted at the Siltronic site to date, including updates to the conceptual site mode, in order to support a source control evaluation with regard to contaminant migration from the Siltronic property to the Willamette River.

The source control evaluation, to be provided as a separate stand-alone document, will evaluate and identify the need to implement source control measures at the Siltronic site, and/or will identify those specific areas where additional investigatory activities are necessary to more completely evaluate the potential that unacceptable levels of hazardous substances may be discharging from the Siltronic site to Willamette River sediments.

A brief summary of the findings, including contaminant source areas and pathways of significance with regard to potential sources of impact to the Willamette River from the Siltronic site, is provided below, as is a preliminary identification of additional data needs – to be refined upon completion of the source control evaluation update.

7.1 Contaminant Sources

7.1.1 Sources Attributable to MGP-Related Waste Management

PG&C operated an oil MGP on the Gasco property, north of Siltronic, from 1912 until 1956. PG&C owned a portion of the Siltronic property from 1939 until 1962, during which time waste management activities were conducted at three portions of the present-day Siltronic property, as follows:

Former 400-foot Wide Lowland Area: Immediately south of the common Siltronic/Gasco property line. This approximate 10-acre area received tar and tar/oil/water emulsifications from effluent pond overflow and from direct placement of MGP residuals between 1941 and 1956. Soil and groundwater impacts attributable to this feature are present at the Siltronic site. Estimates based on tar thickness measurements made in 1960 (2 to 6 feet

of tar across much of the area) indicate approximately 40,000 cubic yards of tarry materials may have been present in this area subsequent to cessation of all MGP-related activities at the Gasco site, which occurred in 1956. The function of this lowland area was to minimize effluent discharges to the Willamette River. COIs related to this area include PAHs, SVOCs, and monoaromatic hydrocarbons (e.g., benzene).

Former Depression or Excavation: South of the former lowland area, approximately 2 to 3 feet of tar was identified at the base of this approximate 0.5-acre apparent excavation when evaluated in 1960. This feature was first observed in aerial photographs dated 1955. Estimates based on tar thickness measurements made in 1960 indicate approximately 2,000 cubic yards of tarry materials may have been present in this area subsequent to cessation of all MGP-related activities at the Gasco site. The function of this depression / excavation is unknown. COIs related to this area include PAHs, SVOCs, and monoaromatic hydrocarbons.

Former Spent Oxide / Gas Purifier Waste Storage Pile: Company records indicate an estimated 34,000 cubic yard stockpile of spent oxide / gas purification wastes were formerly stored immediately south of the common Siltronic/Gasco property line near the western corner of the Siltronic property. Aerial photographs indicate the stockpile was present at this location between 1952 and 1966, several years after NW Natural sold the property. The final disposition of this material is unknown. COIs potentially related to this these materials include cyanide and metals (arsenic, chromium, copper, lead, nickel, zinc).

7.1.2 Other Contaminant Sources

Olympic Pipeline Petroleum Release(s): The Olympic Pipeline utilizes two product lines (diesel and kerosene; gasoline) within a utility corridor that traverses the central portion of the Siltronic property. Line failure resulting in product release and soil and groundwater impacts was identified near the western corner of the Siltronic facility in 1979, proximate to the 400-foot wide former lowland area. COIs related to this area includes PAHs and monoaromatic hydrocarbons.

Western Transportation Petroleum Release(s): Western Transportation operated a petroleum fueling dock at the eastern corner of the Siltronic between approximately 1930 and 1950. Possible surface staining was noted on a 1970 aerial photograph, and petroleum impacts to soil, likely

attributable to these activities, have been identified. COIs related to this area includes PAHs and monoaromatic hydrocarbons.

Siltronic-Related Releases: TCE leaked from an underground storage tank system operated by Siltronic at the northern portion of the property resulting in soil and groundwater impacts. Related COIs include: TCE and degradation products; possibly tetrachloroethene (PCE) as an impurity within TCE. Other releases associated with Siltronic operations (1980-1997), also on the northern portion of the property, include chromium solution, acids, caustics, and organic wastewater releases or spills.

Off-Site Releases: Contaminants related to identified sources south of the Siltronic property have been detected within groundwater at the Siltronic site, indicative of on-site migration. Off-site contaminants include: benzene, chlorobenzene isomers, dichlorobenzene isomers, MTBE, 2,4,5-TP, chloroform, TCE and degradation products.

Filling Activities: Site filling activities were conducted on the Siltronic property between 1967 and 1975. Filling involved placement of 1.5 million cubic yards of material on the property, including approximately 700,000 cubic yards of dredge spoils from unidentified locations. Depending upon origin, dredged sediments could reasonably have been impacted by many different sources of potential contamination, including ship traffic, industrial operations (such as MGP, wood treating facilities, shipyards, pesticide manufacturing, or petroleum terminals), agricultural activities, or urban run-off. During the time of filling activities, the property was owned by Mr. Victor Rosenfeld and Mr. H.A. Anderson.

In addition to possible sources of impact from the dredged sediments used as fill, observations of tar or oil during various investigations or construction activities at the Siltronic site, as well as dark soils visible in aerial photographs between 1967 and 1971, suggest the possibility that MGP-related wastes from the 400-foot wide lowland area may have been redistributed and combined with fill placed at various portions of the Siltronic property during filling activities (1966-1975), after NW Natural sold the property in 1962.

7.2 Hydrogeologic Framework

Groundwater occurs in three hydrologic zones beneath the Siltronic site, the unconfined surficial fill WBZ, the semi-confined alluvial WBZ, and the confined bedrock aquifers of the Columbia River Basalt Group.

Surficial fill consists of 700,000 cubic yards of dredge materials and 800,000 cubic yards of other materials. Impacted soils, derived from the emplaced dredge or other imported fill and/or from re-distribution of impacted soils/residues from former MGP-related waste management areas, have been identified within the surficial fill at numerous locations across the property.

The saturated thickness of the surficial fill WBZ ranges from 1 to 5 feet adjacent to the river, to between 10 and 20 feet across the central, southern, and western portions of the site. Overall groundwater flow direction across a majority of the site is to the northeast, towards the Willamette River. A groundwater divide exists near the southern and western portions of the site, with flow back to the south and toward North Doane Creek.

Responses to tidal fluctuations in the adjacent Willamette River are not expressed in the surficial fill WBZ, indicating this zone is isolated from the river. A downward hydraulic gradient between the surficial fill WBZ and the alluvial WBZ is typical. As such, groundwater in the surficial WBZ may migrate to the alluvial WBZ in areas where the intervening silt unit thins or otherwise does not impede downward flow.

Beneath the surficial fill WBZ, and defining the surface of the alluvial unit, is a laterally extensive fine-grained silt unit. The silt unit beneath the Siltronic site has been found to range in thickness from approximately 70 feet near the central portion of the site, thinning toward the river, where thicknesses of 1 to 3 feet are common at the riverbank. Beyond the riverbank, a thickening prism of silt has been identified. Vertical migration of groundwater through the silt unit has occurred at the northern portion of the Siltronic site (400-foot wide former lowland area), where the silt unit becomes thin, or where the presence of rootlet zones has allowed fingering of NAPL through the silt.

The alluvial WBZ consists of interbedded sands and silts underlying the silt unit, and ranges in thickness from 2 to 25 feet thick at the central and western portions of the site, to up to 175 feet near the northern corner of the site. Overall groundwater flow direction in the alluvial WBZ is to the

northeast toward the Willamette River, although a more northern component of flow is apparent at the basal portions of the alluvial WBZ.

The overall vertical gradient in the alluvium is predominantly downward in the upper portions of the alluvial WBZ, and upward across the lower portions of the alluvial WBZ, with the greatest horizontal gradient identified at locations further away from the river and at intermediate depths (e.g. 100 to 125 feet bgs).

A relatively thick (>10 foot) layer of silt is present in nearshore sediments adjacent to the Gasco and Siltronic sites, extending 200 to 300 feet from the shoreline. It is expected that the fine-grained silt materials impede nearshore discharge of groundwater to the river from both the surficial fill and the upper portions of the alluvial unit.

Water levels measured in offshore well points identified a predominant downward gradient throughout the alluvial WBZ beneath the Willamette River, indicating the river near the Siltronic and Gasco properties may be a losing reach.

Available vertical gradient data and contaminant concentration profiles adjacent to and beneath the Willamette River are not suggestive of the discharge of groundwater from intermediate to deep portions of the alluvial WBZ to Willamette River sediments.

7.3 Groundwater Quality

Oil and tar historically placed within the former lowland area as a result of effluent pond clean-out and overflow are a source area for identified aromatic hydrocarbon, PAH, and SVOC impacts identified within the fill and alluvial WBZs beneath the 400-foot wide lowland area, with a sharp decline in contaminant concentrations to the south, beyond the limit of the former lowland area. Additionally, the Olympic Pipeline release area is present within this portion of the site, and appears likely to be contributing to the identified benzene concentrations in groundwater.

The benzene plume extends to the Willamette River shoreline within the surficial fill WBZ only near the northern corner of the Siltronic site (down-gradient from the former lowland area), and then only at low concentrations

(up to 104 ppb). The naphthalene plume does not extend to the Willamette River shoreline within the surficial fill WBZ at any location.

Vertical migration of petroleum hydrocarbon-related contaminants (e.g., BTEX, PAHs) from the surficial fill WBZ to the underlying alluvial WBZ is limited to the northern portion of the Siltronic property, correlating to the area of deeper DNAPL (oil) penetration in the 400 foot wide low area. The hydrocarbon plume has been delineated laterally and vertically along the shoreline, extending across a depth interval of approximately 60 to 150 feet bgs, and laterally along the shoreline from a location north of the common property boundary with Gasco, to a location approximately 375 to 450 feet upriver of the property line. Maximum concentrations of 8,200 ppb benzene and 19,700 ppb naphthalene have been identified in groundwater within the plume at the extreme north corner of the property (86 feet bgs at WS-14).

Available data from in-water borings suggest the upland petroleum hydrocarbon plume is predominantly migrating beneath the river without discharge to shallow sediments, with the extent of the upland benzene and naphthalene plume components having been delineated in the upriver direction.

Directly impacted river sediments at certain areas off-shore of Siltronic are acting as a primary source of dissolved phase naphthalene in the surface sediment porewater. These impacts, derived from placement of contaminated material at the surface, extend downward into the sediments, and based on the profile of decreasing concentrations with depth, may be a source of contamination to deeper groundwater. If groundwater discharging from the upland were the source of the observed porewater concentrations, then concentrations would likely increase, rather than decrease, with depth.

Benzene and naphthalene impacts to groundwater at the southern and western portions of the Siltronic site are primarily limited to the surficial fill WBZ, with impacts extending to the south as a function of a localized southern component of flow toward North Doane Creek and North Doane Lake in this area. A source for the impacts identified at this portion of the site may be the presence of oily zones within the fill, which includes 1.5 million cubic yards of material, including 700,000 cubic yards of dredge material brought from unknown sources. The benzene and naphthalene plumes attenuate laterally at all locations near the southern and western property boundaries, with exception of monitoring well WS-6, located adjacent to the buried pipeline that carries stormwater/North Doane Creek to

the Willamette River at City of Portland Outfall 22C. Groundwater seepage into the stormwater pipe, if occurring, could result in discharge to the Willamette River at the Outfall 22C location, which is the subject of a separate, on-going investigation. Outfall 22C is the discharge point for 1,008 acres of drainage that includes several industrial properties, city streets and other transportation right-of-ways.

Cyanide impacts to groundwater are present in the surficial fill WBZ across a majority of the Siltronic property, with the highest concentrations being identified at the central portion of the site, south of the former lowland area (GP-2-01), and extending to the shoreline down-gradient of the former lowland area. Within the underlying alluvial WBZ, concentrations greater than 0.5 ppm have been identified to depths of up to 100 feet bgs, and extending across the northern portion of the Siltronic site. The source(s) for the identified cyanide appear to be related to the surficial fill, but are otherwise not well understood. One potential source for the identified cyanide impacts in groundwater is spent oxide / purifier box wastes that may have been incorporated into fill at the property. However, imported fill is another potential source for the cyanide, especially since the greatest cyanide concentrations (greater than 1,000 ppm) were identified in fill at areas well away from the area where spent oxide was stored, and soils containing the highest cyanide concentrations did not contain field screening evidence of the presence of MGP-related materials (e.g., no wood chips, spent lime, prussian blue coloration, tar or oil).

7.4 Surface and Embankment Soils

Surface soil samples collected along the top of the embankment above the rip-rapped area at Siltronic did not contain total petroleum hydrocarbons or total cyanide, although PAHs and/or SVOCs were identified at low concentrations (less than 2.2 ppm) at the three northernmost locations (e.g., S-1 through S-3). Zinc was identified at the northernmost location (S-1) at a concentration slightly exceeding typical background concentrations. No evidence of overland erosion from the densely vegetated area at the top of the embankment to the heavily rip-rapped embankment, was observed.

Catch basin soils/sludge, which contain soils derived from localized overland erosion, as well as stormwater impacted by routine above-ground operations

(e.g., oil and fuel drippage from vehicle parking lot and paved drive areas), contained oil-range petroleum hydrocarbons (9,000 ppm), low levels of total PAHs (2.6 ppm), and low levels of toluene (10 ppm) and cyanide (0.4 ppm). The source for the oil is likely vehicle drippage, while the low level PAH and cyanide concentrations may be indicative of surface soil transport to certain catch basins at the site.

Diesel and oil-range petroleum hydrocarbons, PAHs (91.2 ppm), and cyanide (13,000 ppm) were identified in a sample of embankment soils collected from the only area not completely armored with rip-rap, a location below the Fab 2 outfall. Bank soils are composed of fill. It is not clear if the identified impacts are associated with impacts attributable to the nature of the fill, or if the soils are impacted as a result of historical discharges from the Fab 2 outfall.

Dredging related to bank stabilization activities conducted in 2000 at a location offshore of boring P-4 created an oily sheen, with characterization of the petroleum impacts within the sediments containing oil and diesel-range petroleum hydrocarbons characteristic of a creosote. The location of the identified oily sediments was in proximity to the former ditch that may have received discharges from the former lowland area (1951-1956).

7.5 Subsurface Soils / Non-Aqueous Phase Liquid

Oil and tar, likely attributable to historical MGP waste management practices at the Siltronic site, have been identified near the base of the surficial fill unit and extending into, and beneath, the underlying silt unit within portions of the former 400-foot wide lowland area, where up to 6 feet of oil have accumulated in a well screened to 85 feet bgs, and where oily soils have been observed as deep as 74 feet bgs. Further, DNAPL has been identified in two alluvial WBZ wells screened to 125 feet bgs at a location between the former lowland area and the Willamette River. The area of deep DNAPL migration beneath, and down-gradient of, the former lowland area corresponds to the location of the significant TCE concentrations in groundwater, suggesting the possibility of a cosolvency effect.

No evidence for the migration of oil or tar from the surficial fill to Willamette River sediments exists. Evaluation of shoreline borings with evidence of residual oil or tar in the surficial fill (P-1, P-4, and P-5) does not suggest the product migrated to these locations from upland sources. Instead, it appears the product was either placed on the ground prior to filling (tar at P-1), or that the product was incorporated into the fill during placement (oil at P-4 and P-5).

Oil identified at boring P-7 appears to be the result of spills to the former ground surface from former Western Transportation operations. The low concentrations of PAHs in the oil identified at P-7 (total PAHs are less than 2 percent of the TPH), and the non-detection of cyanide, indicate that the TPH at this location is not MGP-related waste, but is more likely diesel or fuel oil associated with the former Western Transportation fueling operations.

Oil identified in borings installed at the southern and western portion of the Siltronic property, appear to be the result of the incorporation of oily soils into the fill during site filling activities. Data do not indicate DNAPL migration to the underlying alluvial WBZ, or lateral migration of NAPL within the fill at any of these locations.

Direct observation of soil cores from upland and in-water borings indicate the upland DNAPL to be disconnected and separate relative to the shallow oily sediments identified at off-shore locations. Further, due to the depth of the DNAPL near the shoreline; the specific gravity of the DNAPL (greater than 1.0); and the apparent presence of a downward hydraulic gradient beneath the river, the DNAPL does not appear to be a future migration threat with regard to Willamette River sediments.

Oil or tar-bearing sediments off-shore of the northern portion of the Siltronic property are likely the result of historical overflow from the former effluent ponds at the southern end of the current Gasco property via the former ditch located near the current Gasco / Siltronic property boundary (1941 to 1951), and with possible discharges from the former lowland area via the ditch formerly located approximately 400 feet upriver from the property boundary (1951 to 1956).

7.6 Identification of Potential Contaminant Transport Pathways

Based on the preceding, potential contaminant transport pathways between the upland portion of the site and the Willamette River, to be further evaluated as part of an updated source control evaluation document, include the following:

A) Groundwater Pathway

B) Surface Water Runoff Pathway (e.g., Site Outfalls and City of Portland Outfall 22C)

C) Catch-Basin Sediment Transport Pathway

D) Soil Erosion Pathway (unarmored areas of embankment)

7.7 Preliminary Estimation of Additional Data Needs

The following areas have been identified where additional data appear needed to fully support completion of a source control decision at the site with regard to former MGP-related waste management areas.

- Due to the potential for shallow groundwater to discharge to North Doane Creek and/or into the large diameter buried pipe leading to the Willamette River at City of Portland Outfall 22C, additional surface water investigation activities are currently being conducted as per a previously-approved work plan. Results of these investigation activities, as well as source control evaluation related to this feature, will be reported under separate cover.

- The lateral extent of the petroleum hydrocarbon plume beneath the river at the northern portion of the Siltronic property (former lowland area) has not been delineated in the down-gradient direction off-shore to the northeast, and it is not clear what the groundwater discharge/recharge regime may be with regard to this plume further into the main channel. It is anticipated that additional off-shore characterization will be necessary to satisfy these data gaps.

- Additional groundwater quality characterization down-gradient of the former depression/excavation area south of the former lowland area is warranted in order more completely to evaluate the potential for deep impacts (e.g., greater than 100 feet bgs) that may be attributable to this area.

- Additional investigation activities appear warranted with regard to the former spent oxide storage pile area to evaluate whether cyanide impacts from historic spent oxide storage may be contributing to the cyanide concentrations observed in groundwater at the site.

8.0 LIMITATIONS AND SIGNATURES

The information presented in this report was collected, analyzed, and interpreted following the standards of care, skill, and diligence ordinarily provided by a professional in the performance of similar services as of the time the services were performed. This report and the conclusions and/or recommendations contained in it are based solely upon research and/or observations, and physical sampling and analytical activities, if any, that were conducted at the Client's request.

The information presented in this report is based only upon activities witnessed by HAI or its contractors, and/or upon information provided to HAI by the Client and/or its contractors. The analytical data presented in this report, if any, document only the concentrations of the target analytes in the particular sample, and not the property as a whole.

Unless otherwise specified in writing, this report has been prepared solely for the use by the Client and for use only in connection with the evaluation of the subject property. Any other use by the Client or any use by any other person shall be at the user's sole risk, and HAI shall have neither liability nor responsibility with respect to such use.

Hahn and Associates, Inc.

Prepared by:

Robert B. Ede, R.G.
Sr. Associate

Date July 22, 2005

REGISTERED PROFESSIONAL
OREGON
ROBERT B. EDE
G1823
GEOLOGIST

SCOEPA00003939

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10.0 GLOSSARY OF ABBREVIATIONS

AMEC	AMEC Earth & Environment, Inc.
bgs	below existing ground surface
BNSF	Burlington Northern Santa Fe Railroad Company
BTEX	benzene, toluene, ethylbenzene, and xylenes
CDM	Camp Dresser & McKee, Inc.
Cm/sec	centimeters per second
COIs	contaminants of interest
CRBG	Columbia River Basalt Group
DEQ	Oregon Department of Environmental Quality
DNAPL	dense non-aqueous phase liquid
DOE	Washington Department of Ecology
ESL	Environmental Services Laboratory, Inc.
EPA	U.S. Environmental Protection Agency
HAI	Hahn and Associates, Inc.
HCID	hydrocarbon identification
KII	Koppers Industries, Inc.
LNG	liquefied natural gas
LTI	Limno-Tech, Inc.
MFA	Maul Foster & Alongi, Inc.
MGP	manufactured gas plant
Msl	mean sea level
MTBE	methyl-tert-butyl-ethene
NAPL	non-aqueous phase liquid
NPDES	National Pollution Discharge Elimination System
PAHs	polynuclear aromatic hydrocarbons
PCE	tetrachloroethene
PCP	pentachlorophenol
PCST	petroleum-contaminated soil treatment
PDC	Portland Development Commission

PG&C	Portland Gas & Coke
PGE	Portland General Electric
ppb	parts per billion
ppm	parts per million
RI	Remedial Investigation
Siltronic	Siltronic Corporation (formerly Wacker Siltronic)
SVOCs	semi volatile organic compounds
TCE	trichloroethene
TOC	total organic carbon
TPH	total petroleum hydrocarbons
URS	URS Greiner Woodward Clyde, Inc.
UST	underground storage tank
VOCs	volatile organic constituents
WBZ	water-bearing zone

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

November 8, 2005

Mr. Rod Struck
Oregon Department of Environmental Quality
Voluntary Cleanup and Site Assessment Section
2020 SW 4th Avenue, Suite 400
Portland Oregon 97201-4987

HAI Project No. 2708/5237

SUBJECT: Summary Report – Former MGP Operations and Dense Non-Aqueous Phase Liquid Occurrence, NW Natural Gasco and Siltronic Corporation Properties, Portland, Oregon

Dear Mr. Struck:

On behalf of NW Natural, Hahn and Associates, Inc. is pleased to submit three copies (including a full electronic copy) of a November 7, 2005 *Summary Report – Former MGP Operations and Dense Non-Aqueous Phase Liquid Occurrence* for the above-referenced properties.

This document has been prepared at the request of the Oregon Department of Environmental Quality (DEQ) to provide a description of the known distribution of oil as a dense non-aqueous phase liquid (DNAPL) related to historical management of manufactured gas plant (MGP) wastes at the NW Natural Gasco property, 7900 NW St. Helens Road, and at the adjacent Siltronic Corporation property, 7200 NW Front Avenue, Portland, Oregon between the years of 1913 and 1956.

This report includes a summary of historical operations, contaminant sources, and hydrogeological conditions to support an overall evaluation of whether MGP-related DNAPL present in upland portions of the properties may be a current or potential future source of DNAPL impact to sediments within the Willamette River.

Please contact the undersigned should you have any questions.

Sincerely,

Robert Ede, R.G.
Sr. Associate

robe@hahnenv.com

enclosure

c: Mr. Bob Wyatt, NW Natural
Ms. Patty Dost, Schwabe, Williamson & Wyatt
Mr. Carl Stivers, Anchor Environmental LLC
Ms. Diane Saber, Gas Technology Institute
Mr. Tom McCue, Siltronic Corporation
Mr. Matt McClincy, DEQ (w/out enclosure)

434 NW 6th AVENUE, SUITE 203 • PORTLAND, OREGON 97209-3651
503-796-0717 Telephone • 503-227-2209 Facsimile

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

November 17, 2005

Mr. Matt McClincy
Oregon Department of Environmental Quality
Voluntary Cleanup and Site Assessment Section
2020 SW 4th Avenue, Suite 400
Portland Oregon 97201-4987

HAI Project No. 2708/5237

SUBJECT: Correction to Cross-Section D-D' – Former MGP Operations and Dense Non-Aqueous Phase Liquid Occurrence, NW Natural Gasco and Siltronic Corporation Properties, Portland, Oregon

Dear Mr. McClincy:

Enclosed please find three copies of Cross-Section D-D' for insertion within Appendix A of the previously submitted November 7, 2005 *Summary Report – Former MGP Operations and Dense Non-Aqueous Phase Liquid Occurrence.* Please replace Cross-Section D-D' presently within each copy of the referenced report with the Cross-Section D-D' enclosed. The enclosed cross-section corrects an error on the lithology type as depicted within the boring for the PW-01 location (corrected from a silt pattern to a sand pattern).

Please contact the undersigned should you have any questions.

Sincerely,

Robert Ede, R.G.
Sr. Associate

robe@hahnenv.com

enclosure

c: Mr. Bob Wyatt, NW Natural
Ms. Patty Dost, Schwabe, Williamson & Wyatt
Mr. Carl Stivers, Anchor Environmental LLC
Ms. Diane Saber, Gas Technology Institute
Mr. Tom McCue, Siltronic Corporation

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D (SW) — D' (NE)

FORMER LIGHT OIL PLANT/ KOPPERS TANK FARM

FORMER EFFLUENT PONDS 1941 - 1956 (Filled by 1973)

B-22, B-23, MW-15, MW-14, B-26, B-34, MW-08-29, MW-08-56, PW-01, MW-04

Fill Unit

Silt Unit

Alluvial Unit

Bedrock Unit

Sand Interval in Silt Unit?

oil and oily tar within thin rootlet zones in silt

Willamette River (median flow)

Match Line (Cross-Section J-J')

Match Line (Cross-Section B-B')

Match Line (Cross-Section I-I')

Match Line (Cross-Section A-A')

H-12 (1913)[1]

18.33 — 40,500 — ND — 17.36 — ND — 10.47 — 85.9 — 17.75 — 20,300 — 5.29 — 6.24 — 1.61 — 5.01 — 15,000 — 12.0 (temp. well point) — 4.88 — 513 — 1.5 (temp. well point)

Elevation (feet msl) / Depth: 25, 0, -25, -50, -75, -100, -125, -150

LEGEND

10.01	Groundwater Potentiometric Elevation - Aug. 11, 2004 (feet msl- City of Portland datum)
▽	Water Table
——	Hydrogeologic Boundary
22	Benzene Concentration in Groundwater (ug/L, ppb)
MW-	Monitoring Well / Boring ID
	Lithologic Log
	Zone with tar/fill mixture or visually limited tar presence
	Tar
	Zone with oil blebs or otherwise limited oil presence
	Visually oil saturated soil
	Screened Interval 10 foot screen = well 2 or 4 foot screen = temp. well point

Locations should be considered approximate

Groundwater quality data from August 2004

Water Table based on wet soils during drilling

Groundwater elevations as measured August 11, 2004

5.33	Groundwater elevation (City of Portland Datum)
→	Estimated groundwater flow direction (Approx.)

Estimated distribution of tar

Estimated distribution of fill / tar mixture or visually limited tar presence in soil

Estimated distribution soil visually saturated with oil

Estimated distribution of oil blebs in soil or otherwise limited oil presence in soil

Gravels/Gravel Sand Mixtures (GP, GW)

Silty Gravels (GM)

Sands, Gravelly Sands (SP)

Silty Sands (SM)

Silts (ML)

Basalt Bedrock

0 100 200

Approximate Scale in Feet

Vertical Exaggeration = 5x

Hydrogeologic Section D-D' with Benzene Concentrations in Groundwater and Generalized Tar and Oil Distribution in Soil

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

HAHN AND ASSOCIATES, INC.
Project No. 2708 — October 2005

SCOEPA00003948

CC: John Pittman Jim Ellis
Harry Schmid
Then file

Site
RECEIVED
JIM DISORBO
JUN 30 1986
WACKER SILTRONIC CORP

VICTOR ATIYEH
Governor

Department of Environmental Quality

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE: (503) 229-5696

FILE

June 26, 1986

Jim D'Sorbo
Wacker Siltronics
PO Box 03180
Portland, OR 97203

Dear Jim:

I appreciate your taking the time to get together. I've discussed with our staff some of the ideas we talked about.

Given the information we have at this time--information gathered both from you and from our files--we do not feel comfortable giving the entire northern end of Doane's Lake area a "clean bill of health," as you mentioned.

However, our technical staff believes it may be possible to accommodate your current expansion plans while investigating the other issues in the area. You may wish to have John Pittman of your engineering staff contact Neil Mullane of the Hazardous and Solid Waste Division (229-6242), whom I have appointed as lead staff person for this project, to explore this further.

Also, I recently received a letter from an attorney for Northwest Natural Gas indicating that Northwest Natural, Koppers & Wacker have met and will be undertaking a study of the area. We look forward to meeting with you as soon as a consultant has been hired.

Again, I enjoyed our visit and please call me at 229-5300 in the future should you have questions or thoughts about Oregon's environmental programs.

Sincerely,

Mike Downs
for

Fred Hansen
Director

FH:s
AS3232

EQ-1

M E M O R A N D U M CH2M HILL

TO: John Pittman/Wacker

COPIES: Bill Matsukado/IDC
Jill Bensen/CH2M HILL

FROM: Christy Shoen/CH2M HILL

DATE: June 28, 1990

SUBJECT: Wacker Environmental Sampling Phase 1

PROJECT: PDX30452.A0

PROJECT OVERVIEW

As outlined in our letter to the Oregon Department of Environmental Quality (DEQ) on May 22, 1990, Wacker Siltronics Corporation (Wacker) has conducted geotechnical soil sampling at the proposed location of the Fab 2 building in Portland. Two environmental samples, referred to as Phase 1, were taken during geotechnical drilling during the week of June 18, 1990. The objective of Phase 1 was to gather preliminary information to determine if soil contamination is present that would preclude the construction of the Fab 2 building on the selected location or inhibit the construction of a basement in the building.

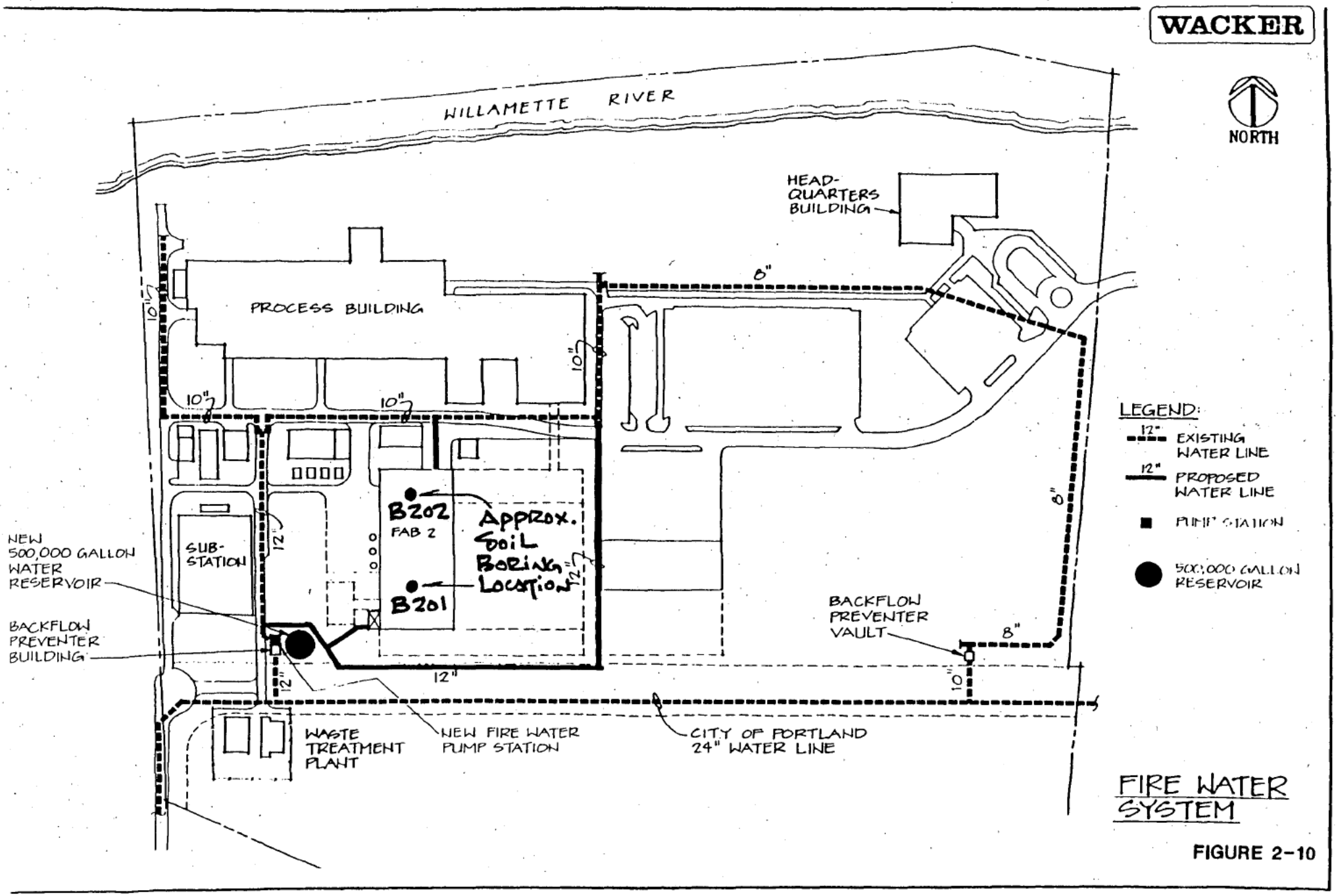
This memorandum presents the preliminary results of the Phase 1 environmental sampling. After discussion of this memorandum, CH2M HILL will prepare a letter for submittal to the DEQ as our scheduled deliverable for the Phase 1 scope of work. The letter will present the results of Phase 1 sampling and the proposed scope of work for Phase 2.

PHASE 1 SCOPE OF WORK

The location of the two soil borings, SB2-01 and SB2-02, are shown in Figure 1. The samples were collected from the 15 to 25 foot interval by drilling with a hollow stem auger using drill methods described in our letter of June 14, 1990 to the DEQ (Attachment 1). Soil samples that were potentially the most contaminated were selected for chemical analysis based on odor, sheen and organic vapor meter (OVM) readings.

Soil samples from each borehole were composited for analysis by the following methods:

SW-8240 -- Volatiles
SW-8270 -- Semivolatiles (minus pesticides and PCBs)
SW-6010 -- Priority metals (13)
SW-1010 -- Ignitability



FIRE WATER SYSTEM

FIGURE 2-10

In addition, a hydrocarbon identification method (gas chromatography (GC) using a flame ionization detector) was performed on the samples to identify diesel components since oily material was observed in the samples and only light hydrocarbons would be detected by the SW-8240 method.

This suite of analyses differs from that originally proposed. The SW-8240 analytical method was used to identify volatiles instead of SW-8010/8020 since it provides positive identification of compounds by GC/mass spectroscopy. Analysis for phenols and polynuclear aromatics hydrocarbons (PAHs) was proposed using separate analytical methods; SW-8270 was substituted. The SW-8270 method detects all the constituents identified by the phenols and PAH methods. An ignitability test was performed on the samples since oily material was observed. Metals analysis was also performed.

RESULTS OF PHASE 1 SAMPLING

Attached are boring logs (draft) detailing soil descriptions, OVM readings during drilling, and the depth interval from which the samples were collected for analysis (Attachment 2). Sample SB2-01 was composited from the 23 to 26.5 foot interval; these soils had the highest OVM readings of the material encountered. Sample SB2-02 was composited from the 17 to 21.5 foot interval; those also had the highest OVM readings. As noted on the boring logs, the SB2-01 soils had an oily appearance and sheen. The SB2-02 soil sample also had a slight sheen and oily appearance.

The preliminary analytical results for volatile and semivolatile compounds for the two soil boring samples are attached (Attachment 3). As shown in the analytical results, volatile constituents frequently associated with gasoline were detected in SB2-01 and, to a lesser extent, in SB2-02. These constituents include benzene, toluene, ethyl benzene and xylene. Styrene and chlorobenzene were also detected.

The primary volatile constituent of concern appears to be benzene since its presence may be used to define a waste as hazardous. The toxicity characteristic leachate procedure (TCLP) regulatory level for benzene is 0.5 mg/l; sample SB2-01 analyzed for benzene without subjecting the sample to the TCLP detected 21.0 mg/kg. If soils were analyzed after subjecting them to the 1:20 dilution used in the TCLP test, it is possible that the extract could contain as high as 1.05 mg/l benzene, which is substantially above the regulatory limit of 0.5 mg/l to classify the material as hazardous waste. (Several factors such as organic carbon content and buffering capacity of the soil determine how readily benzene would leach in the TCLP test.) Given these concentrations, TCLP testing could be undertaken in Phase 2 to determine if the soils could be defined as a hazardous waste and, therefore, potentially make excavation of soils for basement construction infeasible given disposal costs associated with hazardous waste.

In addition, the presence of volatile compounds suggests that

consideration should be given to construction of a vapor barrier or other design modifications to mitigate potential vapors in the basement, if constructed.

Semivolatile constituents, generally associated with coal tar derived materials, were detected in both samples; no phenols or pentachlorophenols, generally associated with wood treating operations, were detected. No regulatory level for defining soil as hazardous waste exists for the compounds detected.

However, soil cleanup levels for semivolatiles are generally based on health-based endangerment assessment values derived from the U.S. Environmental Protection Agency models and subscribed to by DEQ depending on the response scenario. Soil cleanup levels for total carcinogenic semivolatile compounds could range from less that 1 mg/kg to 10 mg/kg. (These compounds include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and fluoranthene.) Total carcinogenic semivolatile compounds detected in the SB2-01 boring soils at Wacker are 920 mg/kg with fluoranthene at 780 mg/kg. It is anticipated that the presence of these semivolatile compounds could present health and safety concerns to workers if basement excavation were undertaken; however, the soil cleanup levels may not be strictly applicable to selection of the Fab 2 building location.

RECOMMENDATIONS AND CONCLUSIONS

Given the elevated levels of volatile and semivolatile compounds detected in the two soil borings within the Fab 2 footprint, additional sampling is recommended to determine if the material is hazardous. Based on results of SB2-01, the levels of benzene may be above the regulatory limit to define the soils as hazardous waste and thus require disposal of excavated material at a hazardous waste facility. Minimum unit costs for disposal of hazardous waste (without treatment costs) are $200/ton. If it is assumed that the soils within the building footprint excavated for a basement (65,000 tons of soil using a 65,000 sq.ft. footprint at a 25-27 foot depth) are hazardous, the cost of disposal would be $13 million.

Should additional sampling indicate that the material is not defined as hazardous waste, it appears that health and safety issues related to workers exposed to the soils during basement construction or footing placement would still be of concern given the levels of constituents present. In addition, some design modifications might be in order to mitigate vapors that could potentially enter the basement.

ATTACHMENT 2

pacific environmental laboratory inc.
9405 S.W. Nimbus Ave. Beaverton, OR 97005 (503) 644-0660
FAX # (503) 644-2202

DRAFT

June 26, 1990

CH2M Hill-Portland
2020 SW 4th, 2nd Floor
Portland, OR 97201

Attn: Christy Shoen

Re: JOB #PDX30425.A0
PEL #90-1696 Preliminary

Enclosed is the preliminary lab report for your samples which were received on June 20, 1990.

I. Sample Description

Two Soil Samples

The samples were received under a chain of custody.

The samples were received in containers consistent with EPA protocol.

II. Quality Control

No project specific QC was requested. In-house QC data is available upon request.

III. Analytical Results

Test methods may include minor modifications of published methods such as detection limits or parameter lists. Solid and waste samples are reported on an "as received" basis unless otherwise noted.

Compounds not detected are listed under results as ND.

Sincerely,

PRELIMINARY REPORT
This report has not yet been reviewed by the PEL Quality Control Dept. Results are subject to final review.

Howard Holmes
Lab Manager

Howard Boorse
QA/QC Manager

pacific environmental laboratory inc

PEL REPORT NUMBER: 90-1696 Preliminary
CLIENT: CH2M Hill-Portland
JOB REFERENCE: PDX30425.A0
DATE: June 26, 1990
ITEMS: Two Soil Samples

PRELIMINARY REPORT
This report has not yet been reviewed by the PEL Quality Control Dept. Results are subject to final review.

METHOD: EPA 8240
Results in ug/kg (ppb)

Compound	B201*	B202	Lab Blank	Detection Limit
Acetone	ND	ND	ND	2,500
Acrolein	ND	ND	ND	5,000
Acrylonitrile	ND	ND	ND	5,000
Benzene	29,000	1,000	ND	250
Bromodichloromethane	ND	ND	ND	250
Bromoform	ND	ND	ND	250
Bromomethane	ND	ND	ND	500
2-Butanone	ND	ND	ND	5,000
Carbon disulfide	ND	ND	ND	250
Carbon tetrachloride	ND	ND	ND	250
Chlorobenzene	1,400	370	ND	250
Chlorodibromomethane	ND	ND	ND	250
Chloroethane	ND	ND	ND	500
Chloroform	ND	ND	ND	250
Chloromethane	ND	ND	ND	5,000
Dibromomethane	ND	ND	ND	250
Dichlorobenzenes	ND	ND	ND	250
Dichlorodifluoromethane	ND	ND	ND	250
1,1-Dichloroethane	ND	ND	ND	250
1,2-Dichloroethane	ND	ND	ND	250
1,1-Dichloroethene	ND	ND	ND	250
cis-1,2-Dichloroethene	ND	ND	ND	250
trans-1,2-Dichloroethene	ND	ND	ND	250
1,2-Dichloropropane	ND	ND	ND	250
cis-1,3-Dichloropropene	ND	ND	ND	250
trans-1,3-Dichloropropene	ND	ND	ND	250
Ethanol	ND	ND	ND	5,000
Ethylbenzene	55,000	3,600	ND	250
2-Hexanone	ND	ND	ND	2,500
Methylene chloride	ND	ND	ND	250
4-Methyl-2-pentanone	ND	ND	ND	5,000
Styrene	1,300	490	ND	250
1,1,2,2-Tetrachloroethane	ND	ND	ND	250
Tetrachloroethene	ND	ND	ND	250
Toluene	26,000	2,800	ND	250
1,1,1-Trichloroethane	ND	ND	ND	250
1,1,2-Trichloroethane	ND	ND	ND	250
Trichloroethene	ND	ND	ND	250
Trichlorofluoromethane	ND	ND	ND	250
1,2,3,-Trichloropropane	ND	ND	ND	250
Vinyl acetate	ND	ND	ND	2,500
Vinyl chloride	ND	ND	ND	500
Xylene	57,000	6,800	ND	250

* Detection Limits for this sample are 4 times the listed values.

PEL REPORT NUMBER: 90-1696 Preliminary
CLIENT: CH2M Hill-Portland
JOB REFERENCE: PDX30425.A0
DATE: June 26, 1990
ITEMS: Two Soil Samples

PRELIMINARY REPORT
This report has not yet been reviewed by the PEL Quality Control Dept. Results are subject to final review.

METHOD: BNA's by EPA 8270
Results in mg/kg (ppm)

Compound	#1*	#2	Lab Blank	Detection Limit
Acenaphthene	450	120	ND	10
Acenaphthylene	170	240	ND	10
Anthracene	430	250	ND	10
bis(2-Chloroethyl) ether	ND	ND	ND	10
bis(2-Chloroisopropyl) ether	ND	ND	ND	10
bis(2-Chloroethoxy) methane	ND	ND	ND	10
bis(2-ethylhexyl)phthalate	ND	ND	ND	10
Benzoic Acid	ND	ND	ND	10
Benzo(a)anthracene	210	190	ND	10
Benzo(a)pyrene	210	240	ND	10
Benzo(b)fluoranthene	140	180	ND	10
Benzo(k)fluoranthene	120	120	ND	10
Benzo(g,h,i)perylene	140	190	ND	10
Benzyl Alcohol	ND	ND	ND	10
4-Bromophenyl phenyl ether	ND	ND	ND	10
Butylbenzyl phthalate	ND	ND	ND	10
Chrysene	280	260	ND	10
4-Chloroaniline	ND	ND	ND	10
4-Chloro-3-methylphenol	ND	ND	ND	10
2-Chloronaphthalene	ND	ND	ND	10
2-Chlorophenol	ND	ND	ND	10
4-Chlorophenylphenyl ether	ND	ND	ND	10
Dibenz(a,h)anthracene	ND	ND	ND	10
Dibenzofuran	52	28	ND	10
1,2-Dichlorobenzene	ND	ND	ND	10
1,3-Dichlorobenzene	ND	ND	ND	10
1,4-Dichlorobenzene	ND	ND	ND	10
3,3'-Dichlorobenzidine	ND	ND	ND	50
2,4-Dichlorophenol	ND	ND	ND	10
2,4-Dimethylphenol	ND	ND	ND	10
Diethylphthalate	ND	ND	ND	10
Di-n-butylphthalate	ND	ND	ND	10
Di-n-octylphthalate	ND	ND	ND	10
Dimethylphthalate	ND	ND	ND	10
4,6-Dinitro-2-methylphenol	ND	ND	ND	50
2,4-Dinitrophenol	ND	ND	ND	50
2,4-Dinitrotoluene	ND	ND	ND	10
2,6-Dinitrotoluene	ND	ND	ND	10
Fluoranthene	780	760	ND	10
Fluorene	350	210	ND	10
Hexachlorobenzene	ND	ND	ND	10
Hexachlorobutadiene	ND	ND	ND	10
Hexachlorocyclopentadiene	ND	ND	ND	50
Hexachloroethane	ND	ND	ND	50

pacific environmental laboratory inc

PEL REPORT NUMBER: 90-1696 Preliminary
CLIENT: CH2M Hill-Portland
JOB REFERENCE: PDX30425.A0
DATE: June 26, 1990
ITEMS: Two Soil Samples

PRELIMINARY REPORT
This report has not yet been reviewed by the PEL Quality Control Dept. Results are subject to final review.

METHOD: BNA's by EPA 8270-Continued
Results in mg/kg (ppm)

Compound	#1*	#2	Lab Blank	Detection Limit
Indeno(1,2,3-cd)pyrene	ND	160	ND	10
Isophorone	ND	ND	ND	10
2-Methylnaphthalene	900	330	ND	10
2-Methylphenol	ND	ND	ND	10
4-Methylphenol	ND	ND	ND	10
Naphthalene	3,000	840	ND	10
2-Nitroaniline	ND	ND	ND	10
3-Nitroaniline	ND	ND	ND	10
4-Nitroaniline	ND	ND	ND	10
2-Nitrophenol	ND	ND	ND	10
4-Nitrophenol	ND	ND	ND	10
N-Nitrosodiphenylamine	ND	ND	ND	10
N-Nitroso-Di-N-propylamine	ND	ND	ND	50
Nitrobenzene	ND	ND	ND	50
Pentachlorophenol	ND	ND	ND	50
Phenanthrene	1,900	1,200	ND	50
Phenol	ND	ND	ND	50
Pyrene	890	800	ND	50
1,2,4-Trichlorobenzene	ND	ND	ND	50
2,4,5-Trichlorophenol	ND	ND	ND	50
2,4,6-Trichlorophenol	ND	ND	ND	50

* Detection Limits for this sample are 5 times the listed value due to sample extract dilution.

METHOD: Flashpoint (PMCC) per EPA 1010

Sample I.D.	Flashpoint
B201	No flash to 200°F

FINAL REPORT FORM - METALS

DATE: 6/26/90 CLIENT: CH2M Hill

CHEMIST: Jen ITEM: 1 oz

PEL #: 90-1696

PRELIMINARY REPORT
This report has not yet been reviewed by the PEL Quality Control Dept. Results are subject to final review.

METHOD: Total Metals per EPA 3005, 6010, 7000 series

Results in mg/kg (ppm)

	B201	Lab Blank	Detection Limit		
Alumium					
Antimony	8	ND	2		
Arsenic	1.8	ND	0.01		
Barium					
Beryllium	ND	ND	0.5		
Cadmium ~~Calcium~~	0.9	ND	0.5		
Chromium	10	ND	0.5		
Cobalt					
Copper	15	ND	0.5		
Iron					
Lead	16	ND	2		
Magnesium					
Manganese					
Mercury	0.86	ND	0.01		
Nickel	14	ND	2		
Potassium					
Selenium	ND	ND	0.1		
Silcon					
Silver	ND	ND	0.5		
Sodium					
Thallium	14	ND	5		
Tin					
Vanadium					
Zinc	46	ND	0.5		

ATTACHMENT 3

CH2M HILL

DRAFT

PROJECT NUMBER	BORING NUMBER	SHEET	OF
PBX 301B.A5	B201	1	3

SOIL BORING LOG

PROJECT WACKER SILTRONICS CORP. - FAB 2 LOCATION N10155 E10650

ELEVATION 36' DRILLING CONTRACTOR GEOTECH EXPLORATIONS

DRILLING METHOD AND EQUIPMENT CME 75, Hollow STEM AUGER

WATER LEVELS ELEV. 22' START 6.18.90 FINISH 6.19.90 LOGGER JK BENSEN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					BROWN SANDY SILTY fill IN UPPER 4-5 FEET.	
5	5.0					
	6.5	S1	18"	1.1.2	FINE SANDY SILT, GRAYISH BROWN, DRY, SOFT (ML)	
	8.5	ST2	24"	—	SANDY SILT (ML) SIMILAR TO S1, VERY STIFF	TORVANE = 2.5 TSF
10	10.0					
	11.5	S3	18"	5.8.9	FINE TO MEDIUM SAND, BLACK, BITUMEN ODOR, NO VISIBLE EVIDENCE OF CONTAMINATION, MEDIUM RELATIVE DENSITY (SP)	OVM = 0 PPM STRONG ODOR @ BOREHOLE OILY SAND CUTTINGS @ 13-15 FT.
15	15.0					
	16.5	S4	15"	5.6.7	TOP 3": BROWN SILT (ML) MID 10": FINE TO MED SAND, BLACK OILY, VERY STRONG ODOR (SP)	OVM = 19 PPM
	17.0				BOTTOM 2": BROWN SILT (ML) & WOOD FIBERS	
	18.5	S5	16"	2.3.6	TOP 9": BROWN SILT (ML) BOTTOM 7": FINE TO MED. SAND, BROWN, LESS OIL/BITUMEN THAN S4 (SP)	OVM = 0.7 PPM
20	20.0					
	21.5	S6	15"	2.2.4	FINE TO MED SAND, BROWN, WET, STRONG ODOR, LOOSE RELATIVE DENSITY (SP)	OVM = 2.0 PPM
	23.0					
	24.5	S7	18"	2.3.8	FINE TO MED SAND, BLACK, MEDIUM RELATIVE DENSITY, (SP) VERY STRONG ODOR, SHINY, OILY IN APPEARANCE,	OVM = 38 PPM
25	25.0					
	26.5	S8	18"	2.6.7	SIMILAR TO S7, (SP)	OVM = 30 PPM

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET 2 OF 3
BX30113.A5	B201	

SOIL BORING LOG

PROJECT WACKER SILTRONICS CORP. - FAB 2 LOCATION N10155 E10650

ELEVATION 36' DRILLING CONTRACTOR GEOTECH EXPLORATIONS

DRILLING METHOD AND EQUIPMENT CME 75 Hollow STEM AUGER

WATER LEVELS ELEV. 22' START 6.18.90 FINISH 6.19.90 LOGGER KRENDEN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0–31.5	S9	18"	2.2.2	SIMILAR TO S8, DARKER GREEN	OVM: 13 ppm BENTONITE HOLE PLUG SET @ BOTTOM OF BORED HOLE FROM 28'-30'.
35	35.0–36.5	S10	18"	2.2.4	SILT, GRAY, SOME FIB. WOOD PARTICLES, MOIST, FIRM CONSISTENCY (ML)	OVM: 1.5 ppm TORVANE: 2.0 TSF
	38.5	S11	24"	—	SIMILAR TO S10.	
40	40.0–41.5	S12	18"	1.1.2	SIMILAR TO S10, SOFT CONSISTENCY (ML) LESS WOOD.	POCKET PENETROMETER: Ø OVM: Ø ppm BENTONITE HOLE PLUG SET FROM 35' TO 40' & LARGE HSA ADVANCED TO 40'. REMAINDER OF HOLE DRILLED WITH 3¾" ID HSA.
45	45.0–47.0	S13	24"	—	SIMILAR TO S10, LESS WOOD FIRM CONSISTENCY (ML)	OVM: Ø ppm P.P. = Ø TSF
	48.5	S14	18"	0.2.2	FINE TO MED SANDY SILT, GRAY, MOIST, TRACE WOOD FIBERS, SOFT CONSISTENCY (ML).	
50	50.0–51.5	S15	18"	3.5.6	SIMILAR TO S14, LESS SAND STIFF ? (ML)	P.P. = Ø TSF
55	55.0–56.5	S16	18"	2.2.3	SIMILAR TO S14/S15	OVM = Ø ppm P.P. = Ø TSF

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
PDX 30113.A5	B202	SHEET 1 OF 3

SOIL BORING LOG

PROJECT WACKER SILTRONICS CORP. - PAB 2 LOCATION N10350 E10650

ELEVATION 34' DRILLING CONTRACTOR GEOTECH EXPLORATIONS

DRILLING METHOD AND EQUIPMENT CME 75 Hollow STEM AUGERS

WATER LEVEL AND DATE ELEV. 18.5' START 6.20.90 FINISH 6.21.90 LOGGER JKRENGEN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	2.0						
	3.5	S1	4"	3.2.3	SILT, BROWN, 1½" DIA. ROCK IN SAMPLER TIP (ML) DRY.		OVM = ϕ
	4.0						
5	6.5	S2	18"	1.2.2	SILT, GRAY, SOFT CONSISTENCY MOIST TO WET, (ML)		OVM = ϕ P.P. = ϕ
	7.5	S3	6"	—	SILT SIMILAR TO S2.		6" RECOVERY @ TOP of TUBE, BOTTOM LEFT IN HOLE.
	9.0						
10	10.5	S4	15"	ϕ - WT. OF HAMMER	SILT SIMILAR TO S2, VERY SOFT CONSISTENCY,		OVM = ϕ PP = ϕ
	12.5	S5	17"	—	SILT SIMILAR TO S4, SAND @ BOTTOM OF TUBE.		
	14.0						
15	15.5	S6	15"	2.4.6	FINE TO MED SAND, BROWN, DRY, LOOSE RELATIVE DENSITY, (SP).		OVM = ϕ
	17.0						
	18.5	S7	16"	8.11.14	FINE TO MED SAND, GRAY, MOIST TO WET, SOME ODOR, SLIGHT SHEEN, DENSE (SP)		OVM = 3.0
	19.0						
20	21.5	S8	9"	12.10.8	BLACK TAR-LIKE SUBSTANCE W/ WOOD FIBERS/CHUNKS, VERY STIFF & STICKY, ODOR.		OVM = 5.0
	24.0						
25	25.5	S9	18"	5.7.10	FINE TO COARSE SAND, GRAY, WET, MEDIUM RELATIVE DENSITY, (SW) NO VISUAL INDICATION OF CONTAMINATION.		OVM = ϕ
	29.0						
	30.5	S10	18	1.2.3	TOP 12" SAND SIMILAR TO S9.		

CH2M HILL

PROJECT NUMBER	BORING NUMBER
PDX 30113.A5	SHEET 2 OF 3

SOIL BORING LOG

PROJECT WACKER SILTRONICS CORP, FAB 2 LOCATION N10350 E10650

ELEVATION 34' DRILLING CONTRACTOR GEOTECH EXPLORATIONS

DRILLING METHOD AND EQUIPMENT CME 75 Hollow STEM AUGERS

WATER LEVEL AND DATE ELEV. 18.5 START 6.20.90 FINISH 6.21.90 LOGGER J. KRESSEL

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.5	S10	CONT.		Bottom 6": SILT, GRAY.		
35	35.0						
	36.5	S11	18"	1.4.6	SILT, GRAY, WET, STIFF (ML)		NOTE: SET BENTONITE HOLE PLG FROM 30'-32' & ADVANCED AUGERS TO 32'. REMAINDER OF BORING DRILLED WITH 3¾" LB. HSA.
40	40.0						
	41.5	S12	18"	0.1.3	SILT, GRAY, WET, SOFT, SOME WOOD FIBERS (ML).		TORVANE: 1.0 TSF
	43.5	ST13	24"	—	SILT SIMILAR TO S12.		
45	45.0						
	46.5	S14	18"	1.2.3	SILT, SIMILAR TO S12, FIRM.		P.P. = 0.25 TSF
50	50.0						
	51.5	S15	18"	1.1.2	SILT, SIMILAR TO S12, MORE PLASTIC.		PP = 0.25 TSF
	53.5	ST16	24"	—	SILT SIMILAR TO S15.		TORVANE = 2.5 TSF
55	55.0						
	56.5	S17	18	0.1.3	SILT SIMILAR TO S15.		P.P. = 0.25 TSF

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
PDX30113.A5	B202	SHEET 3 OF 3

SOIL BORING LOG

PROJECT WACKER SILTRONICS CORP. - FAB 2 LOCATION N10350 E10650

ELEVATION 34' DRILLING CONTRACTOR GEOTECH EXPLORATIONS

DRILLING METHOD AND EQUIPMENT CME 75 Hollow STEM AUGER

WATER LEVEL AND DATE ELEV. 18.5' START 6.20.90 FINISH 6.21.90 LOGGER J KRIEGSEN

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0						
	61.5	S18	18"	2.2.4	SILT Similar To S15, WOOD IN BOTTOM 2" of SAMPLER.		PP = 0.25 TSF MAX.
65	65.0						
	66.5	S19	16"	0.0.5	SILT, Similar To S15, WET.		
70	70.0						
	71.5	S20	18"	0.1.2	SILT Similar To S15, Bottom 6" WITH SAND & WET.		
	73.5	ST21	24"	—	SILT Similar To S15		TORVANE = 1.1 TSF
75	75.0						
	76.5	S22	18"	0.1.1	SILT Similar To S15.		PP. = ϕ

Bottom of Boring @ 76.5'

NOTES:

1. BORING BACKFILLED WITH BENTONITE HOLEPLUG UPON DRILLING COMPLETION
2. SAMPLES S7 & S8 COMPOSITED FOR CHEMICAL ANALYSES.

pacific environmental laboratory inc.

9405 S.W. Nimbus Ave. Beaverton, OR 97005 (503) 644-0660
FAX # (503) 644-2202

PRELIMINARY REPORT
This report has not yet been reviewed by the PEL Quality Control Dept. Results are subject to final review.

FAX TRANSMITTAL

DATE: July 25, 90

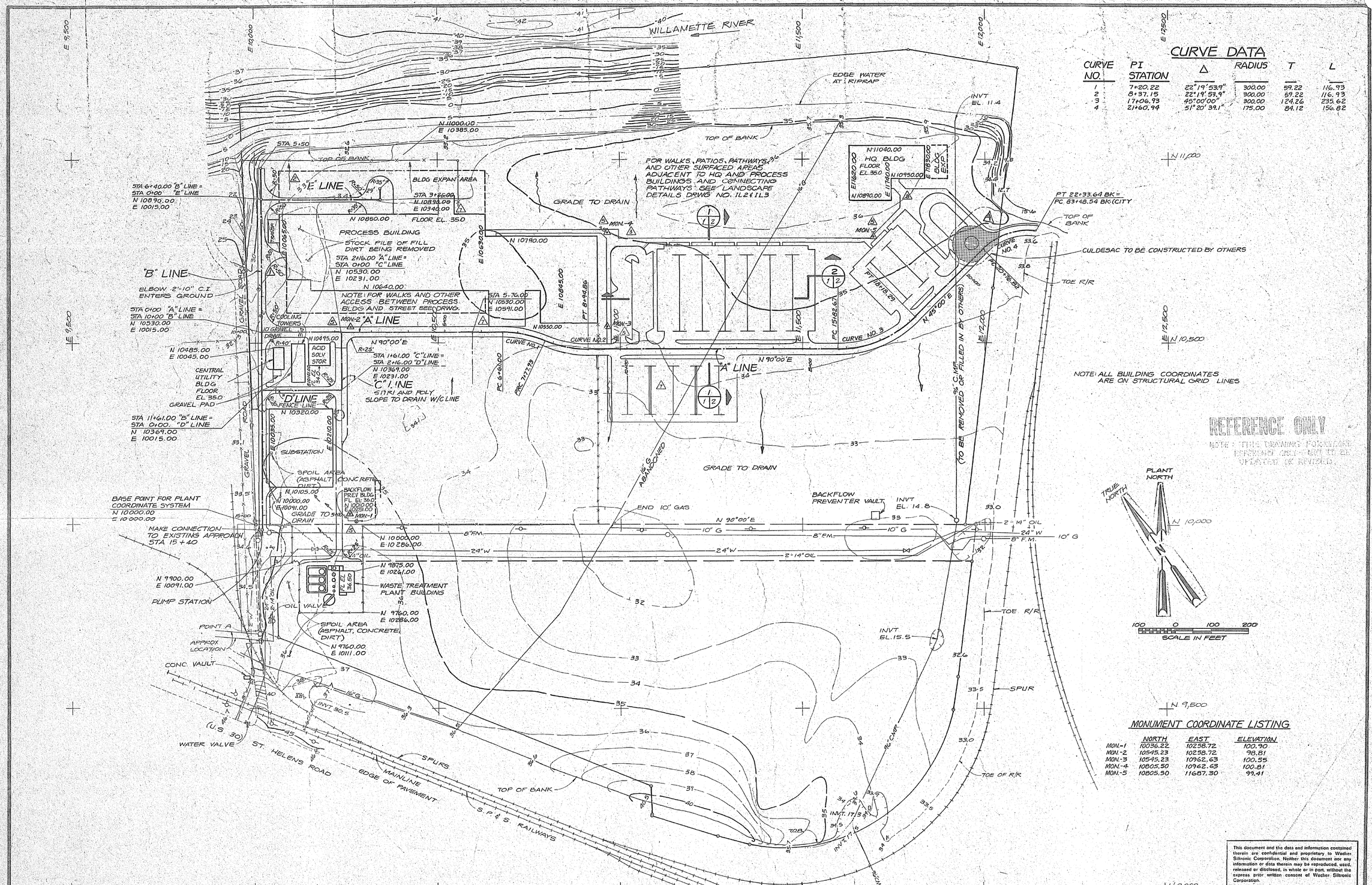
TO: Wacker Siltronic Corp.

ATTN: Rick Gariepy

FROM: Cindy

We are sending 5 pages (including this cover sheet)

DESCRIPTION: PEL 90-1984 preliminary



CURVE DATA

CURVE NO.	PI STATION	Δ	RADIUS	T	L
1	7+20.22	22°19'53.9"	300.00	59.22	116.93
2	8+37.15	22°19'53.9"	300.00	59.22	116.93
3	17+06.93	45°00'00"	300.00	124.26	235.62
4	21+60.94	51°20'39.1"	175.00	84.12	156.82

MONUMENT COORDINATE LISTING

	NORTH	EAST	ELEVATION
MON.-1	10036.22	10258.72	100.90
MON.-2	10545.23	10258.72	98.81
MON.-3	10545.23	10962.63	100.55
MON.-4	10805.50	10962.63	100.81
MON.-5	10805.50	11687.30	99.41

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REGISTERED PROFESSIONAL ENGINEER — OREGON — MICHAEL DILENIP

6	11-26-80	RECORD DRAWING	PJC	DFD
5	4-30-80	ADDITION OF MONUMENTS & COORDINATES LISTING	DLG	REM
4	6 Jun 79	REVISED CUL-DE-SAC F.O. 202	MD	MD
3	16 JAN 79	TITLE BLOCK CHANGE, CHANGED WALKS TO COINCIDE WITH ARCH. SHTS.	PJC	DFD
2		REVISED "B" & "E" LINES AND ADJACENT FENCE	MD	MD
1	7 NOV 78	REVISED BLDG ACCESS & "E" LINE CUL-DE-SAC	MD	MD
7	2-18-93	GENERAL UPDATE	TQV	

NO. | DATE | REVISIONS | BY | APPD.

CH2M HILL

DES. MD
DR. PJC
CHK. MD
APPD.

RECORD DRAWING
NOV 10 1980

WACKER SILTRONIC PLANT
PORTLAND, OREGON

REFERENCE ONLY

SITE
CIVIL
SITE PLAN

REFERENCE ONLY

SHEET TC1
16 OF 431
DATE DEC 1978
DWG. NO. P11054.A1

DO NOT REMOVE FROM FILE

A PRELIMINARY REPORT
SOIL INVESTIGATION FOR PROPOSED POLYSILICON PLANT

WACKER SILTRONIC CORPORATION
PORTLAND, OREGON

Prepared By

CH2M HILL NORTHWEST, INC.
2020 S.W. Fourth Avenue
Portland, Oregon 97201

JUNE 1985
P19786.A1.00

INTRODUCTION

Wacker Siltronic Corporation contracted CH2M HILL to conduct a soil investigation on Wacker's property located in the Northwest Industrial area of Portland, Oregon. The purpose of the investigation was to evaluate subsurface conditions within a section of the vacant portion of the site as part of the preliminary engineering for the design and construction of the proposed polysilicon plant.

The subsurface investigation was initiated based on the presence (both past and current) of industrial manufacturing and processing facilities within the Doane Lake area and recent environmental regulations--the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Resource Conservation and Recovery Act of 1976 (RCRA). Wacker was concerned that past or current management practices of industrial wastes within the Doane Lake area may have resulted in the presence of these materials or subsequent residues on Wacker's property, which would prevent or hinder the construction of the proposed polysilicon plant and future expansions of the existing manufacturing facilities.

This preliminary report describes the soil boring, sampling, and analytical procedures and construction of the groundwater monitoring wells. It also presents the results of the laboratory analyses, which indicate the presence of chemical constituents commonly associated with petroleum products, coal tar, and pesticides. Interpretation of the results presented in this report is beyond the scope of our contract and will be included as part of future work (i.e., site environmental assessment).

SCOEPA00003969

SITE DESCRIPTION

Wacker Siltronic Corporation is located in the northwest section of the City of Portland on the west bank of the Willamette River. The property, consisting of approximately 85 acres, is situated between the St. Johns Bridge and the Burlington Northern Railroad Bridge and is essentially rectangular in shape. Property boundaries are the Willamette River to the northeast; the Burlington Northern Railroad berm, which provides the approach to the railroad bridge, to the southwest; Burlington Northern track and adjacent N.W. St. Helens Road to the southwest; and the property line shared with Northwest Natural Gas and the Koppers Company to the northwest. Figure 1 shows the location of the Wacker property in relation to these landmarks and other industrial companies in the vicinity.

The project site is located in a vacant field about 400 feet south of Wacker's existing facilities, as shown in Figure 2. The site is bounded on the north by the existing Wacker plant, and is bordered on the south and east by Burlington Northern Railroad right-of-way. Underground utilities, consisting of oil, water, gasoline, natural gas, and sewer lines, as well as electric and telephone cables, are located in a 100-foot-wide easement on the north side of the site.

The site is relatively level with elevations ranging from about 40 feet National Geodetic Vertical Datum 1929 (NGVD) in the southern part to about 32 feet in the northern part. The local ground surface is deeply rutted with heavy machinery tracks and ditches. Wood debris, concrete, and other waste materials are present in small amounts across the field.

FIELD INVESTIGATION

The field investigation was performed from April 1 through 5, 8 and 9, 1985. The investigation involved collecting soil

SCOEPA00003970

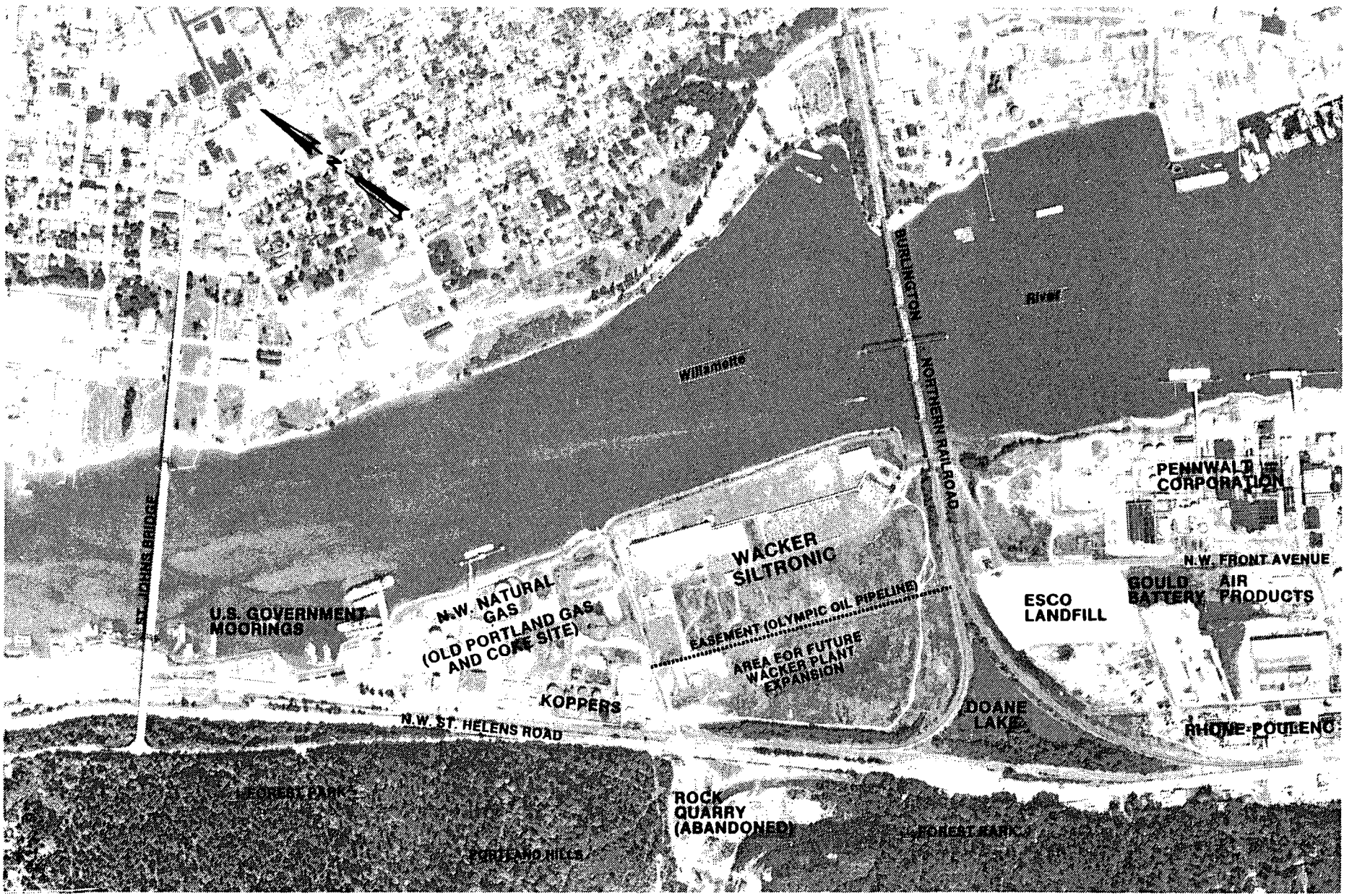

Figure 1 **WACKER SILTRONIC PLANT AND SURROUNDING VICINITY (1983)**

SCALE: 1" = 940 FEET (1 cm : 110 m)

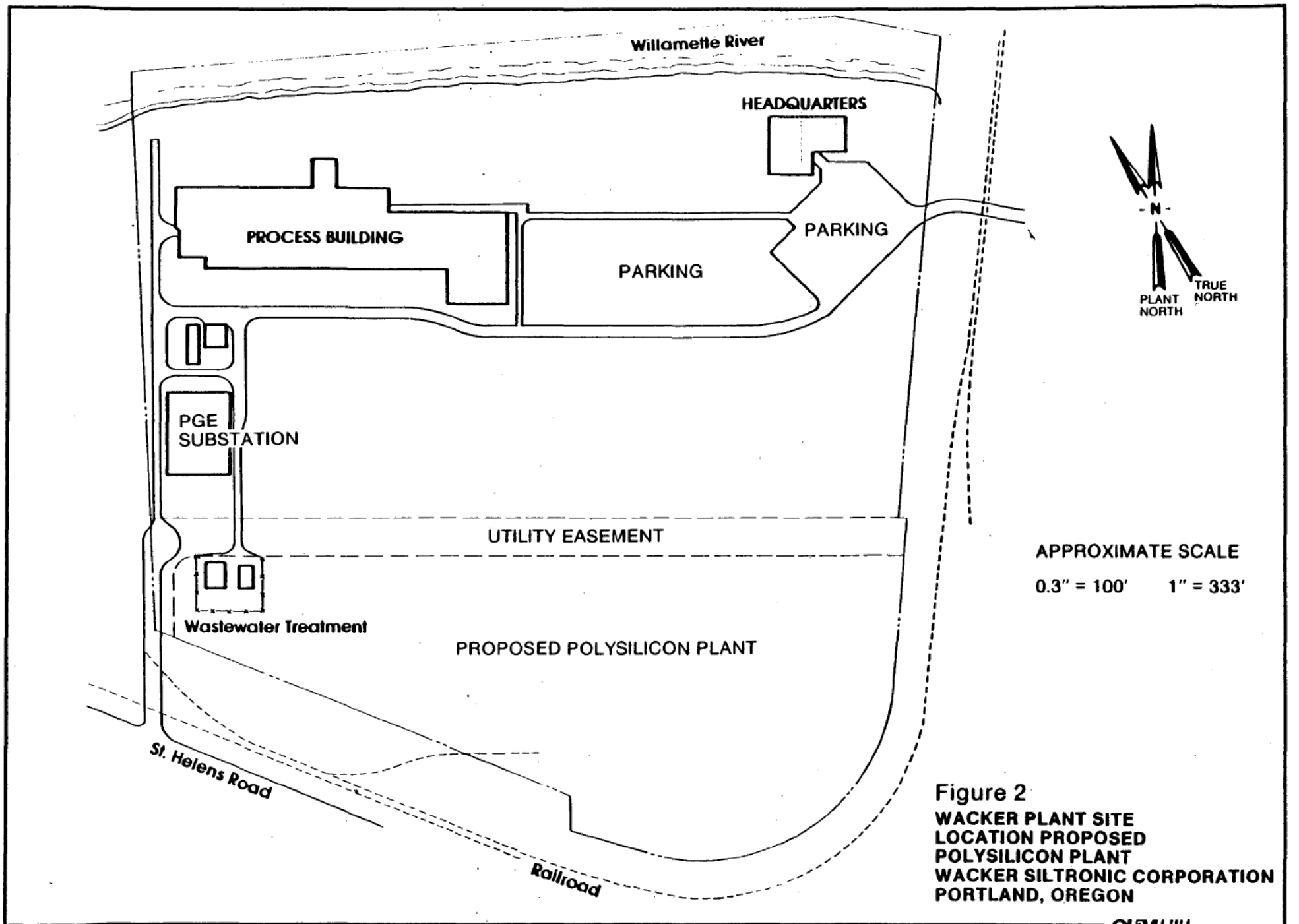

Figure 2
WACKER PLANT SITE
LOCATION PROPOSED
POLYSILICON PLANT
WACKER SILTRONIC CORPORATION
PORTLAND, OREGON

CH2M HILL

samples from seven soil borings, all of which were completed as monitoring wells. The locations of the borings/monitoring wells (designated MW-1 through MW-7) are shown in Figure 3. The soil borings were drilled and monitoring wells constructed by Geotech Explorations, Inc., of Beaverton, Oregon, under the field observation of a CH2M HILL hydrogeologist.

SOIL BORING AND SAMPLING

The seven soil borings were drilled using a CME-55 rotary drill rig and 6¼-inch (OD) hollow-stem augers. Soil samples were recovered at 5-foot intervals. Samples were recovered using a 2-inch split-spoon sampler following the requirements of the standard Penetration Test (ASTM D 1586). The sampler was driven 18 inches ahead of the auger bit to collect an undisturbed soil sample. The depth of soil borings ranged from 31.5 to 41.5 feet, generally between 5 and 20 feet below fill material and into native soils. The CH2M HILL hydrogeologist inspected, classified, and logged each borehole and soil sample in the field in approximate accordance with the Visual-Manual Procedure (ASTM D 2488). The log included a physical description of the soil type and a visual and odor estimate for the presence of contaminants. Sample intervals, soil types, and descriptions of the soil types and soil borings are provided in the soil boring record drawings presented in the appendix.

A composite soil sample from each split-spoon was placed in a clean 8-ounce glass jar. Each jar was filled to the top before it was sealed. The label that had been affixed to the sample container was then filled out. Information on the label included the facility name, the sample identification number, the name of the person collecting the sample, date and time of collection, and the location of the sample. The sample was then placed in a portable cooler until the end of each day when it was transferred via chain-of-custody record

SCOEPA00003973

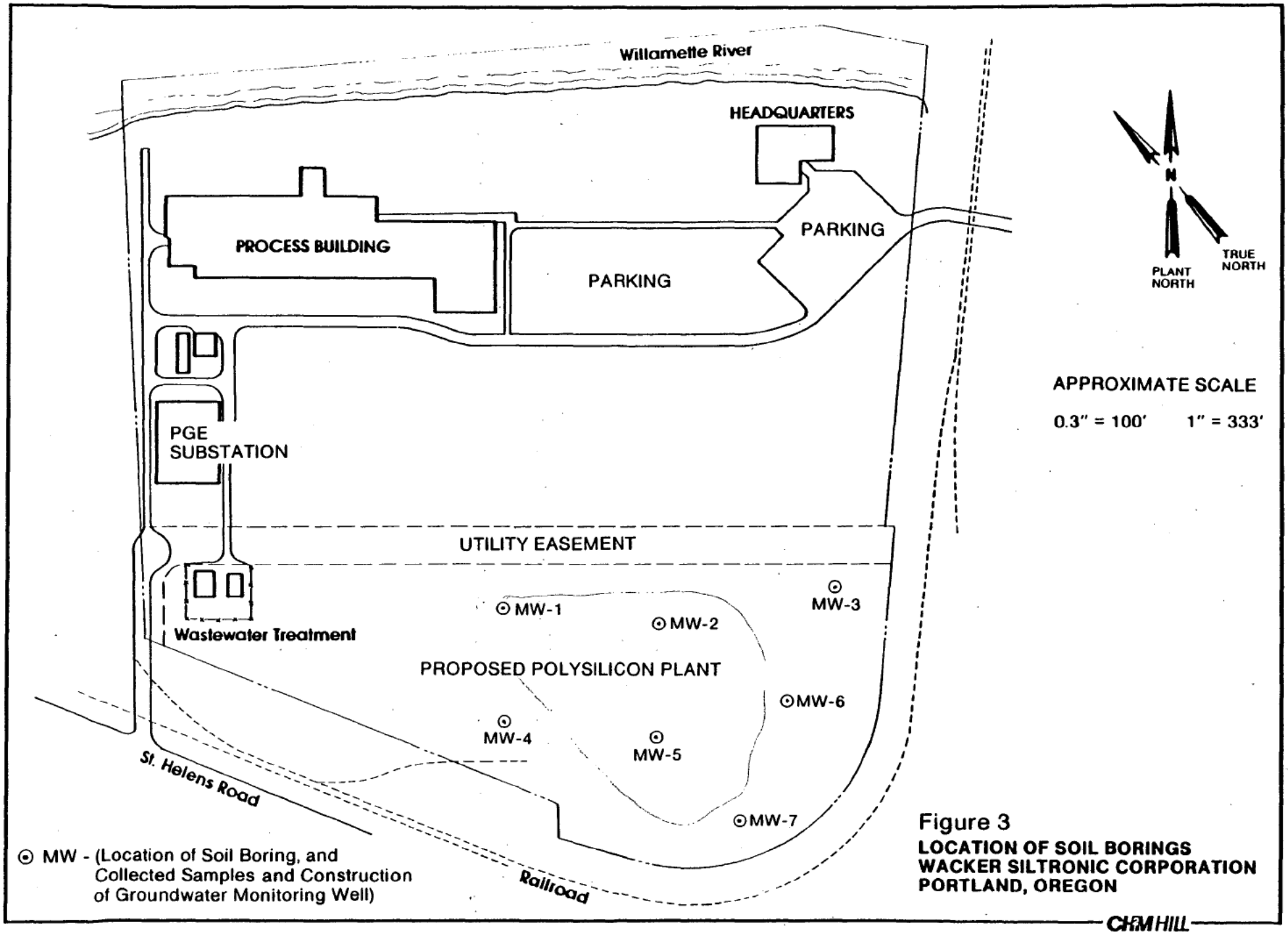

Figure 3
LOCATION OF SOIL BORINGS
WACKER SILTRONIC CORPORATION
PORTLAND, OREGON

to a refrigerator located inside the laboratory area of Wacker's wastewater treatment building. Chain-of-custody records were kept for every sample collected. Sample custody was maintained until the samples were relinquished directly to Wacker or an outside laboratory. A sample of the chain-of-custody form used is illustrated in the appendix.

All drilling equipment was thoroughly steam-cleaned before drilling each boring. Oil and grease were not used at drill rod connection fittings to prevent contamination of the soil samples. The split-spoon soil sampler was decontaminated between each use. Decontamination steps included:

- Washing off grass, soil particles, mud smears, etc., in a bucket of tap water
- Washing in a 5 to 10 percent solution of trisodium phosphate (TSP) and tap water
- Two rinses in clean tap water
- One rinse each with distilled water and methanol

The same decontamination procedures were used for the stainless steel utensils used to transfer soil from the sampler to the jars. Utensils were stored in a new plastic bag until they were ready for use.

A number of quality control measures were performed in order to ensure that all data generated was of known precision, and accuracy and conformed to accepted procedures. Soil sample splits were collected at soil boring sites MW-2, -5, and -6. Several transfer blanks were also prepared to check for potential contamination of sample jars. Samples of water poured into the drill holes to hold back heaving sands were also collected.

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GROUNDWATER MONITORING WELL CONSTRUCTION

Seven groundwater monitoring wells were constructed by installing well screen casing assemblies into the completed drill holes.

Each assembly consisted of 2-inch diameter schedule 40 PVC. Well screens consisted of a 15-foot length of PVC with three rows of 0.010-inch machine-slotted openings. A 5-foot solid PVC sump was placed beneath each screen. Solid PVC casing was placed above the screen and extended to the ground surface. Casing lengths were connected by flush-threaded fittings; no solvents were used to connect PVC sections.

Each well screen interval was gravel-packed by pouring a coarse-grained sand into the annular space between the PVC and the hollow stem of the auger. As the auger was pulled up, the sand dropped out of the hollow stem into the well to envelop the well screen. After the sand pack was installed to 2 or 3 feet above the top of the well screen, the annular space between the PVC casing and the hollow stem was filled with 1 to 2 feet of pelletized bentonite followed by cement grout to the ground surface. A summary of the construction of each well is provided in the soil boring record drawings presented in the appendix.

Well heads were completed at approximately 2 feet above the ground surface with locking steel caps that were anchored 2 to 3 feet into the cement grout mixture. The monitoring wells were developed by the drilling contractor by blowing compressed air through an air line into the sump (tail pipe) located below the well screen. Development was considered complete when the return water became visibly less turbid. The PVC monitoring well assembly was thoroughly steam-cleaned before construction of each well. As a measure of additional quality assurance and control, samples of the sand filter

SCOEPA00003976

pack material used for well construction were collected and saved.

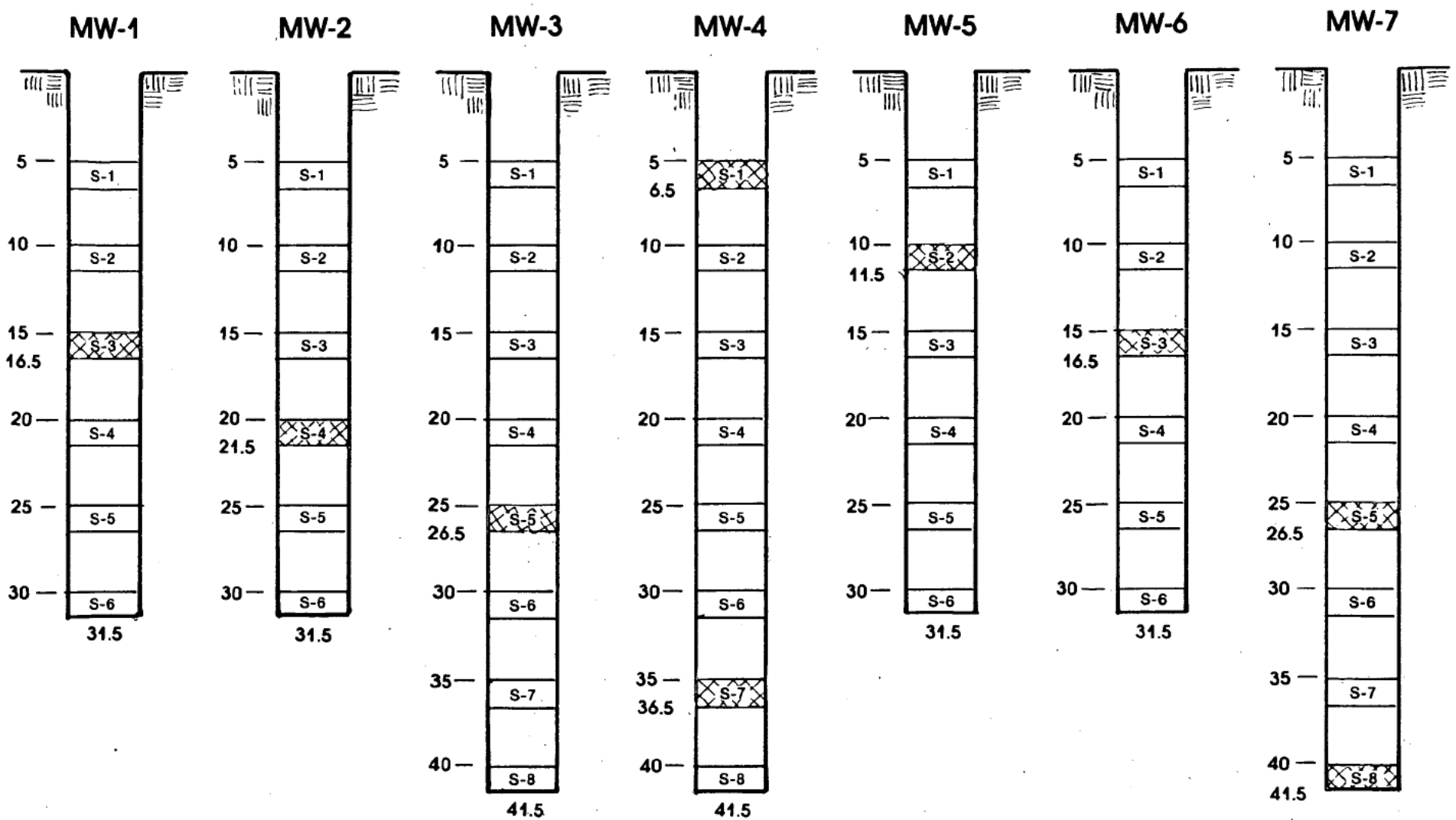
LABORATORY ANALYSIS AND SOIL SAMPLE RESULTS

The field sample description generally provided the basis for selecting samples to be sent to the laboratory for chemical analysis. Samples in which contaminants were most apparent visually and by odor were selected for analysis. Also, at least one soil sample from each soil boring site was analyzed, as was at least one sample at every 5-foot depth (except at 30 feet) from the combination of all soil boring locations. Figure 4 shows the approximate vertical location of the collected soil samples for each monitoring well and identifies which samples were analyzed.

The selection of the chemical analyses to be performed on each soil sample was based on the past and current industrial chemical manufacturing and handling activities within the Doane Lake area (i.e., petroleum products, coal tar, creosote, pesticides, battery recycling, foundry process waste disposal). The following chemical analyses were performed on the selected soil samples by Coffey Laboratories, Inc. (located at 4914 N.E. 122nd Avenue, Portland, Oregon):

- Oil and grease
- Phenols
- Volatiles and polynuclear aromatic hydrocarbons
- E.P. toxicity for:
  --pesticides
  --herbicides
  --arsenic
  --barium
  --cadmium
  --chromium
  --lead
  --mercury
  --selenium
  --silver

SCOEPA00003977



Analyzed Collected Soil Samples

(NOTE: Parallel lines denote soil samples. These were taken at 1.5 ft intervals starting every five feet)

Figure 4
GENERAL VERTICAL LOCATION COLLECTED SOIL SAMPLES WACKER SILTRONIC CORPORATION PORTLAND, OREGON

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The results of the laboratory analysis are presented in Table 1. A copy of the Coffey Laboratories, Inc., report is included in the appendix.

The field samples were analyzed for phenols, pesticides, herbicides, metals, volatiles, and aromatic hydrocarbons by EPA methods (SW-846, EPA-602, 4-79-020); the oils and grease were measured by standard methods (method 503 D).

Laboratory quality assurance procedures included method blanks, duplicates for precision measurements, and spikes for accuracy measurements. The frequency of blank, duplicate, and spike measurements was at a minimum of 10 percent per set to meet the standard requirements. The data were evaluated in view of the QC findings and found acceptable.

A review of the laboratory analysis indicates that each soil boring location contained a mixture of substances commonly associated with petroleum products, coal tar, and pesticides. The following list summarizes the principal substances found in each of the seven borings:

- MW-1 PAHs, petroleum products
- MW-2 PAHs, petroleum products
- MW-3 petroleum products
- MW-4 petroleum products
- MW-5 PAHs, petroleum products, 2,4-D
- MW-6 petroleum products, 2,4-D
- MW-7 petroleum products

Interpretation of results presented in Table 1 is beyond the scope of this report and will be included as part of future work (i.e., site environmental assessment).

SCOEPA00003979

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, SWQ
2-Chlorophenol	ND	7.8	0.08	0.26	ND	ND	0.13	ND	0.14	NR	pp, SWQ
2-Nitrophenol	ND	0.20	ND	ND	ND	ND	ND	ND	ND	NR	pp, SWQ
2,4-Dimethylphenol	ND	3.1	ND	ND	ND	0.22	0.17	ND	ND	NR	pp, SWQ
2,4-Dichlorophenol	ND	2.7	ND	ND	ND	0.24	ND	ND	ND	NR	pp, SWQ
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	0.22	ND	ND	ND	NR	pp, SWQ
2,4-Dinitrophenol	ND	ND	ND	ND	ND	0.81	ND	ND	ND	NR	pp, SWQ
Pentachlorophenol	ND	ND	ND	ND	0.31	6.9	5.1	ND	ND	NR	pp,SWQ,SHW
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, SHW, 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

PDR956.031.3

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	BD	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.

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CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-1	SHEET 1 OF 2

SOIL BORING RECORD DRAWING

PROJECT WACKER SILTRONIC CORPORATION LOCATION PORTLAND, OREGON

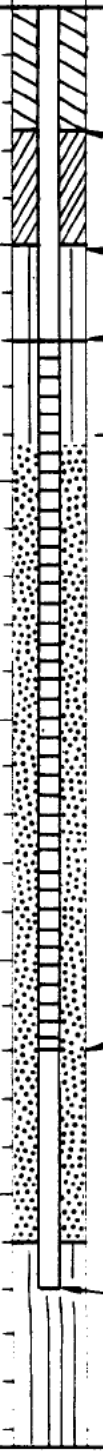
ELEVATION _____ DRILLING CONTRACTOR GEOTECH EXPLORATIONS, BEAVERTON, OREGON

DRILLING METHOD AND EQUIPMENT CME-55, 6" HS AUGERS

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	5	5.0				SILT, low plasticity, medium gray with brown mottling, moist, soft (ML), fill.	Top of gravel at 5'
		6.5	S-1	18	1-1-1 (2)		Screen top at 7'
	10	10.0				Upper 10" - SILT, same as S-1, some hydrocarbon odor (Jar 1 of 2), fill.	Driller notes water at ±9';
		11.5	S-2	0	4-4-5 (9)	Lower 8" - SAND, poorly graded, fine sand, dark gray, wet compact (SP), heavily saturated with oil, strong odor (Jar 2 of 2), fill.	Prominent oily sheen and odor to cuttings between 10' and 15'
	15	15.0				SAND, poorly graded, fine sand, dark gray, wet, compact (SP), heavily saturated with oil, fill.	
OIL		16.5	S-3	18	3-4-5 (9)		
	20	20.0				SAND, same as S-3, heavily saturated with oil, fill.	
		21.5	S-4	18	4-3-4 (7)		Screen bottom at 22'
							Driller notes 3 feet of heave at 25', had to wash out hole to clean out heave
	25	25.0				Upper 14" - SAND as in S-3 (SP), mild hydrocarbon odor, probably is slough from washing out heave and not representative.	Fill Native ±21'
		26.5	S-5	18	3-3-4	Lower 4" - SILT, low plasticity, medium brownish gray, moist, firm (ML), no noticeable hydrocarbon odor, probably native soil.	Sump bottom at 27'

SYMBOLIC LOG



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CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-1	SHEET 2 OF 2

SOIL BORING RECORD DRAWING

PROJECT WACKER SILTRONIC CORPORATION LOCATION PORTLAND, OREGON

ELEVATION _____ DRILLING CONTRACTOR GEOTECH EXPLORATIONS, BEAVERTON, OREGON

DRILLING METHOD AND EQUIPMENT CME-55, 6" HS AUGERS

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30	30.0				**SILT, low plasticity, medium brownish gray, moist to wet, includes some sandy silt in upper 6", firm (ML), no noticeable hydrocarbon odor, native soil.**		
		31.5	S-6	18	4-4-5 (9)			**Bottom gravel at 31.5'**
						END MW at 31.5 feet.		
								Worst samples
								S-2, Jar 2 of 2 and S-3 are equally bad, more sample in S-3 for testing.

REV 11 82 FORM D1586

SCOEPA00003983

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-2	SHEET 1 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION **PORTLAND, OREGON**

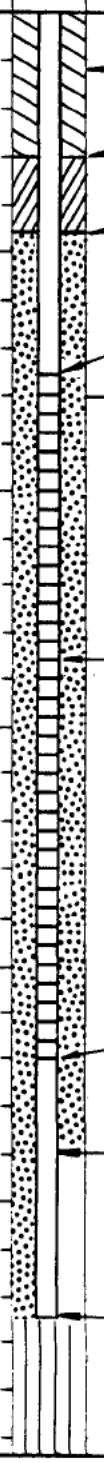
ELEVATION _____ DRILLING CONTRACTOR **GEOTECH EXPLORATIONS, BEAVERTON, OREGON**

DRILLING METHOD AND EQUIPMENT **CME-55, 6" HS AUGERS**

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	5	5.0					
		6.5	S-1	18	1-2-3 (5)	SAND, poorly graded, fine sand, brown, moist, loose (SP), fill.	
	10	10.0					
		11.5	S-2	0	1-4-5	NO RECOVERY; sample tube came up oily, strong hydrocarbon odor, sandy material on outside of sampler.	
	15	15.0					
		16.5	S-3	18	1-1-2 (3)	SAND, poorly graded, fine sand, chalk gray, wet, loose (SP), some lenses of silt; strong hydrocarbon odor, oily material observed on sample fill.	
	20	20.0					
		21.5	S-4	18	5-6-6 (12)	SANDY SILT, non-plastic, ~30% fill sand, medium to dark gray, wet, firm, (ML), strong hydrocarbon oder, noticeable oil in sample fill?	
	25	25.0					
		26.5	S-5	18	3-5-5 (10)	Upper 14" - SAND, as in S-3, includes strong hydrocarbon odor and visible oil in sample, material may be slough from drilling and washing out heaved zone, may not be representative of 25'-26.5' interval. Lower 4" - SILT, low plasticity, medium grayish brown, firm, moist (ML), no apparent hydrocarbon, native.	

SYMBOLIC LOG



COMMENTS:

- Grout to surface
- Top of bentonite at 3'
- Top of gravel at 4 1/2'
- Screen top at 7 1/2'
- Driller notes water at ±8';
- 15' screen 2" schedule 40 10 slot PVC
- Driller notes considerabe degree of oiliness to cutting from 15'-25', more than in MW-1
- Screen bottom at 22'
- 5' sump
- Driller notes 2' heave at 25', had to wash out hole
- Sump bottom at 27' 4"

OIL

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CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-2	SHEET 2 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION **PORTLAND, OREGON**

ELEVATION _____ DRILLING CONTRACTOR **GEOTECH EXPLORATIONS, BEAVERTON, OREGON**

DRILLING METHOD AND EQUIPMENT **CME-55, 6" HS AUGERS**

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30							
		31.5	S-6	18	3-3-4 (7)	**SILT, low plasticity, grayish brown, moist, firm (ML), no noticeable hydrocarbon odor, native soil.**		
						END MW at 31.5 feet		
								Worst sample
								S-3, S-4 - about the same

REV 11 82 FORM D1586

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CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-3	SHEET 1 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION **PORTLAND, OREGON**

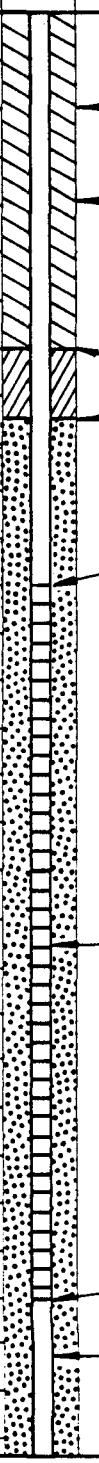
ELEVATION _____ DRILLING CONTRACTOR **GEOTECH EXPLORATIONS, BEAVERTON, OREGON**

DRILLING METHOD AND EQUIPMENT **CME-55, 6" HS AUGERS**

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	5	5.0					
		6.5	S-1	18	7-6-2 (8)	SAND, poorly graded, fine sand, ~15% fine, but some interlayers of silt, medium dense, dry, light brown, (SP), fill.	
	10	10.0					
		11.5	S-2	18	2-2-7 (9)	Interbedded silt and sand, sand same as above (SP), except gray, SILT, low plasticity, 10-15% sand, odor, light gray, moist, firm (ML), fill.	
	15	15.0					
		16.5	S-3	18	1-4-10 (14)	SAND, poorly graded, same as S-1, except strong hydrocarbon odor (SP), fill.	
	20	20.0					
		21.5	S-4	18	4-4-7 (11)	Interbedded silt and sand, same as S-2, except includes partially decomposed wood fragments and mild to strong hydrocarbon odor, wet, gray, fill.	
	25	25.0					
		26.5	S.5	18	5-6-6 (12)	SAND, poorly graded, fine sand, less than 10% fine, wet, medium to dark gray, compact (SP), strong hydrocarbon odor, fill.	
	30	30.0					

SYMBOLIC LOG



- Silty topsoil, then sandy cuttings to 5'
- Grout to surface
- Cuttins change to dark gray silt at ±7'
- 7' top of bentonite soil
- Top of sand pace 8 1/2'
- Screen top 12'
- Driller notes H_2O at ±15'
- First notice hydrocarbon odor in cutting at 15'
- 15' schedule 40 2" 10 slot PVC screen
- Screen bottom 27'
- 5'- 4" Sump

910

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CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-3	SHEET 2 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION **PORTLAND, OREGON**

ELEVATION _____ DRILLING CONTRACTOR **GEOTECH EXPLORATIONS, BEAVERTON, OREGON**

DRILLING METHOD AND EQUIPMENT **CME-55, 6" HS AUGERS**

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
		31.5	S-6	18	4-5-5 (10)	**SAND, poorly graded, fine sand, some interbedded silt in lower 2-4", medium gray, wet, medium dense, strong hydrocarbon odor, fill.**		**Sump bottom at 32'- 4"**
								Bottom of fill at ±34 1/2'
	35	35.0				**Upper 14" - mixture of sand and silt, probably washed cavings.**		**Augered to 35' and driller notes 3' of heave; opted to remove check ball from sampler and jet it to sample position in hopes of getting recovery; sample may be disturbed; pumped fresh water into hole (sample of water taken).**
		36.5	S-7	18	8-6-6 (12)	**Lower 4" - SILT, low plasticity, medium to dark gray, moist, firm (ML), slight hydrocarbon odor in upper 12", not noticeable in lower 6", sand and silt were mixed together in jar, silt is probably native soil.**		
	40	40.0				**Upper 12" - sand as in S-6, but is washed, probably is heaved material, discarded.**		
		41.5	S-8	6"	3-3-3 (9)	**Lower 6" - SILT, low plasticity, medium to dark gray, moist, firm (ML), probably native soil, no noticeable hydrocarbon odor.**		**Worst samples**
								Sample choices, any of S-3, S-4, S-5, S-6.

REV 11 82 FORM D1586

SCOEPA00003987

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-4	SHEET 1 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION **PORTLAND, OREGON**

ELEVATION _____ DRILLING CONTRACTOR **GEOTECH EXPLORATIONS, BEAVERTON, OREGON**

DRILLING METHOD AND EQUIPMENT **CME-55, 6" HS AUGERS**

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
								Hole is within 20' of abandoned natural gas line
								Grout 5' to surface
	5	5.0				Upper 9" - SAND, poorly graded, fine sand, brown, moist to wet, loose (SP).		Bentonite from 5'-6'
		6.5	S-1	18	5-1-2 (3)	Lower 9" - SILT, non-plastic, 10-20% fine sand, dark gray, moist, soft (ML), fill.		Screen top at 6 1/2'
								Some gravel - like material at 8'
								Driller notes water at ±8';
	10	10.0				Upper 6" - SAND, same as S-1, maybe slough.		
		11.5	S-2	18	11-13-11 (24)	Lower 12" - SILT, same as above.		15' screen 10 slot 2" schedule 40 PVC
OIL?	15	15.0				SAND, poorly graded, fine sand, saturated, loose, (SP), maybe slough, possible mild odor of hydrocarbon.		Piece wood jammed into end of shoe
		16.5	S-3	6"	3-3-4 (7)			
	20	20.0				SILT, low plasticity, brownish gray, moist, firm, (ML), native soil; included pieces of wife, probably dragged into sample.		FIN ±20' Native
		21.5	S-4	18	1-4-4 (8)			Screen bottom at 21 1/2'
								5'- 4" Sump
	25	25.0				SILT, same as above.		
		26.5	S.5	12	4-4-4 (8)			Tailpiece bottom at 27'
								Bentonite from 27-28'
	30	30.0						Gravel to 41 1/2'

REV 11 82 FORM D1586

SCOEPA00003988

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-4	SHEET 2 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION **PORTLAND, OREGON**

ELEVATION _____ DRILLING CONTRACTOR **GEOTECH EXPLORATIONS, BEAVERTON, OREGON**

DRILLING METHOD AND EQUIPMENT **CME-55, 6" HS AUGERS**

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
		31.5	S-6	18	4-5-4 (9)	**SILT, low plasticity, gray with brown mottling, moist, firm (ML), includes some decomposed plant fragments.**		
	35	35.0				**SANDY SILT, non-plastic, 30-50% fine sand, brown, moist, firm (ML).**		**Gravel to 41 1/2'**
		36.5	S-7	8	2-3-8 (11)			
	40	40.0						
		41.5	S-8	8		**END MW at 41.5'**		

Worst samples

None - all have clean appearance

REV 11 82 FORM D1586

SCOEPA00003989

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-5	SHEET 1 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION PORTLAND, OREGON

ELEVATION _____ DRILLING CONTRACTOR GEOTECH EXPLORATIONS, BEAVERTON, OREGON

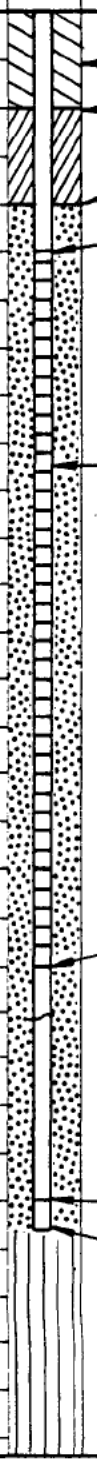
DRILLING METHOD AND EQUIPMENT CME-55, 6" HS AUGERS

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	5	5.0						
		6.5	S-1	18	4-4-8 (12)	SAND, poorly graded, fine sands, brown and gray, some 1/2" silt lenses, moist, loose; includes some oil sheen and odor.		
	10	10.0						
		11.5	S-2	18	6-6-8 (14)	SAND, poorly graded, fine sand, dark gray, wet, loose to compact, (SP), fill, saturated with oil (split samples taken. Jar 1 and Jar 2).		
	15	15.0						
		16.5	S-3	18		SAND, same as S-2, except only has oily odor and occassional sheen in soil.		
	20	20.0						
		21.5	S-4	18	3-4-5 (9)	SAND, same as S-2, excet has mild odor of oil; silt in top.		
	25	25.0						
		26.5	S-5	9	3-5-10 (15)	SILT, low plasticity, 10-15% fine sand, medium gray with brown, yellow and reddish mottling, slightly moist, very stiff (ML), no noticeable hydrocarbon odor.		
	30	30.0						

Mild HC odor

OK



Grout to surface

Top of bentonite scale = 2'

Top of sand at 4'

Screen top at 5'

Dark gray sandy material in cuttings from 5'-10', noticeable oily smell and sheen

Driller notes water 5'-10'

Screen bottom at 20'

Silt in tip of sampler, for S-4
fill ±21
Native

Sump bottom at 25'

Tailpiece bottom at 25' - 4"

NOTE: Driller lost steel weight for tape in hole at 30 feet, not recovered.

REV 11 82 FORM D1586

SCOEPA00003990

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-5	SHEET 2 OF 2

SOIL BORING RECORD DRAWING

PROJECT WACKER SILTRONIC CORPORATION LOCATION PORTLAND, OREGON

ELEVATION _____ DRILLING CONTRACTOR GEOTECH EXPLORATIONS, BEAVERTON, OREGON

DRILLING METHOD AND EQUIPMENT CME-55, 6" HS AUGERS

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		31.5	S-6	18	4-5-5 (10)	**SILT, low plasticity, about 10% fine sand, gray with brown mottling, moist, stiff (ML), no noticeable hydrocarbon oder.**		
						END MW at 31.5 feet.		
								Worst samples
								S-2 = worst
								S-3

REV 11 82 FORM D1586

SCOEPA00003991

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-6	SHEET 1 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION **PORTLAND, OREGON**

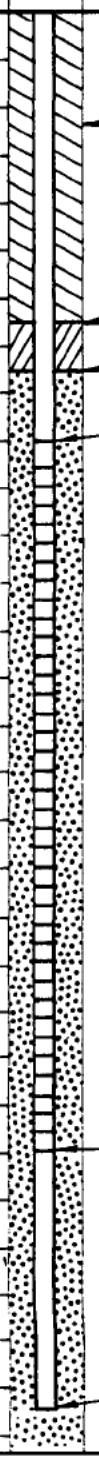
ELEVATION _____ DRILLING CONTRACTOR **GEOTECH EXPLORATIONS, BEAVERTON, OREGON**

DRILLING METHOD AND EQUIPMENT **CME-55, 6" HS AUGERS**

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	5	5.0					
		6.5	S-1	18	3-8-11 (19)	SAND, poorly graded, fine sand, less than 10% fine, brown, moist, compact (SP), fill.	
	10	10.0					
		11.5	S-2	18	10-10-11 (21)	Primarily sand, as in S-1, but with several 1-inch silt layers; lower 6" of sample has strong hydrocarbon odor to it.	
	15	15.0					
		16.5	S-3	18	1-1-2 (3)	SAND, as in S-1, except lower 6" have blackish discoloration and strong hydrocarbon odor; small oily splotches noticeable in soil.	
	20	20.0					
		21.5	S-4	18	3-3-5 (8)	Upper 6" - SAND as in S-1, have blackish discoloration and hydrocarbon odor, fill. Lower 12" - SILT, low plasticity, gray with brown mottling, firm (ML), hydrocarbon odor not noticeable.	
	25	25.0					
		26.5	S-5	18	9-26-26 (52)	SAND, as in S-1, but dark gray with mild hydrocarbon odor, material might be heaved sands and not representative of in-situ soil at 25'.	
	30	30.0					

SYMBOLIC LOG



Grout to surface

Bentonite to 6 1/2'

Sand to 7 1/2'

Top of screen at 9'

Driller notes water at ±12', coincident with appearance of "oily" odor from cuttings while drilling from 10-15'

A-rods came out of hold with unusual yellow discoloration from water at 20-25'

Bottom of screen at 24'

Driller notes 4' of heave after drilling to 25'; also, chain fell in hole, but was able to recover by retracting augers from hole; Augers moved during SPT from S-5, driller says no contact with sampler; why so high of an N value?

Sump to 29 1/2'

OIL & BLACK

REV 11 82 FORM D1586

SCOEPA00003992

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-6	SHEET 2 OF 2

SOIL BORING RECORD DRAWING

PROJECT WACKER SILTRONIC CORPORATION LOCATION PORTLAND, OREGON

ELEVATION _____ DRILLING CONTRACTOR GEOTECH EXPLORATIONS, BEAVERTON, OREGON

DRILLING METHOD AND EQUIPMENT CME-55, 6" HS AUGERS

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		31.5	S-6	18	5-7-12 (19)	All 18" of soil in barrel is SAND, poorly graded, fine sand, less than 10% fine, medium to dark gray, wet, compact, (SP), probably heave or disturbed soil, not representative of 30' depth; mild hydrocarbon odor. 2" of soil in shoe of sampler is SANDY SILT, non-plastic, 30-50% fine sand, medium gray, wet, firm, (ML); no noticeable hydrocarbon odor, sandy silt is probably representative of in-situ soil.		Driller notes 3' of heave from 30-29' prior to sampling S-6; had to drill/wash out heave
								Sample choices S-3

REV 11 82 FORM D1586

SCOEPA00003993

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-7	SHEET 1 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION PORTLAND, OREGON

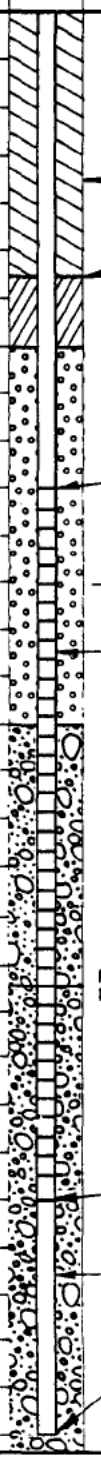
ELEVATION _____ DRILLING CONTRACTOR GEOTECH EXPLORATIONS, BEAVERTON, OREGON

DRILLING METHOD AND EQUIPMENT CME-55, 6" HS AUGERS

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	5	5.0				Lower 6" - SILT, low plasticity, moist, gray, soft (ML).	Grout to surface
		6.5	S-1	12"	1-3-1 (4)	Upper 6" - SAND, poorly graded, fine sand, brown, wet, loose, (SP), fill.	5 1/2' top of bentonite
	10	10.0				SAND as in upper 6" of S-1, (SP), fill.	Cavings around PVC 7-15'
		11.5	S-2	14	5-9-11 (18)		10' of top of screen
							Driller notes water at ±12'
							15' section 10 slot PVC wells
	15	15.0				SAND, same as upper 6" of S-1 (SP), fill.	
		16.5	S-3	18	2-1-5		During well construction, drill hole walls began squeezing in at 5' up to 7', sand was packed in auger and walls apparently squeezed in faster than sand could drop out; tried twice unsuccessfully to jet-out sand.
odor	20	20.0				Upper 6" - sand as in upper 6" of S-1, (SP), fill; mild hydrocarbon odor.	Fill ±
		21.5	S-4	18	5-5-6 (11)	Lower 12" - SILT, low plasticity, medium brown with gray mottling, moist, firm, (ML); native soil.	Native
	25	25.0				Upper 9" - SILT, low plasticity, medium brown with gray mottling, moist, firm, (ML).	25' bottom screen
		26.5	S-5	18	4-3-4 (7)	Lower 9" - SAND, poorly graded, fine sand, medium gray, wet, loose, (SP), strong hydrocarbon odor, visible blotches of oil (?) in both silt and sand.	5'-4" Sump
Strong HC odor	30	30.0					Bottom of Sump = 30'
							Driller notes heave at 30' ±4' of heave

SYMBOLIC LOG



REV 11 82 FORM D1566

SCOEPA00003994

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
P19436.A2	MW-7	SHEET 2 OF 2

SOIL BORING RECORD DRAWING

PROJECT **WACKER SILTRONIC CORPORATION** LOCATION PORTLAND, OREGON

ELEVATION _____ DRILLING CONTRACTOR GEOTECH EXPLORATIONS, BEAVERTON, OREGON

DRILLING METHOD AND EQUIPMENT CME-55, 6" HS AUGERS

WATER LEVEL AND DATE _____ START _____ FINISH _____ LOGGER _____

ELEVATION	DEPTH BELOW SURFACE (FT.)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
		31.5	S-6	18	2-1-2 (3)	Lower 9" - SAND, poorly graded, fine, brown, wet, soft, (SP),.		Reamed out heaved area from 26 to 30' with wash water and tricone bit to clear auger
						Upper 9" - SAND, very fine, brown, wet, loose, (SM); All has definite hydrocarbon (?) odor, not visible in soil, however. Sample may be distrubed, heave material.		Backfill to 32'-4"
	35	35.0				SANDY SILT, low plasticity, 20-30% fine sand, medium brown, moist, soft, (ML); noticeable hydrocarbon (?) odor.		
		36.5	S-7	18	3-5-5 (10)			
	40	40.0				Upper 7" - SILT, low plasticity, brown, wet, firm, (ML).		
		41.5	S-8	14"	8-11-17 (28)	Lower 7" - SILTY SAND, fine sand, about 30% fine, brown, wet, compact, (SM); both silt and sand have noticeable hydrocarbon (?) odor, no visible traces.		
						END MW at 41.5 feet		

Sample choices

(Ranked from worst)

*S-5
S-6
S-7 - S-8 (about the same)

*amount of odor

REV 11 82 FORM D1536

SCOEPA00003995

CH2M HILL *CHAIN OF CUSTODY RECORD*

PROJECT NUMBER	PROJECT NAME
LABORATORY	

STA. NO.	DATE	TIME	COMP	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS										REMARKS

SAMPLED BY AND TITLE *(SIGNATURE)*	DATE/TIME	RELINQUISHED BY: *(SIGNATURE)*	DATE/TIME	RECEIVED BY: *(SIGNATURE)*
RELINQUISHED BY: *(SIGNATURE)*	DATE/TIME	RECEIVED BY: *(SIGNATURE)*	RELINQUISHED BY: *(SIGNATURE)*	DATE/TIME	RECEIVED BY LAB: *(SIGNATURE)*

REMARKS _____

SAMPLE SHIPPED VIA
☐ UPS ☐ BUS
☐ FEDERAL EXPRESS

AIR BUS BILL NUMBER

DISTRIBUTION: WHITE — ORIGINAL ACCOMPANIES SHIPMENT, PINK — COPY TO COORDINATOR FIELD FILES, YELLOW — CLIENT

FORM 240

SCOEPA00003996

COFFEY LABORATORIES, INC.
4914 N.E. 122nd Ave.
Portland, OR 97230
Phone: (503) 254-1794

April 30, 1985
Log #A850410-I

Wacker Siltronics
P.O. Box 03180
Portland, Oregon 97203

Analyses Requested: Oil and Grease, Phenols, Volatiles, and Polynuclear Aromatic Hydrocarbons

Sample Identifications:
#1 - MW1, S-3 (15.0' - 16.5')
#2 - MW2, S-4 (20.0' - 21.5')
#3 - MW3, S-5 (25.0' - 26.5')
#4 - MW4, S-1 (5.0' - 6.5')
#5 - MW4, S-7 (35.0' - 36.5')
#6 - MW5, S-2 (10.0' - 11.5')
#7 - MW6, S-3 (15.0' - 16.5')
#8 - MW7, S-5 (25.0' - 26.5')
#9 - MW7, S-8 (40.0' - 41.5')

SAMPLE #	OIL AND GREASE
#1	0.340 %
#2	0.1498 %
#3	0.0587 %
#4	0.0914 %
#5	0.0304 %
#6	0.190 %
#7	0.0539 %
#8	0.0650 %
#9	0.0586 %

THIS REPORT CONTINUES

COFFEY LABORATORIES, INC.
4914 N.E. 122nd Ave.
Portland, OR 97230
Phone: (503) 254-1794

Wacker Siltro
Log #A850410-I

April 30, 1985
Page Two

PHENOL RESULTS

ANALYSIS	SAMPLE #1 RESULTS
Phenol	0.35
O-Cresol	0.04
3 & 4 Chlorophenol	0.44
2,3,4,6 Tetrachlorophenol	0.24
2,3,4,5 Tetrachlorophenol	4.9
M & P Cresol	0.006

	SAMPLE #2 RESULTS
Phenol	3.1
O-Cresol	3.4
3 & 4 Chlorophenol	17.5
2-Chlorophenol	7.8
2-Nitrophenol	0.20
2,4 Dimethylphenol	3.1
2,4 Dichlorophenol	2.7
2,4,5 Trichlorophenol	1.9
2,3,5,6 Tetrachlorophenol	4.0
2,3,4,5 Tetrachlorophenol	256

	SAMPLE #3 RESULTS
Phenol	0.20
3 & 4 Chlorophenol	0.06
2-Chlorophenol	0.09

	SAMPLE #4 RESULTS
Phenol	0.30
2-Chlorophenol	0.26
O-Cresol	0.02
M & P Cresol	0.08
2,3,5,6 Tetrachlorophenol	0.59
2,3,4,5 Tetrachlorophenol	0.40

	SAMPLE #5 RESULTS
Phenol	0.17
2,3,5,6 Tetrachlorophenol	0.11
Pentachlorophenol	0.31

Results reported in mg/kg

THIS REPORT CONTINUED

COFFEY LABORATORIES, INC.
4914 N.E. 122nd Ave.
Portland, OR 97230
Phone: (503) 254-1794

Wacker Siltronics
Log #A850410-I

April 30, 1985
Page Three

PHENOL RESULTS

ANALYSIS	SAMPLE #6 RESULTS
Phenol	0.07
O-Cresol	0.19
2,4 Dimethylphenol	0.22
2,4 Dichlorophenol	0.24
3 & 4 Chlorophenol	1.7
2,4,6 Trichlorophenol	0.22
2,3,5,6 Tetrachlorophenol	0.33
2,3,4,5 Tetrachlorophenol	0.23
2,4 Dinitrophenol	0.81
Pentachlorophenol	6.9

	SAMPLE #7 RESULTS
Phenol	0.05
O-Cresol	0.05
2-Chlorophenol	0.13
2,4 Dimethylphenol	0.17
3 & 4 Chlorophenol	0.32
2,3,5,6 Tetrachlorophenol	0.55
2,3,4,5 Tetrachlorophenol	4.7
Pentachlorophenol	5.1

	SAMPLE #8 RESULTS
Phenol	0.06
2,3,4,6 Tetrachlorophenol	1.0
2,3,4.5 Tetrachlorophenol	0.06

	SAMPLE #9 RESULTS
Phenol	0.08
2-Chlorophenol	0.14
2,3,5,6 Tetrachlorophenol	0.45
2,3,4,5 Tetrachlorophenol	0.25

Results reported in mg/kg

THIS REPORT CONTINUED

COFFEY LABORATORIES, INC.
4914 N.E. 122nd Ave.
Portland, OR 97230
Phone: (503) 254-1794

Wacker Siltronics
Log #A850410-I

April 30, 1995
Page Four

EP TOXICITY PESTICIDES

Results below apply to the water extract of soil samples. Water extracts performed as per EPA Specification of EP-Toxicity Method.

SAMPLE #	ENDRIN	LINDANE	METHOXYCHLOR	TOXAPHENE
#1	<0.002	<0.04	<0.1	<0.05
#2	<0.002	<0.04	<0.1	<0.05
#3	<0.002	<0.04	<0.1	<0.05
#4	<0.002	<0.04	<0.1	<0.05
#5	<0.002	<0.04	<0.1	<0.05
#6	<0.002	<0.04	<0.1	<0.05
#7	<0.002	<0.04	<0.1	<0.05
#8	<0.002	<0.04	<0.1	<0.05
#9	<0.002	<0.04	<0.1	<0.05
Allowed Limits	0.02	0.4	10	0.5

< denotes "less than"

Results expressed in mg/liter

EP TOXICITY HERBICIDES

SAMPLE #	2,4-D	2,4,5 TP (SILVEX)
#1	<10 (mg/liter)	<1 (mg/liter)
#2	<10	<1
#3	<10	<1
#4	<10	<1
#5	<10	<1
#6	10.0	<1
#7	150.0	<1
#8	<10	<1
#9	<10	<1

THIS REPORT CONTINUED

COFFEY LABORATORIES, INC.
4914 N.E. 122nd Ave.
Portland, OR 97230
Phone: (503) 254-1794

Wacker Siltronics
Log #A850410-I

April 30, 1985
Page Five

Subject: E P Toxicity Test.

Method of Analysis: Federal Register/Vol.45, No.98/Monday, May 19, 1980/ Rules and Regulations; Appendix II, Page 33127

Field Data: Samples were collected and delivered by the Client

ANALYSIS	#1	#2	#3	#4	#5
Arsenic	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	0.05	0.11	0.05	0.09	<0.05
Cadmium	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury	<0.05	<0.05	<0.05	<0.05	<0.05
Selenium	<0.05	<0.05	<0.05	<0.05	<0.05
Silver	<0.05	<0.05	<0.05	<0.05	<0.05

ANALYSIS	#6	#7	#8	#9	Limit
Arsenic	<0.05	<0.05	<0.05	<0.05	5.0
Barium	0.05	0.11	0.08	0.15	100.0
Cadmium	<0.05	<0.05	<0.05	<0.05	1.0
Chromium	<0.05	<0.05	<0.05	<0.05	5.0
Lead	<0.05	<0.05	<0.05	<0.05	5.0
Mercury	<0.05	<0.05	<0.05	<0.05	0.2
Selenium	<0.05	<0.05	<0.05	<0.05	1.0
Silver	<0.05	<0.05	<0.05	<0.05	5.0

< denotes "less than"

Results expressed in mg/liter

THIS REPORT CONTINUED

COFFEY LABORATORIES, INC.
4914 N.E. 122nd Ave.
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Phone: (503) 254-1794

Wacker Siltronics
Log #A850410-I

April 30, 1985
Page Six

VOLATILES (HEADSPACE ANALYSIS)

COMPOUND	#1	#2	#3	#4	#5
1,2-Dichloro-ethane	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloro-ethane	0.01	<0.01	<0.01	<0.01	<0.01
Toluene	1.2	20	0.11	<0.1	<0.1
1,1,2,2 Tetra-chloroethylene	2.2	11	<0.05	<0.05	<0.05
Chlorobenzene	0.04	<0.04	<0.04	<0.04	<0.04
Ethyl Benzene	17.0	5.4	<0.04	<0.04	<0.04
Xylene	146	116	<1.0	<1.0	<1.0

COMPOUND	#6	#7	#8	#9
1,2-Dichloro-ethane	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloro-ethane	<0.01	<0.01	<0.01	<0.01
Toluene	0.20	<0.1	<0.1	<0.1
1,1,2,2 Tetra-chloroethylene	0.14	<0.05	<0.05	<0.05
Chlorobenzene	<0.04	<0.04	<0.04	<0.04
Ethyl Benzene	<0.04	<0.04	<0.04	0.05
Xylene	1.5	<1.0	2.8	1.2

< denotes "less than"

Results reported in mg/kg

Some interference was encountered due to naphthalene and some of the more volatile phenols and PNA s.

THIS REPORT CONTINUES

COFFEY LABORATORIES, INC.
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Wacker Siltronics
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April 30, 1985
Page Seven

POLYNUCLEAR AROMATIC HYDROCARBONS

COMPOUND	#1	#2	#3	#4	#5
Naphthalene	6.7	360	< 1	< 1	< 1
Acenaphthalene	5.6	230	< 1	< 1	< 1
Acenaphthene	8.0	560	< 1	< 1	< 1
Fluorene	5.0	290	< 1	< 1	< 1
Phenanthrine-Anthracene	32	1400	3	< 1	< 1
Fluoranthrene	16	530	< 1	< 1	< 1
Pyrene	18	550	< 1	< 1	< 1
Chrysene	12	92	< 1	< 1	< 1
Benzo(b) + Benzo(k) Fluoranthrene	8.0	120	< 1	< 1	< 1
Benzo(a)Pyrene	19	120	< 1	< 1	< 1
Indeno(1,2,3-CD) Pyrene+Dibenzo (a,b)Anthracene	< 1	270	< 1	< 1	< 1
Benzo(ghi)-Perylene	< 1	360	< 1	< 1	< 1

COMPOUND	#6	#7	#8	#9
Naphthalene	230	< 1	< 1	< 1
Acenaphthalene	24	< 1	< 1	< 1
Acenaphthene	28	< 1	< 1	< 1
Fluorene	20	< 1	< 1	< 1
Phenanthrine-Anthracene	150	< 1	1.6	< 1
Fluoranthrene	50	< 1	1.1	< 1
Pyrene	57	< 1	1.2	< 1
Chrysene	36	< 1	1.7	< 1
Benzo(b)+Benzo(k) Fluoranthrene	200	< 1	< 1	< 1
Benzo(a)Pyrene	100	< 1	< 1	< 1
Indeno(1,2,3-CD Pyrene+Dibenzo (a,b)Anthracene	7	< 1	< 1	< 1
Benzo(ghi)-Perylene	25	< 1	< 1	< 1

< denotes "less than"
Results reported in mg/Kg

Sincerely,

Susan M. Coffey

Susan M. Coffey,
President

SMC/db

Oregon DEQ

Environmental Cleanup Site Information Database
Site Summary Report - Details for Site ID 183

This report shows data entered as of February 25, 2003 at 3:57:00 PM

See the bottom of this page for a key to certain acronyms and terms used in the report below

For more information on what is occuring at this site see DEQ's Facility Profiler.

Site Information

Site ID: 183	Site Name: Wacker Siltronic Corp.		CERCLIS No: 096253737
	Address: 7200 NW Front AVE Portland 97210		
	County: Multnomah		Region: Northwest
	Investigation Status: Listed on CRL or Inventory	NPL Site: No	Orphan Site: No / Study Area: No
Property:	Twnshp/Range/Sect: 1N , 1W , 13		Tax Lots: 1
	Latitude: 45 deg. 34 ' 39"	Longitude: -122 deg. 45 ' 18.7"	Site Size: 84.6 acres
Other Site Names:			

Operations:

Name: Wacker Siltronic Corp.

Comments: Semiconductor manufacture

Years of Operation: 1978 - present

SIC Code: 3674 Operating Status: Active

Contamination Information

Hazardous Substances/Waste Types:	PAHs, BTEX, phenols, 2,4-D. In adjacent Willamette River sediments: beryllium, cobalt, iron, manganese, selenium, silver, titanium, vanadium, zinc, 2-methylnaphthalene, bis(2-ethyhexyl)phthalate, carbazole, pentachlorophenol, di-n-butylphthalate, dibenzofuran, PAHs, DDTs, 2,4-D, 2,4-DB
Manner and Time of Release:	Past practices; time of release unknown.
Contamination Information:	(5/20/93 KPD/SAS) Predecessor company of Northwest Natural Gas accumulated 30,000 cubic yards of coal tar in on-site pits. Coal tar pits were buried under 10 feet of overburden and spent oxide in 1973. Wacker purchased part of the property in 1978. Subsurface soil sampling on the vacant southern half of the site in 1985 found high levels of PAHs, plus lesser amounts of herbicides. Similar contamination was found in subsurface soil sampling on another portion of the site in 1990. The same year groundwater contaminated with TPH and BTEX compounds was found near a fuel line corridor. In addition, there has been occasional releases of solvents from Wacker's operations. (1/19/00 JMW/SAP) In September and October 1997, EPA's contractor, Roy F. Weston Inc., collected sediment samples within the Portland Harbor (RM 3.5 to RM

9.5). Beryllium, cobalt, iron, manganese, selenium, silver, titanium, vanadium, zinc, carbazole, 2-methylnaphthalene, bis(2-Ethylhexyl) phthalate, dibenzofuran, Di-N-Butylphthalate, pentachlorophenol, PAHs, DDTs, 2,4-D, and 2,4-DB were detected in river sediments.

Pathways: The site is located in a heavily industrialized part of NW Portland. The Willamette River is adjacent to the site on the northeast, and Forest Park is less than a quarter mile to the southwest. Past solvent releases and suspected leaks from an underground fuel line may have helped to mobilize the coal tar contamination.

Environmental/Health Threats: Site is located in heavy industrial area. Significant soil and groundwater contamination, but contaminated soil is under surface and groundwater used. Greatest threat may be to Willamette River and to on-site workers who dig into contaminated soil without adequate personal safety equipment.

Status of Investigative or Remedial Action: (5/20/93 KPD/SAS) Contaminated soil is 10-20 feet below ground surface, and groundwater in the area is not used. Contaminants may pose a threat to the environment, particularly the adjacent Willamette River. Similar contamination at the adjacent Northwest Natural Gas Company Site (ECSI #84) has been referred to Voluntary Cleanup and Site Response for further action. Site Assessment recommends that this site be included in those investigations. (1/19/00 JMW/SAP) Based on initial sampling results from a river sediment quality study, the Wacker Siltronic site has been identified as a potential source of contamination to the Portland Harbor. A Strategy Recommendation was completed on October 8, 1999. Contamination in sediments and the high potential for groundwater contamination prompted DEQ to require an RI/FS for the facility (high priority). (3/1/00 JMW/SAP) Voluntary Agreement for Remedial Investigation and Source Control Measures forwarded to Wacker Siltronic Corporation on February 29, 2000. (2/6/01 ELB/VCP) Following Wacker Siltronic Corp's refusal to sign the voluntary agreement, a Unilateral Order was issued jointly to Wacker and Northwest Natural on October 4, 2000. Both parties agreed to comply. An RI proposal was received on November 20, 2000. (11/21/01 ELB/VCP) A Remedial Investigation work plan was approved in June 2001. The Phase I Remedial Investigation was initiated in August 2001; investigative efforts are ongoing.

Data Sources: 1) "Preliminary Report: Soil Investigation for Proposed Polysilicon Plant" by CH2M Hill, June 1985. 2) EPA CERCLA Preliminary Assessment report, by Ecology and Environment, October 1987. 3) Laboratory data from Pacific Environmental Laboratory, July 25, 1990. 4) "Findings Report: Groundwater and Soil Gas Investigation" by CH2M Hill, December 1990. 5) GASCO files (ECSI #84)(see VCS Project Manager files). 6) Doane Lake Study Area files (ECSI #36). 7) Portland Harbor Sediment Investigation Report, Roy F. Weston, Inc. for USEPA, May 1997.

Substance Contamination Information

Substance	Media Contaminated	Concentration Level	Date Recorded	Lab Data	Agency Observation	Owner Operator Admission
BENZENE	Groundwater	23,300 ppb	12/1/1990	Yes	No	No
BENZENE	Soil	29 ppm	7/25/1990	Yes	No	No
BENZO(a)ANTHRACENE	Soil	210 ppm	7/25/1990	Yes	No	No
BENZO(a)PYRENE	Groundwater	760 ppb		Yes	No	No
BENZO(a)PYRENE	Soil	120 ppm	6/1/1985	Yes	No	No
BENZO(a)PYRENE	Soil	240 ppm	7/25/1990	Yes	No	No
BENZO(b)FLUORANTHENE	Soil	180 ppm	7/25/1990	Yes	No	No
BENZO(b)FLUORANTHENE	Soil	up to 120 ppm	6/1/1985	Yes	No	No

BENZO(k)FLUORANTHENE	Soil	up to 120 ppm	6/1/1985	Yes	No	No
BENZO(k)FLUORANTHENE	Soil	120 ppm	7/25/1990	Yes	No	No
BERYLLIUM	Sediment	0.9 ppm	9/1/1997	Yes	No	No
BIS(2-ETHYLHEXYL) PHTHALATE	Sediment	210 - 700 ppb	9/1/1997	Yes	No	No
CARBAZOLE	Sediment	170 - 3600 ppb	9/1/1997	Yes	No	No
CHLOROPHENOL	Soil	17.5 ppm		Yes	No	No
CHRYSENE	Soil	92 ppm	6/1/1985	Yes	No	No
CHRYSENE	Soil	280 ppm	7/25/1990	Yes	No	No
COBALT	Sediment	20.3 - 24.6 ppm	9/1/1997	Yes	No	No
D,2,4-	Sediment	9 - 93 ppb	9/1/1997	Yes	No	No
DB,2,4-	Sediment	13 - 130 ppb	9/1/1997	Yes	No	No
DDT,p,p'-	Sediment	570 - 380 ppb	9/1/1997	Yes	No	No
DIBENZOFURAN	Sediment	160 - 3600 ppb	9/1/1997	Yes	No	No
DIMETHYLPHENOL,2,4-	Groundwater	27 ppb		Yes	No	No
DIMETHYLPHENOL,2,4-	Soil	3.1 ppm		Yes	No	No
DI-n-BUTYL PHTHALATE	Sediment	21 ppb	9/1/1997	Yes	No	No
ETHYLBENZENE	Groundwater	4,680 ppb	12/1/1990	Yes	No	No
INDENO(1,2,3-cd)PYRENE	Soil	160 ppm	7/25/1990	Yes	No	No
INDENO(1,2,3-cd)PYRENE	Soil	up to 270 ppm	6/1/1985	Yes	No	No
IRON	Sediment	51900 - 64500 ppm	9/1/1997	Yes	No	No
MANGANESE	Sediment	863 - 909 ppm	9/1/1997	Yes	No	No
METHYLNAPHTHALENE,2-	Sediment	180 - 11000 ppb	9/1/1997	Yes	No	No
PENTACHLOROPHENOL	Sediment	4.6 - 11 ppb	9/1/1997	Yes	No	No
PETROLEUM HYDROCARBONS	Groundwater	89,000 ppb	12/1/1990	Yes	No	No
POLYAROMATIC HYDROCARBONS (PAH)	Sediment	LPAHs 6860 - 165600 ppb	9/1/1997	Yes	No	No
POLYAROMATIC HYDROCARBONS (PAH)	Sediment	HPAHs 3034 - 268800 ppb	9/1/1997	Yes	No	No
SELENIUM	Sediment	16 - 17 ppm	9/1/1997	Yes	No	No
SILVER	Sediment	1.5 - 1.7 ppm	9/1/1997	Yes	No	No
TETRACHLOROETHYLENE	Soil	11 ppm		Yes	No	No
TITANIUM	Sediment	2740 - 3200 ppm	9/1/1997	Yes	No	No
TOLUENE	Groundwater	5,960 ppb	12/1/1990	Yes	No	No
TOLUENEDIAMINE,2,4-	Soil	160 ppm	6/1/1985	Yes	No	No
VANADIUM	Sediment	113 - 152 ppm	9/1/1997	Yes	No	No
ZINC	Sediment	120 - 150 ppm	9/1/1997	Yes	No	No

Investigative, Remedial and Administrative Actions

	Compl.	Agency	Lead

Action	Start Date	Date	Resp. Staff	Code	Region	Pgm
Site added to CERCLIS	6/14/1985			EPA		
EPA Basic Preliminary Assessment	11/9/1987	11/9/1987		EPA		
Site added to database	5/2/1988		Michael Zollitsch	DEQ	HQ	SAS
Responsible party notified re 11/88 Inventory listing	11/30/1988			DEQ	HQ	SAS
EPA Screening Site Inspection 1	12/15/1988	12/15/1988		EPA		
NEGOTIATIONS	5/11/1990	8/5/1991		DEQ	HQ	SRS
SITE EVALUATION	8/4/1991	8/4/1991		DEQ	HQ	SRS
Preliminary Assessment Equivalent recommended (PAE)	8/4/1991	8/4/1991		DEQ	HQ	SRS
PRELIMINARY ASSESSMENT EQUIVALENT	8/5/1991	8/5/1991		DEQ	HQ	SRS
Listing Review completed	8/6/1991	8/6/1991		DEQ	HQ	SRS
Proposal for Confirmed Release List recommended	8/7/1991	8/7/1991		DEQ	HQ	SRS
Proposal for Inventory recommended	8/7/1991	8/7/1991		DEQ	HQ	SRS
Facility proposed for Confirmed Release List	11/15/1991	11/15/1991		DEQ	HQ	SRS
Facility proposed for Inventory	11/15/1991	11/15/1991		DEQ	HQ	SRS
Extension requested by owner/operator	12/20/1991	12/20/1991				
Petition or request granted	12/22/1991	12/22/1991	Loretta Pickerell	DEQ	HQ	SAS
Owner/operator comments received on listing notification	2/13/1992	2/13/1992	Loretta Pickerell	DEQ	HQ	SAS
Review for final listing	7/29/1992	7/29/1992	Loretta Pickerell	DEQ	HQ	SAS
Listing on Confirmed Release List recommended	7/30/1992	7/30/1992	Loretta Pickerell	DEQ	HQ	SAS
Listing on Inventory recommended	7/30/1992	7/30/1992	Loretta Pickerell	DEQ	HQ	SAS
Facility placed on Confirmed Release List	10/22/1992	10/22/1992	Loretta Pickerell	DEQ	HQ	SAS
Facility placed on Inventory	10/22/1992	10/22/1992	Loretta Pickerell	DEQ	HQ	SAS
SITE PRIORITY EVALUATION FOR FURTHER ACTION	5/19/1993	5/19/1993	Kevin Dana	DEQ	HQ	SAS
Other remedial or investigative action recommended	5/20/1993	5/20/1993	Kevin Dana	DEQ	HQ	SAS
EPA Site Inspection Prioritization	3/7/1995	3/7/1995		EPA		
SITE SCORING	10/8/1999	10/8/1999	Eric Blischke	DEQ	NWR	VCS
Remedial Investigation/Feasibility Study recommended	10/8/1999	10/8/1999	Eric Blischke	DEQ	NWR	VCS
BASIC PRELIMINARY ASSESSEMENT	10/8/1999	10/8/1999	Eric Blischke	DEQ	NWR	VCS
NEGOTIATIONS	2/29/2000	10/4/2000	Eric Blischke	DEQ	NWR	VCS
Letter Agreement	2/29/2000	10/4/2000	Eric Blischke	DEQ	NWR	VCS

SCOEPA00004007

REMEDIAL INVESTIGATION	10/4/2000		Eric Blischke	DEQ	NWR	VCS
Consent Order	10/4/2000	10/4/2000	Eric Blischke	DEQ	NWR	VCS

Key to certain acronyms and terms in this report:
CERCLIS No.: The U.S. EPA's Hazardous Waste Site identification number, shown only if EPA has been involved at the site.
Region: DEQ divides the state into three regions (E, NW, and W); the regional office shown is responsible for site investigation/cleanup.
NPL Site: Is the site on EPA's Superfund List? (Y/N).
Orphan Site: Has DEQ's Orphan Program been active at this site? (Y/N). The Orphan Program cleans up high-priority sites where owners and operators responsible for the contamination are absent, or are unwilling or unable to use their own resources for cleanup.
Study Area: Is this site a Study Area? (Y/N). ECSI assigns unique Site ID numbers to both individual sites and to Study Areas, which are groupings of individual ECSI sites that may be contributing to a larger, area-wide problem.
SIC Code: The Standard Industrial Classification code assigned to the operation described in this part of the report.
Pathways: A description of human or environmental resources that site contamination could affect.
Lead Pgm: This column refers to the Cleanup Program affiliation of the DEQ employee responsible for the action shown. SAS = Site Assessment; VCS = Voluntary Cleanup; SRS = Site Response (enforcement cleanup).

For more information about this page please contact Gil Wistar at (503) 229-5512 or via email at wistar.gil@deq.state.or.us.

DEQ Online is the official web site for the Oregon Department of Environmental Quality.

SCOEPA00004008

Wacker Siltronic Corporation

WACKER

TO: Rudy Staudigl

FROM: John Pittman

SUBJECT: Plant Site Environmental Update

DATE: June 20, 1990

On May 11, Jim DiSorbo and myself met with Fred Hansen, Director of the Department of Environmental Quality and Michael Downs, Administrator of the Environmental Cleanup Division. The purpose of the meeting was to discuss the "innocent purchaser" situation and what procedural steps would be necessary to proceed with the Fab II installation on this plant site. After lengthy discussions, it was concluded that Wacker Siltronic would not receive a written notice that we were innocent purchasers, but that there is very low risk that any further actions would be taken. We have a draft letter from Fred Hansen that indicates that the Department would approach the culpable parties before addressing those issues with Wacker Siltronic.

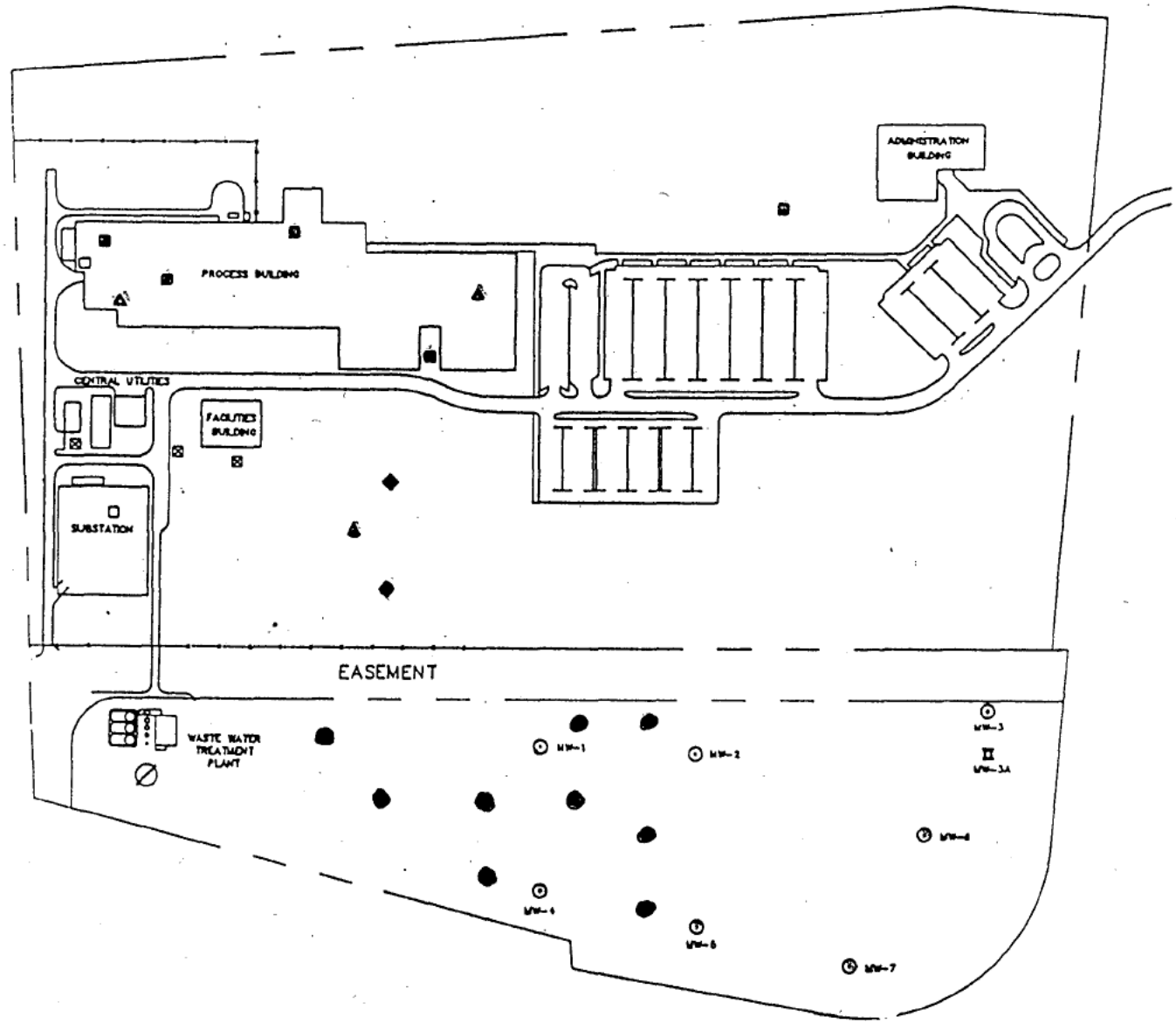
The second issue was how we would handle the Fab II expansion knowing that there is some degree of contaminated material on the property site. A meeting was set with Michael Downs, Tom Miller of DEQ, Bill Matsukato and Christy Shoen of CH2M-Hill/IDC, and myself to discuss the procedures for obtaining geotechnical information for the building construction and environmental impact of the soil in the area of the proposed excavation. The meeting was very positive and requirements requested were minimal. Christy Shoen sent the DEQ a followup memo outlining the discussion so that this would be documented. Then Michael Downs of DEQ sent a letter indicating additional testing that would be required. He was informed that these items would be looked at and negotiated on the Phase II portion of construction where additional environmental sampling will be required, but for this phase we will proceed with the actions discussed in the meeting. It was also expressed to the DEQ that the activity taking place at this time was strictly for business purposes. The geotechnical information is necessary for building construction and in no way are the drillings that are being done to be associated with the Doane Lake Investigation taking place on the SuperFund Site.

JLP:bw

HISTORY OF BORINGS

1977	PRELIMINARY BORINGS FOR GEOTECHNICAL PROJECT ESTIMATING
1978	ADDITIONAL GEOTECHNICAL INFORMATION FOR APPROVED PROJECT
1982	GEOTECHNICAL BORINGS FOR POLY PLANT STRUCTURES *(PROJECT PUT ON HOLD)*
1985	GEOTECHNICAL AND ENVIRONMENTAL BORINGS FOR POLY PLANT SITE RELOCATION *(PROJECT PUT ON HOLD)*
1987	PROPOSED ENVIRONMENTAL BORINGS IN CONJUNCTION WITH NORTHWEST NATURAL GAS SURVEY *(PROJECT CANCELED)*
1990	GEOTECHNICAL AND ENVIRONMENTAL BORINGS FOR FAB II
1990	ADDITIONAL ENVIRONMENTAL BORING FOR GOULD SUPERFUND SURVEY *(BY OTHERS)*

Business Division Semiconductors of Wacker-Chemie



LEGEND

- △ BORING (1977)
- ▣ BORING (1978)
- ● BORING (1982)
- ⊕ BORING (1985)
- ⊠ PROPOSED BORING (1987)
- ◆ BORING (1990)
- ⧖ BORING (1990) (BY OTHERS)

Wacker Siltronic Corporation

WACKER

SCOEPA00004011

Oregon

September 10, 1993

CERTIFIED MAIL NO. P-915-447-128
RETURN RECEIPT REQUESTED

DEPARTMENT OF
ENVIRONMENTAL
QUALITY

Ms. Sandra Hart
Northwest Natural Gas Co.
220 NW 2nd Ave.
Portland, OR 97209

RECEIVED
SEP 16 1993
WACKER SILTRONIC
Environmental Health & Safety

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

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 Saling, 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

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.

PRELIMINARY ASSESSMENT REPORT
WACKER SILTRONIC CORPORATION
PORTLAND, OREGON

TDD F10-8709-17

Report Prepared by: Ecology and Environment, Inc.
Date: October 1987

Submitted to: J.E. Osborn, Regional Project Officer
Field Operations and Technical Support Branch
U.S. Environmental Protection Agency
Region X
Seattle, Washington

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101 YESLER WAY, SEATTLE, WASHINGTON, 98104, TEL. 206/624-9537
International Specialists in the Environment

recycled paper

SCOEPA00004017

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International Specialists in the Environment

MEMORANDUM

DATE: November 9, 1987

TO: John Osborn, FIT-RPO, USEPA, Region X

THRU: for David Buecker, FIT-OM, E&E, Seattle MT

FROM: Timothy L. Syverson, FIT-SM, E&E, Seattle TLS

SUBJ: Preliminary Assessment Report for
Wacker Siltronic Corporation
Portland, Oregon

REF: TDD F10-8709-17

CC: Deborah Flood, HWD-SM, USEPA, Region X
Jeffrey Villnow, FIT-PM, E&E, Seattle
Thomas Tobin, E&E, Seattle

1. Introduction and Purpose of the Preliminary Assessment:

Pursuant to U.S. Environmental Protection Agency (EPA) Contract No. 68-01-7347 and Technical Directive Document (TDD) F10-8709-17, Ecology and Environment, Inc. (E&E) conducted a Preliminary Assessment (PA) of the Wacker Siltronic Corporation in Portland, Oregon. The PA represents the second of a three-step assessment process which begins with Site Discovery and concludes, if necessary, with a Site Inspection. The assessment process, in general, is intended to identify, compare, and rank the potential hazards associated with a particular site relative to other sites across the nation for the purpose of identifying priority sites requiring remedial responses. It does not include extensive or complete site characterization, contaminant fate determination, or quantitative risk assessment.

The Wacker Siltronic Corporation Site PA was conducted to identify potential public health and/or environmental hazards related to the site and, if present, evaluate the need for additional investigative action. The PA is based on data derived from available files pertaining to the site, and conversations with state and local officials (1-19). Information developed during the PA is summarized in Appendix A on EPA Form 2070-12.

2. Information Obtained During the Preliminary Assessment:

- Site Location and Description - The Wacker Siltronic Corporation Site is located at 7200 N.W. Front Street, in the northwest portion of the City of Portland, in Multnomah County, Oregon (Figure 1). The 85 acre Wacker Siltronic Site is bordered on the east by the Willamette River, on the west by Highway 30 (St. Helen's Road), on the north by Koppers, Inc. and Northwest Natural Gas, and on the south by the Burlington Northern Railroad Bridge. Wacker has a processing plant and offices in two buildings adjacent to the river, and a wastewater treatment facility along the northwest boundary of the property (Figure 2). A Portland General Electric (PGE) substation is located between the treatment facility and the process building. The southwestern portion of the site is undeveloped, but is the proposed location for Wacker's Polysilicon Plant. Access to the site is limited due to the site's close proximity to the river and the railroad grades that border the site on two sides (Figure 3). The active portions of the site are fenced, and the area is patrolled by private security personnel.

- Site History / Potential Problem(s) at Site - The Wacker Siltronic Site is located in the northwest industrial district of Portland (Figure 3) commonly referred to as "Doane's Lake". The Doane's Lake area previously included two lakes: Doane's Lake to the north, and Guild Lake to the south. Near the turn of the century, the area was filled with dredge sands and mud from the Willamette River, and industrial wastes to provide additional land for developement (1). The land now owned by Wacker is a portion of the old Portland Gas and Coke (PG&C) site. The PG&C plant was in operation from 1913 to 1956. Since 1956, the PG&C property has been owned by Northwest Natural Gas (NNG) (2). In 1976 Wacker purchased the southeast portion of the property, and began construction of their facility (1).

  The Wacker Siltronic Corporation manufactures silicon wafers used in the production of integrated circuits. The plant grows and processes single crystals of silicon from high purity polycrystalline silicon. The Wacker facility is listed under the Resource Conservation and Recovery Act (RCRA) as a generator of industrial wastes (3). The facility has an NPDES permit for the processing and discharge of wastewater to the Willamette River, and an air contaminant discharge permit. Both permits are issued by the Oregon Department of Environmental Quality (DEQ) (4, 5).

  Currently, the Doane Lake area includes a number of industrial plants including Gould Battery, Pennwalt, Rhone-Poulenc, Koppers, Inc., Northwest Natural Gas, and an ESCO landfill. These companies

have produced or handled numerous toxic materials over the past 40 years, including creosote, flammable hydrogen gas, hydrochloric acid, and dioxin-tainted chemicals (6). The Gould Battery site is listed on the EPA's National Priorities List.

The Doane Lake Area has a history of waste disposal problems. Prior to regulatory action by the Oregon Department of Environmental Quality (DEQ) and the EPA, wastes from local industry were discharged to the air, to the ground and surface water, and landfilled in the immediate area (1). Wastes from the old PG&C plant's production of coal gas were landfilled on the lots now occupied by Wacker and Koppers (1) (Figure 3). DEQ has identified abandoned coal tar disposal pits on the Koppers Site, but the history and extent of past waste disposal on the Wacker Site has never been detailed (7).

Wacker Siltronic discovered oil in the ground water and soil of their property twice since 1976. In 1979, oil was found in two excavations in the northwest corner of their property adjacent to the Koppers Site. The oil seepage was contained, and thought to be isolated to the northwest portion of the site (8). Test borings in 1985, for a proposed plant expansion, encountered petroleum products, coal tar, and pesticides at 7 locations in the western portion of the site (9). Generally the contaminants were encountered at depths of 10-20 feet below ground surface, and did not appear to be migrating toward the river approximately 1,400 feet to the east (6, 9). Analyses of ground water samples from monitoring wells completed in the test borings detected low levels of volatile organics and base neutral extractables (10). Wacker proposed that the low levels of contaminants posed no threat to human health or to the environment, but the DEQ did not agree with their assessment and is requesting further work at the site (10, 11).

The Wacker Siltronic Corporation has had at least six incidents since 1976 involving the discharge of hazardous materials from their facility. These discharges have included chromic acid (07/80, 12/80, 05/84), TCE (12/83, 12/84), and wastewater (06/87). Contamination of soil, ground water, and surface water have resulted from these spills or leakages at the Wacker facility (16, 17, 18, 19). The cumulative effect of on-site spills of hazardous materials by Wacker is unknown.

Currently, Wacker Siltronic, Koppers Inc., and Northwest Natural Gas are working under DEQ guidance to develop a plan for a comprehensive study of past practices in the North Doane's Lake area (sites north of the Burlington Northern Railroad bridge) (12).

- Physical Environment - The Wacker Site is located adjacent to the Willamette River at an elevation of 10-25 feet above mean sea level. The immediate area is generally flat, but the bluffs to the east across St. Helen's Road rise to 1,000 feet. The site is underlain by river sediments and mechanically deposited fill. The depth to ground water beneath the site is less than 10 feet below the ground surface (9).

  In the Portland area the Willamette River flows north-west and is extensively used for commercial shipping and recreational purposes. Recreational activities on the river include boating and sport fishing.

  Drinking water for the site area is provided by the City of Portland. The primary source for the Portland public water supply is the Bullrun Watershed located approximately 27 miles east of the city. The city has a secondary source of water from a field of 26 wells located along the Columbia River approximately seven miles northeast of the Wacker Site (13).

  The Portland area has a mild climate with wet winters, and warm dry summers. Total annual precipitation is about 40 inches, and the annual lake evaporation is about 26 inches (14). The one-year 24 hour rainfall for the Portland area is 2.5-3 inches (15).

- Waste Types, Quantities, and Characteristics - Hazardous materials at the Wacker Site include both wastes from past disposal practices in the site area, and wastes generated by current Wacker operations. The petroleum products, coal tar, and pesticides found in the 1985 soil borings represent past disposal at the site or contamination from adjacent sites, because Wacker's operation has never handled these substances.

  As a regulated RCRA generator, Wacker Siltronic generates three waste streams during the normal course of business: waste freon, waste trichloroethylene (TCE), and chromic acid sludge (3).

  TCE is used to clean silicon wafers before a wax coating is applied. Currently about 4,000 gallons per month of waste TCE is recycled through Van Waters and Rogers, a DEQ approved facility. Waste TCE is pumped from the process building to an outside holding tank. This tank and other waste tanks are equipped with level indicators, and are diked to contain spills and leakage (3).

  Waste freon is generated in Wacker's silicon wafer manufacturing process. Currently five to ten, 55 gallon drums per month of waste freon are sent to McClary Columbia (also a DEQ approved facility) for recycling. The waste freon is also stored in an outside storage tank (3).

Chromic acid is used during the etching of silicon wafers. Waste chromic acid is pumped from the processing plant to a treatment building where the acid is neutralized and reduced to trivalent chrome. The liquid portion is pumped to Wacker's wastewater treatment unit (WWTU). The sludge is dried and sent to Chem Security Systems Incorporated for disposal. Wacker generates approximately one, 55 gallon drum of sludge per month (3).

Wastewater from Wacker's processing plant is sent to the WWTU, and then discharged to the city sewer system or to the Willamette River under NPDES permit (4).

- Pollutants, Mobilization, Pathways, and Risks- Common characteristics of the chemical constituents of petroleum products found at the Wacker Site include high chemical stability, low water solubility, low vapor pressure, and a high affinity to soil (7). As a result, these substances are relatively immobile in the subsurface environment. Subsurface contamination by petroleum products may have a long term affect on soil and ground water due to their high organic content and low solubility (7). The 1985 soil borings and ground water analysis confirm the presence and persistence of materials disposed at the site during past industrial practices. The effect of these contaminants on the public health and the environment is unknown.

  The site has a history of soil, ground and surface water contamination, and there have been reports of skin and eye irritation due to air-borne contaminants (11). The site is composed of fill material of unknown permeability. The contamination of soil and ground water does not pose a direct threat to local drinking water supplies. However, the site's close proximity to the Willamette River makes the potential for contamination of the river by surface runoff or seepage through the soil high. Any releases to the river pose a direct threat to the environment, and an indirect threat to the large population using the river for recreation.

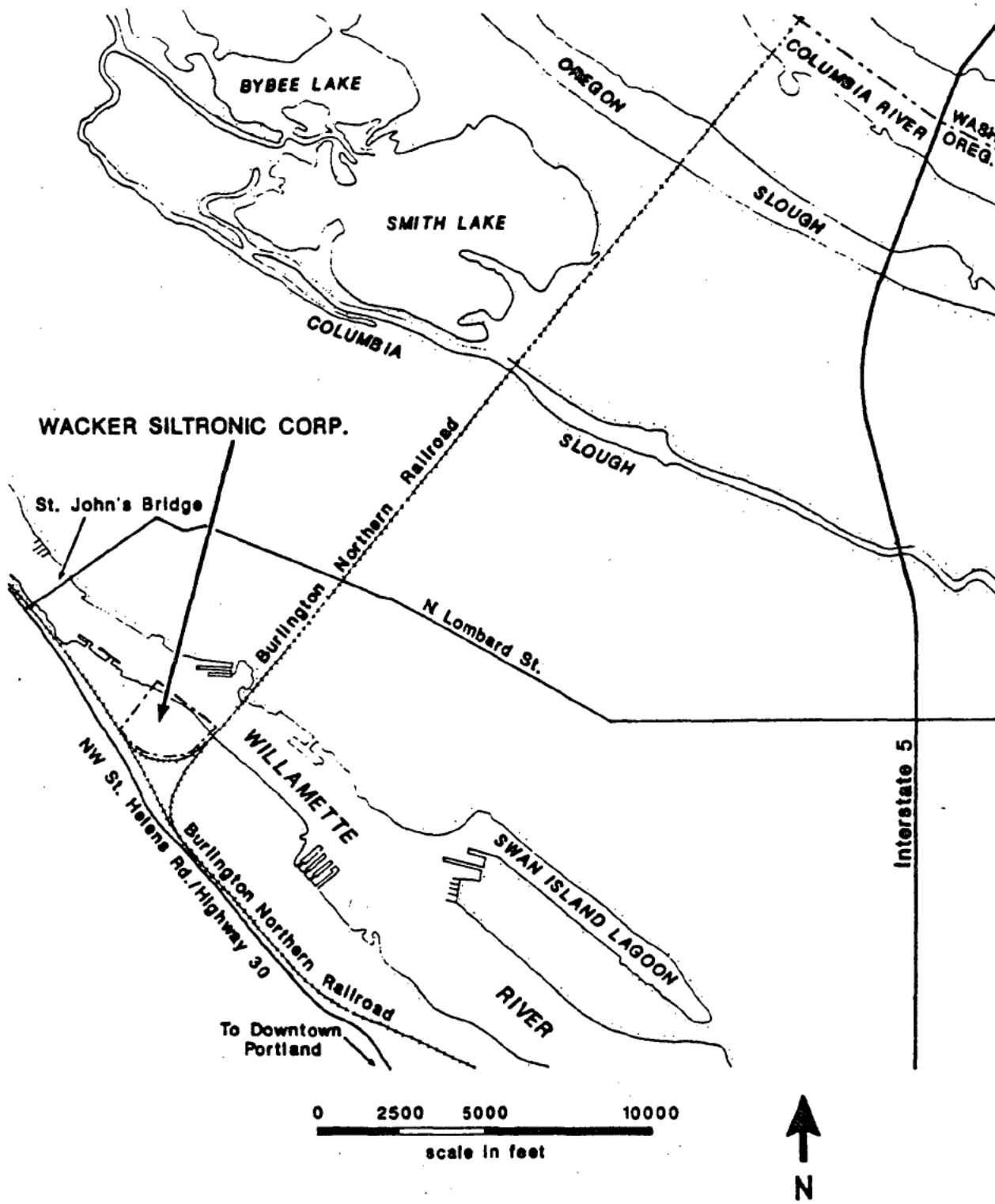
3. Priority Assessment:

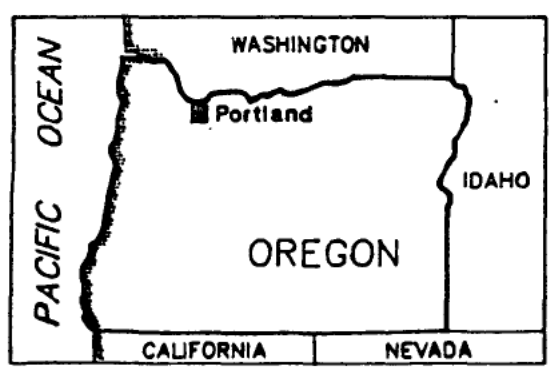
No further action is appropriate by the pre-remedial program. However, the site should continue to be assessed as part of the Doane Lake Investigation.

4. Follow-up Recommendations:

The Wacker Siltronic Site is located in a heavily industrialized area with a long history of waste disposal problems. Based on the fact that there is no target population drinking ground or surface water in the site area, and the on-going monitoring of the site by DEQ under RCRA, no further action under CERCLA is recommended. Results from this PA are in agreement

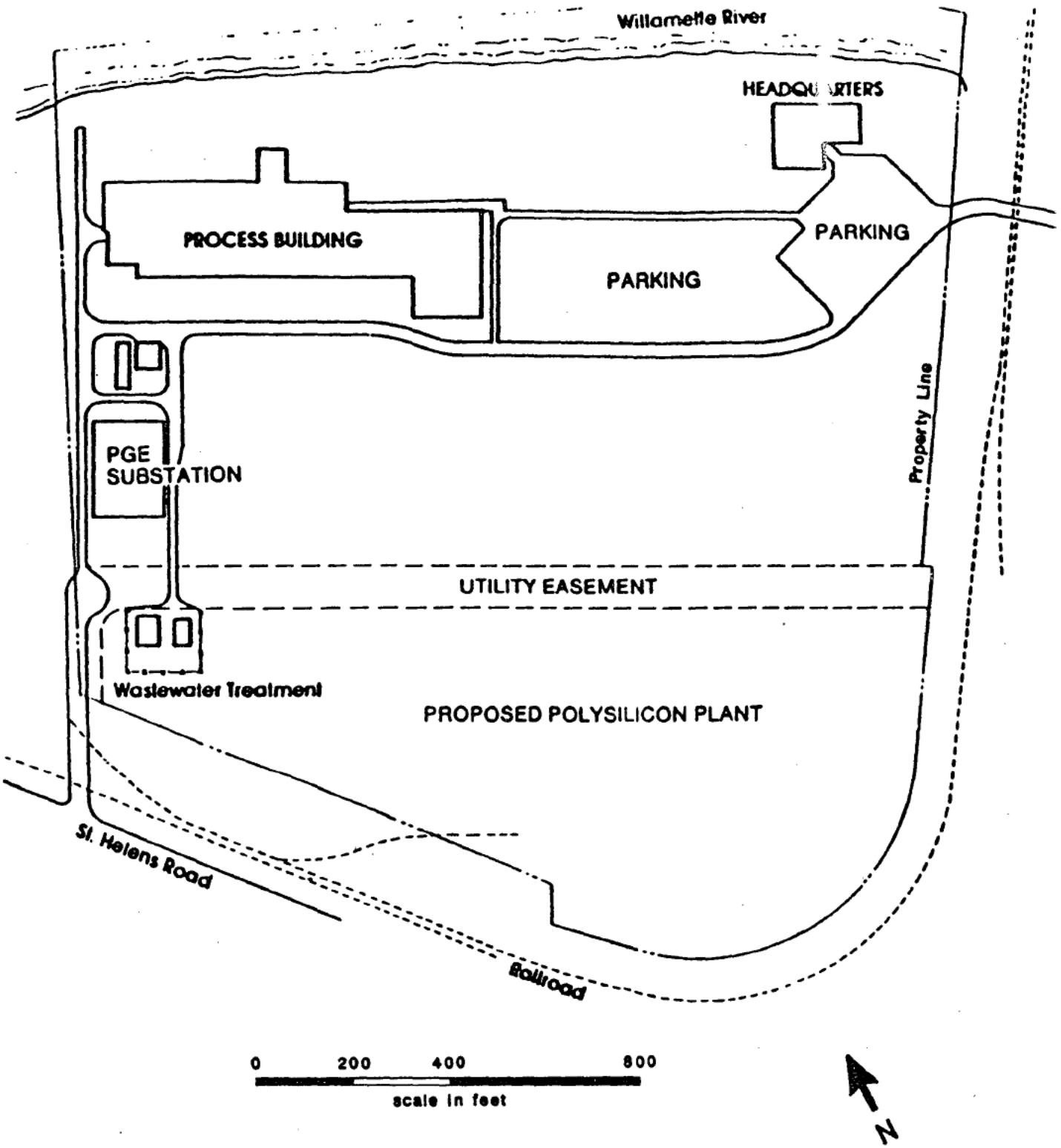
with DEQ's recommendation that a comprehensive study is needed to characterize the extent of contamination at the Wacker Siltronic Site, and in the North Doane Lake Area. The area-wide study should target both past and present waste handling practices to assess the potential impact of site contamination on the Willamette River, and the threat to human health during any future construction in the area.





ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

FIGURE 1
LOCATION MAP
WACKER SILTRONIC CORP.
Portland, OR

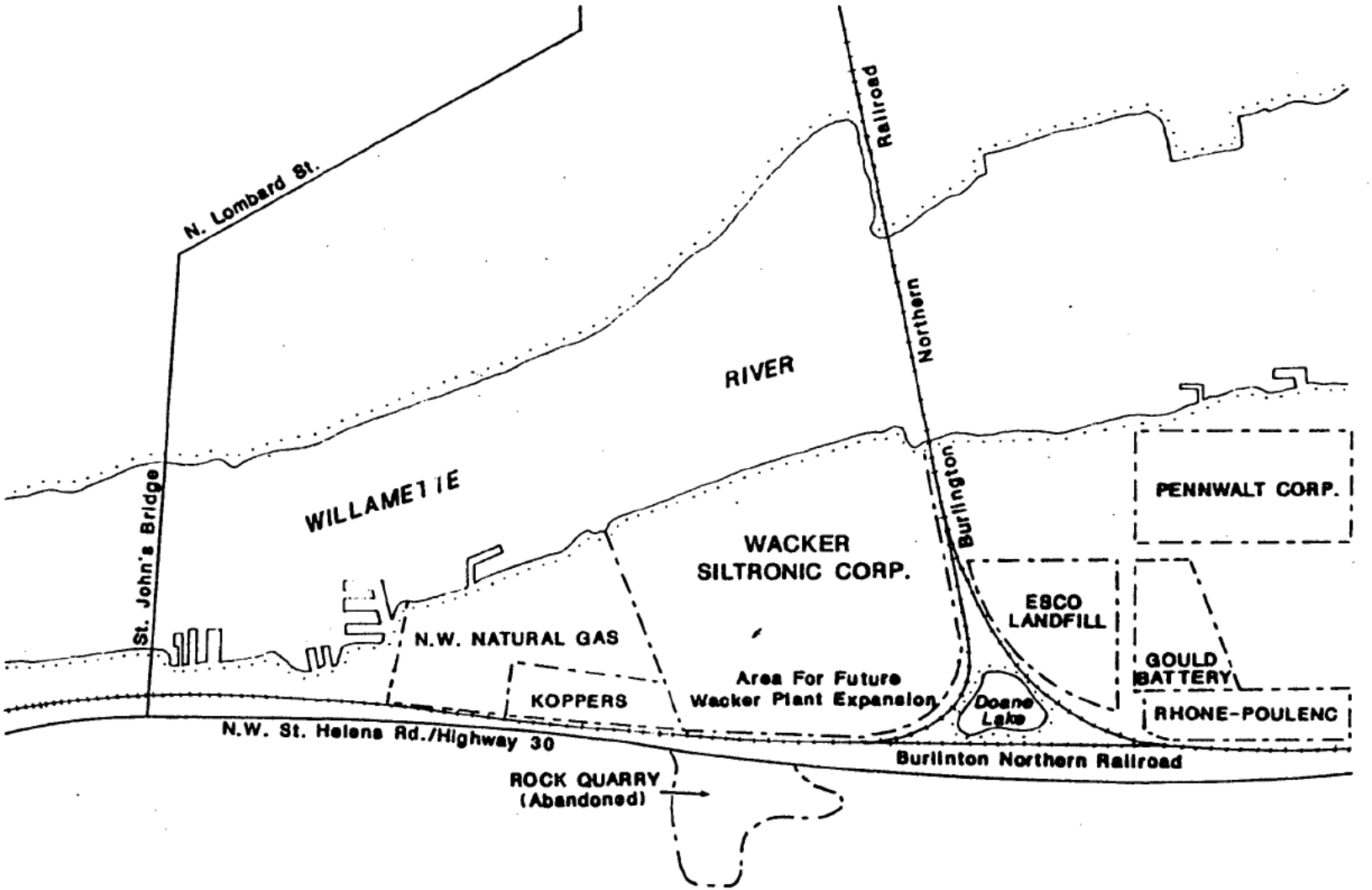


ecology & environment, Inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

FIGURE 2
SITE MAP
WACKER SILTRONIC CORP.
Portland, OR

Source: CH2M Hill

SCOEPA00004025



LEGEND

— · — · — Property line

0 500 1000 2000

scale in feet

N

ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/27/1987

FIGURE 3
VICINITY MAP (1983)
WACKER SILTRONIC CORP.
Portland, OR

REFERENCES

1. Memo from F. Hansen to Governor V. Atiyeh, June 19, 1985. ODEQ Site Files.

2. Willamette Week, Vol. 11, No. 4, August 8-14, 1985. Portland's Toxic Armpit. USEPA Region X, Gould, Inc. Superfund Site File.

3. Memo and RCRA inspection checklist from E. Woods to File, September 4, 1987. ODEQ Site Files.

4. Correspondence from F. Hansen to J. Pittman, February 18, 1987. ODEQ Site Files.

5. Correspondence from M. Tilson to G. Davis, February 11, 1987. ODEQ Site Files.

6. The Oregonian, June 24, 1985. Wacker plant deferment points to other problems. USEPA, Region X, Gould, Inc. Superfund Site File.

7. Ecology and Environment, Inc. (E&E), 1987. Preliminary Assessment Report for Koppers Site, Portland, Oregon. TDD F10-8709-09, Draft Copy.

8. Memo from S. Carter to File, February 12, 1979. ODEQ Site Files.

9. CH_2M Hill Northwest, Inc., June 1985. A Preliminary Report Soil Investigation for Proposed Polysilicon Plant, Wacker Siltronic Corporation, Portland, Oregon. ODEQ Site Files.

10. Memo from C. Humphrey to P. Storm, October 23, 1985. USEPA Region X, Gould, Inc. Superfund Site File.

11. Personal Communication, Tom Miller, ODEQ, October 20, 1987.

12. Memo from R. Bach to F. Hansen, July 14, 1985. ODEQ Site Files.

13. Personal Communication, Todd Humphrey, Engineer, City of Portland, October 28, 1987.

14. U.S. Department of Commerce, NOAA, Climatic Atlas of the United States, 1968.

15. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper No. 40, 1963.

16. Correspondences from J. Ellis to S. Carter, July 14, 1980 and December 22, 1980. ODEQ Site Files.

17. Correspondences from G. Carr to C. Clinton, January 6, 1984 and June 4, 1984. ODEQ Site Files.

SCOEPA00004027

REFERENCES (Cont.)

18. Correspondence from J. Gillaspie to J. Ellis, April 16, 1985. ODEQ Site Files.

19. Correspondence from M. Tilson to G. Davis, July 2, 1987. ODEQ Site Files.

SCOEPA00004028

APPENDIX A

EPA FORM 2070-12

SCOEPA00004029

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION	
01 State	02 Site Numb
OR	D096253737

II. SITE NAME AND LOCATION

01 Site Name (Legal, common, or descriptive name of site)	02 Street, Route No., or Specific Location Identifier				
Wacker Siltronic Corporation	7200 N. W. Front Avenue				
03 City	04 State	05 Zip Code	06 County	07 County Code	08 C D 0
Portland	OR	97229	Multnomah	051	

09 Coordinates Latitude	Longitude
45° 35' 18.0"	122° 45' 39.0"

10 Directions to Site (Starting from nearest public road)
Highway 30 NW from downtown Portland, approximately 5 miles. Highway 30 becomes St. Helens Road. Wacker is loc in the 7000 block of N.W. Front Street, 2 blocks north of St. Helens Road past the railroad bridge and 1 mile SE St. Johns Bridge in the North Doane Lake industrial area.

III. RESPONSIBLE PARTIES

01 Owner (if known)	02 Street (Business, mailing, residential)		
Wacker Siltronic Corporation	7200 N. W. Front Avenue		
03 City	04 State	05 Zip Code	06 Telephone Number
Portland	OR	97229	(503) 243-2020
07 Operator (if known and different from owner)	08 Street (Business, mailing, residential)		
09 City	10 State	11 Zip Code	12 Telephone Number ( )

13 Type of Ownership (Check one)
[X] A. Private [ ] B. Federal _____ (agency name) [ ] C. State [ ] C. County [ ] E. Municipal
[ ] F. Other _____ (specify) [ ] G. Unknown

14 Owner/Operator Notification on File (Check all that apply)
[ ] A. RCRA 3001 Date Received: / / (Month Day Year) [X] B. Uncontrolled Waste Site (CERCLA 103c) Date Received: 06 / 14 / 85 (Month Day Year) [ ] C. None

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 On-Site Inspection
[ ] Yes Date / / (Month Day Year)
[X] No
[ ] A. EPA [ ] B. EPA Contractor [ ] C. State [ ] D. Other Contractor
[ ] E. Local Health Official [ ] F. Other _____ (specify)
Contractor Names(s): _____

02 Site Status (Check one)
[X] A. Active [ ] B. Inactive [ ] C. Unknown

03 Years of Operation
Unknown - may be as early as 1940s (Beginning Year) Present (Ending Year) [ ] Unknown

04 Description of Substances Possibly Present, Known, or Alleged
Wastes and spillage from industrial activities in the Doane Lake area, including petroleum products, coal tar, pesticides. Compounds of concern include: polyaromatic hydrocarbons; 2,4-dichlorophenol; 2,4-D; lead; benzene and toluene.

05 Description of Potential Hazard to Environment and/or Population
Ground water contamination, possible seepage to the Willamette River and potential direct contact to workers du construction at the site.

V. PRIORITY ASSESSMENT

01 Priority for Inspection (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part Description of Hazardous Conditions and Incidents)
[ ] A. High (Inspection required promptly) [ ] B. Medium (Inspection required) [ ] C. Low (Inspect on time available basis) [X] D. None (No further action needed, complete current disposition f

VI. INFORMATION AVAILABLE FROM

01 Contact	02 Of (Agency/Organization)	03 Telephone
Deborah Flood	USEPA Region X, Superfund	(206) 442-27

04 Person Responsible for Assessment	05 Agency	06 Organization	07 Telephone No.	08 Date
Timothy L. Syverson	EPA/FIT	E&E, Inc.	(206)624-9537	09 /22 / (Month Day)

SCOEPA00004030

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION	
01 State	02 Site Numb
OR	D096253737

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 Physical States (Check all that apply)

- [ ] A. Solid
- [ ] B. Powder, Fines
- [x] C. Sludge
- [x] D. Other Unknown (Specify)
- [ ] E. Slurry
- [x] F. Liquid
- [ ] G. Gas

02 Waste Quantity at Site (Measure of waste quantities must be independent)

Tons _____

Cubic Yards Unknown

No. of Drums _____

03 Waste Characteristics (Check all that apply)

- [x] A. Toxic
- [ ] B. Corrosive
- [ ] C. Radioactive
- [x] D. Persistent
- [ ] E. Soluble
- [ ] F. Infectious
- [ ] G. Flammable
- [ ] H. Ignitable
- UNKNOWN
- [ ] I. Highly Volati
- [ ] J. Explos
- [ ] K. Reacti
- [ ] L. Incomp ible
- [ ] M. Not Applic

III. WASTE TYPE

Category	Substance Name	01 Gross Amount	02 Unit of Measure	03 Comments
SLU	Sludge	Unknown		Industrial wastes and spillage including petroleum products, coa tar, and pesticides. Materials disposed of on site prior to owne ship by Wacker. *Current waste generated on site includes Trichloroethylene, Freon and Chromic Acid.
OLW	Oily Waste	Unknown		
SOL	Solvents	Unknown		
PSD	Pesticides	Unknown		
OCC	Other Organic Chemicals	Unknown		
IOC	Inorganic Chemicals			
ACD	Acids			
BAS	Bases			
MES	Heavy Metals			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 Category	02 Substance Name	03 CAS Number	04 Storage/Disposal Method	05 Concentration	06 Measure Concentrat
*	Waste Trichloroethylene		Recycled through VanWaters and Rogers.		4,000 gal per montr
*	Waste Freon		Recycled through McClary Columbia.		5 - 10 dr per montr
*	Chromic Acid		Acid is neutralized and reduced to Cr+3. Liquid fraction is pumped to the wastewater treatment unit. Sludge is dried and sent to Arlington.		2 - 3 dru per year

NOTE: Wacker has a wastewater treatment unit (WWTV) on site. WWTV discharge to the city sewer and the Willamette River are included under NPDS Permit #99527 issued by the Oregon DEQ.

V. FEEDSTOCKS (See Appendix for CAS Numbers)

Category	01 Feedstock Name	02 CAS Number	Category	01 Feedstock Name	02 CAS Numt
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Oregon Department of Environmental Quality, RCRA Generator Inspection, 09/04/87.

CH_2M Hill Northwest, Inc.; A Preliminary Report Soil Investigation for Proposed Polysilicon Plant, Wacker Siltronic Corporation, Portland, Oregon, 06/85.

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 State	02 Site Number
OR	D096253737

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 [X] A. Ground Water Contamination — 02 [X] Observed (Date: approx. 1940's to Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

Disposal of petroleum products, coal tar, and pesticides during industrial activity in the North Doane Lake area Recent spills (post 1980) include Trichloroethylene (TCE) and Chromic Acid. Sampling (1985) of shallow monitori wells (<40') in the undeveloped southern portion of the site detected low levels of semi-volatile organics. Dep to ground water is < 15 feet.

01 [X] B. Surface Water Contamination — 02 [X] Observed (Date: 1980 - Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

The site is adjacent to the Willamette River. Leakage and spills at the Wacker facility enter the river via out from the plant's wastewater treatment unit. Documented spills of hazardous materials to the river include: Chr Acid (07/80, 12/80, and 05/84); TCE (12/83 anid 12/84); and wastewater (06/87).

01 [X] C. Contamination of Air — 02 [X] Observed (Date: Unknown-Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

The Wacker facility has an Air Contaminant Discharge Permit (#26-3002) issued by the Oregon DEQ. However, there reports of odors and skin irritation from fumes originating from wastes landfilled at the site and in the adjace Doane Lake.

01 [X] D. Fire/Explosive Conditions — 02 [ ] Observed (Date:) [X] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

Petroleum products of an unknown type and quantity have been landfilled at the site.

01 [X] E. Direct Contact — 02 [X] Observed (Date: Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

Skin and eye irritation have been reported in the site area. The potential exists for exposure to buried pesticides, and petroleum products, if excavation is conducted at the site.

01 [X] F. Contamination of Soil — 02 [X] Observed (Date: approx. 1940's to Present) [ ] Potential [ ] Alle
03 Area Potentially Affected (Acres) Unknown — 04 Narrative Description

Petroleum products, coal tar, and pesticides were disposed of and/or spilled at the site. Soil borings done in confirm the presence of petroleum products and pesticides in sediments < 20 feet below the surface.

01 [ ] G. Drinking Water Contamination — 02 [ ] Observed (Date:) [ ] Potential [ ] Alle
03 Population Potentially Affected: — 04 Narrative Description

The area is served by the City of Portland public water supply. Contamination of ground water at the site is unlikely to affect local drinking water supplies.

01 [X] H. Worker Exposure/Injury — 02 [ ] Observed (Date:) [X] Potential [ ] All
03 Workers Potentially Affected: Unknown — 04 Narrative Description

Direct contact with buried wastes is possible for workers during any construction or excavation at the site.

01 [X] I. Population Exposure/Injury — 02 [X] Observed (Date: Present) [X] Potential [ ] All
03 Population Potentially Affected: Unknown — 04 Narrative Description

The Doane Lake area has a history of waste disposal problems. The potential exists for exposure if there are a uncontained or unknown disposal areas.

SCOEPA00004032

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 State	02 Site Number
OR	D096253737

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 [ ] J. Damage to Flora — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Allege
04 Narrative Description

None reported, observed, or suspected.

01 [ ] K. Damage to Fauna — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Alleg
04 Narrative Description (include name(s) of species)

None reported, observed, or suspected.

01 [ ] L. Contamination of Food Chain — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Alleg
04 Narrative Description

None reported or observed. Contamination of the Willamette River has the potential to affect fishing resources.

01 [X] M. Unstable Containment of Wastes (Spills/runoff/standing liquids, leaking drums) — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Alleg
03 Population Potentially Affected: _____ 04 Narrative Description

Petroleum products and coal tar were landfilled at, or adjacent to, the site causing soil contamination.

01 [X] N. Damage to Off-site Property — 02 [ ] Observed (Date: _____) [X] Potential [ ] Alleg
04 Narrative Description

Adjacent property has the potential to be affected by subsurface migration of wastes.

01 [X] O. Contamination of Sewers, Storm Drains, WWTPs — 02 [X] Observed (Date: 12/27/83) [ ] Potential [ ] Alleg
04 Narrative Description

Wastewater spill at the facility was diverted to the municipal sewer system. The water contained 2.02 ppm chrom

01 [X] P. Illegal/Unauthorized Dumping — 02 [ ] Observed (Date: approx. 1940's to 1980) [ ] Potential [ ] Alleg
04 Narrative Description

The exact quantity and types of materials disposed of or spilled on site during past practices are unknown.

05 Description of Any Other Known, Potential, or Alleged Hazards

Due to the long history of petroleum and chemical manufacturing in the site area, and unknown waste handling practices, the potential exists for the discovery of additional hazardous materials and conditions in the site ar

III. TOTAL POPULATION POTENTIALLY AFFECTED: Unknown

IV. COMMENTS

The Wacker site is located in the heavily industrialized North Doane Lake area of northwest Portland. East of th site is the Gould, Inc. Superfund site. The Doane Lake area has a history of waste disposal and operational problems. The Wacker site will be included in a North Doane Lake study, to be conducted by Wacker, Northwest Natural Gas, and Koppers, Inc., under the guidance of the Oregon DEQ.

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

CH2M Hill N.W., Inc., A Preliminary Soil Investigation, Wacker Siltronic Corporation, 06/85; Memos from J. Ellis, Wacker Siltronic, to S. Carter, ODEQ, dated 07/14/80 and 12/22/80; Memo from G. Carr, Wacker Siltronic, to C. Carter, ODEQ, dated 06/04/84; Memo from G. Carr, Wacker Siltronic, to C. Clinton, ODEQ, dated 01/06/84; Memo f J. Gillaspie, ODEQ, to J. Ellis, Wacker Siltronic, dated 04/16/85; Memo from M. Tillson, Wacker Siltronic, to G. Davis, ODEQ, dated 07/02/87; Memo from M. Tillson, Wacker Siltronic, to G. Davis, ODEQ, dated 02/11/87; Tom Mille ODEQ, Personal Communication, 10/20/87.

PRELIMINARY ASSESSMENT REPORT
WACKER SILTRONIC CORPORATION
PORTLAND, OREGON

TDD F10-8709-17

Report Prepared by: Ecology and Environment, Inc.
Date: October 1987

Submitted to: J.E. Osborn, Regional Project Officer
Field Operations and Technical Support Branch
U.S. Environmental Protection Agency
Region X
Seattle, Washington

ecology and environment, inc.
101 YESLER WAY, SEATTLE, WASHINGTON, 98104, TEL. 206/624-9537
International Specialists in the Environment

SCOEPA00004034

ecology and environment, inc.
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International Specialists in the Environment

MEMORANDUM

DATE: November 9, 1987

TO: John Osborn, FIT-RPO, USEPA, Region X

THRU: for David Buecker, FIT-OM, E&E, Seattle MT

FROM: Timothy L. Syverson, FIT-SM, E&E, Seattle TLS

SUBJ: Preliminary Assessment Report for
Wacker Siltronic Corporation
Portland, Oregon

REF: TDD F10-8709-17

CC: Deborah Flood, HWD-SM, USEPA, Region X
Jeffrey Villnow, FIT-PM, E&E, Seattle
Thomas Tobin, E&E, Seattle

1. Introduction and Purpose of the Preliminary Assessment:

Pursuant to U.S. Environmental Protection Agency (EPA) Contract No. 68-01-7347 and Technical Directive Document (TDD) F10-8709-17, Ecology and Environment, Inc. (E&E) conducted a Preliminary Assessment (PA) of the Wacker Siltronic Corporation in Portland, Oregon. The PA represents the second of a three-step assessment process which begins with Site Discovery and concludes, if necessary, with a Site Inspection. The assessment process, in general, is intended to identify, compare, and rank the potential hazards associated with a particular site relative to other sites across the nation for the purpose of identifying priority sites requiring remedial responses. It does not include extensive or complete site characterization, contaminant fate determination, or quantitative risk assessment.

The Wacker Siltronic Corporation Site PA was conducted to identify potential public health and/or environmental hazards related to the site and, if present, evaluate the need for additional investigative action. The PA is based on data derived from available files pertaining to the site, and conversations with state and local officials (1-19). Information developed during the PA is summarized in Appendix A on EPA Form 2070-12.

2. Information Obtained During the Preliminary Assessment:

- Site Location and Description - The Wacker Siltronic Corporation Site is located at 7200 N.W. Front Street, in the northwest portion of the City of Portland, in Multnomah County, Oregon (Figure 1). The 85 acre Wacker Siltronic Site is bordered on the east by the Willamette River, on the west by Highway 30 (St. Helen's Road), on the north by Koppers, Inc. and Northwest Natural Gas, and on the south by the Burlington Northern Railroad Bridge. Wacker has a processing plant and offices in two buildings adjacent to the river, and a wastewater treatment facility along the northwest boundary of the property (Figure 2). A Portland General Electric (PGE) substation is located between the treatment facility and the process building. The southwestern portion of the site is undeveloped, but is the proposed location for Wacker's Polysilicon Plant. Access to the site is limited due to the site's close proximity to the river and the railroad grades that border the site on two sides (Figure 3). The active portions of the site are fenced, and the area is patrolled by private security personnel.

- Site History / Potential Problem(s) at Site - The Wacker Siltronic Site is located in the northwest industrial district of Portland (Figure 3) commonly referred to as "Doane's Lake". The Doane's Lake area previously included two lakes: Doane's Lake to the north, and Guild Lake to the south. Near the turn of the century, the area was filled with dredge sands and mud from the Willamette River, and industrial wastes to provide additional land for developement (1). The land now owned by Wacker is a portion of the old Portland Gas and Coke (PG&C) site. The PG&C plant was in operation from 1913 to 1956. Since 1956, the PG&C property has been owned by Northwest Natural Gas (NNG) (2). In 1976 Wacker purchased the southeast portion of the property, and began construction of their facility (1).

  The Wacker Siltronic Corporation manufactures silicon wafers used in the production of integrated circuits. The plant grows and processes single crystals of silicon from high purity polycrystalline silicon. The Wacker facility is listed under the Resource Conservation and Recovery Act (RCRA) as a generator of industrial wastes (3). The facility has an NPDES permit for the processing and discharge of wastewater to the Willamette River, and an air contaminant discharge permit. Both permits are issued by the Oregon Department of Environmental Quality (DEQ) (4, 5).

  Currently, the Doane Lake area includes a number of industrial plants including Gould Battery, Pennwalt, Rhone-Poulenc, Koppers, Inc., Northwest Natural Gas, and an ESCO landfill. These companies

have produced or handled numerous toxic materials over the past 40 years, including creosote, flammable hydrogen gas, hydrochloric acid, and dioxin-tainted chemicals (6). The Gould Battery site is listed on the EPA's National Priorities List.

The Doane Lake Area has a history of waste disposal problems. Prior to regulatory action by the Oregon Department of Environmental Quality (DEQ) and the EPA, wastes from local industry were discharged to the air, to the ground and surface water, and landfilled in the immediate area (1). Wastes from the old PG&C plant's production of coal gas were landfilled on the lots now occupied by Wacker and Koppers (1) (Figure 3). DEQ has identified abandoned coal tar disposal pits on the Koppers Site, but the history and extent of past waste disposal on the Wacker Site has never been detailed (7).

Wacker Siltronic discovered oil in the ground water and soil of their property twice since 1976. In 1979, oil was found in two excavations in the northwest corner of their property adjacent to the Koppers Site. The oil seepage was contained, and thought to be isolated to the northwest portion of the site (8). Test borings in 1985, for a proposed plant expansion, encountered petroleum products, coal tar, and pesticides at 7 locations in the western portion of the site (9). Generally the contaminants were encountered at depths of 10-20 feet below ground surface, and did not appear to be migrating toward the river approximately 1,400 feet to the east (6, 9). Analyses of ground water samples from monitoring wells completed in the test borings detected low levels of volatile organics and base neutral extractables (10). Wacker proposed that the low levels of contaminants posed no threat to human health or to the environment, but the DEQ did not agree with their assessment and is requesting further work at the site (10, 11).

The Wacker Siltronic Corporation has had at least six incidents since 1976 involving the discharge of hazardous materials from their facility. These discharges have included chromic acid (07/80, 12/80, 05/84), TCE (12/83, 12/84), and wastewater (06/87). Contamination of soil, ground water, and surface water have resulted from these spills or leakages at the Wacker facility (16, 17, 18, 19). The cumulative effect of on-site spills of hazardous materials by Wacker is unknown.

Currently, Wacker Siltronic, Koppers Inc., and Northwest Natural Gas are working under DEQ guidance to develop a plan for a comprehensive study of past practices in the North Doane's Lake area (sites north of the Burlington Northern Railroad bridge) (12).

- Physical Environment - The Wacker Site is located adjacent to the Willamette River at an elevation of 10-25 feet above mean sea level. The immediate area is generally flat, but the bluffs to the east across St. Helen's Road rise to 1,000 feet. The site is underlain by river sediments and mechanically deposited fill. The depth to ground water beneath the site is less than 10 feet below the ground surface (9).

  In the Portland area the Willamette River flows north-west and is extensively used for commercial shipping and recreational purposes. Recreational activities on the river include boating and sport fishing.

  Drinking water for the site area is provided by the City of Portland. The primary source for the Portland public water supply is the Bullrun Watershed located approximately 27 miles east of the city. The city has a secondary source of water from a field of 26 wells located along the Columbia River approximately seven miles northeast of the Wacker Site (13).

  The Portland area has a mild climate with wet winters, and warm dry summers. Total annual precipitation is about 40 inches, and the annual lake evaporation is about 26 inches (14). The one-year 24 hour rainfall for the Portland area is 2.5-3 inches (15).

- Waste Types, Quantities, and Characteristics - Hazardous materials at the Wacker Site include both wastes from past disposal practices in the site area, and wastes generated by current Wacker operations. The petroleum products, coal tar, and pesticides found in the 1985 soil borings represent past disposal at the site or contamination from adjacent sites, because Wacker's operation has never handled these substances.

  As a regulated RCRA generator, Wacker Siltronic generates three waste streams during the normal course of business: waste freon, waste trichloroethylene (TCE), and chromic acid sludge (3).

  TCE is used to clean silicon wafers before a wax coating is applied. Currently about 4,000 gallons per month of waste TCE is recycled through Van Waters and Rogers, a DEQ approved facility. Waste TCE is pumped from the process building to an outside holding tank. This tank and other waste tanks are equipped with level indicators, and are diked to contain spills and leakage (3).

  Waste freon is generated in Wacker's silicon wafer manufacturing process. Currently five to ten, 55 gallon drums per month of waste freon are sent to McClary Columbia (also a DEQ approved facility) for recycling. The waste freon is also stored in an outside storage tank (3).

Chromic acid is used during the etching of silicon wafers. Waste chromic acid is pumped from the processing plant to a treatment building where the acid is neutralized and reduced to trivalent chrome. The liquid portion is pumped to Wacker's wastewater treatment unit (WWTU). The sludge is dried and sent to Chem Security Systems Incorporated for disposal. Wacker generates approximately one, 55 gallon drum of sludge per month (3).

Wastewater from Wacker's processing plant is sent to the WWTU, and then discharged to the city sewer system or to the Willamette River under NPDES permit (4).

- Pollutants, Mobilization, Pathways, and Risks- Common characteristics of the chemical constituents of petroleum products found at the Wacker Site include high chemical stability, low water solubility, low vapor pressure, and a high affinity to soil (7). As a result, these substances are relatively immobile in the subsurface environment. Subsurface contamination by petroleum products may have a long term affect on soil and ground water due to their high organic content and low solubility (7). The 1985 soil borings and ground water analysis confirm the presence and persistence of materials disposed at the site during past industrial practices. The effect of these contaminants on the public health and the environment is unknown.

  The site has a history of soil, ground and surface water contamination, and there have been reports of skin and eye irritation due to air-borne contaminants (11). The site is composed of fill material of unknown permeability. The contamination of soil and ground water does not pose a direct threat to local drinking water supplies. However, the site's close proximity to the Willamette River makes the potential for contamination of the river by surface runoff or seepage through the soil high. Any releases to the river pose a direct threat to the environment, and an indirect threat to the large population using the river for recreation.

3. Priority Assessment:

No further action is appropriate by the pre-remedial program. However, the site should continue to be assessed as part of the Doane Lake Investigation.

4. Follow-up Recommendations:

The Wacker Siltronic Site is located in a heavily industrialized area with a long history of waste disposal problems. Based on the fact that there is no target population drinking ground or surface water in the site area, and the on-going monitoring of the site by DEQ under RCRA, no further action under CERCLA is recommended. Results from this PA are in agreement

with DEQ's recommendation that a comprehensive study is needed to characterize the extent of contamination at the Wacker Siltronic Site, and in the North Doane Lake Area. The area-wide study should target both past and present waste handling practices to assess the potential impact of site contamination on the Willamette River, and the threat to human health during any future construction in the area.

BYBEE LAKE

SMITH LAKE

OREGON

COLUMBIA RIVER

WASH.

OREG.

SLOUGH

COLUMBIA

SLOUGH

WACKER SILTRONIC CORP.

St. John's Bridge

Burlington Northern Railroad

N Lombard St.

WILLAMETTE

NW St. Helens Rd./Highway 30

Burlington Northern Railroad

SWAN ISLAND LAGOON

RIVER

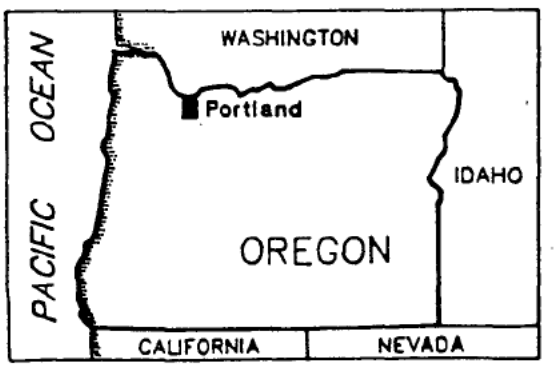
Interstate 5

To Downtown Portland

0 2500 5000 10000

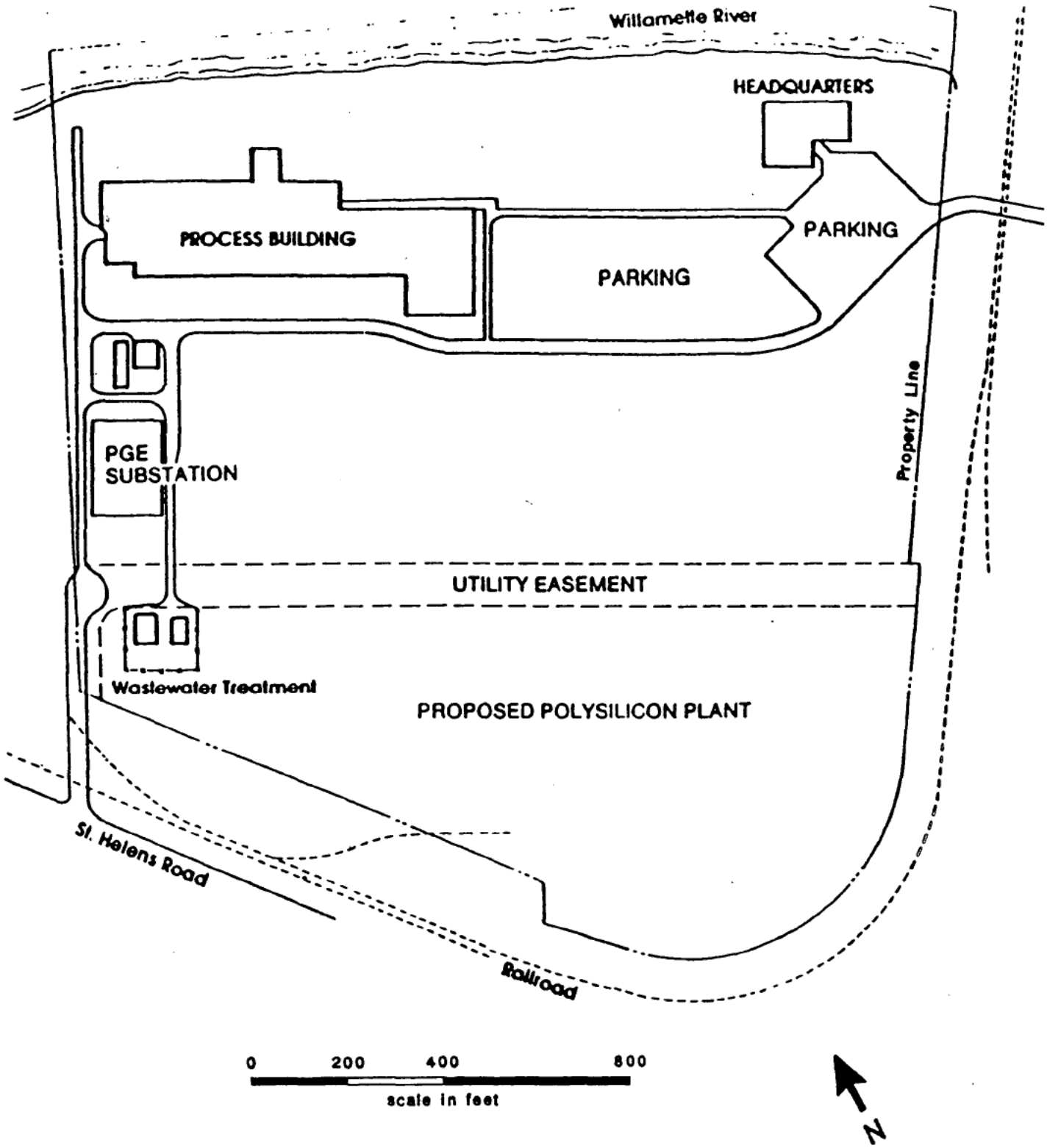
scale in feet

N



ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

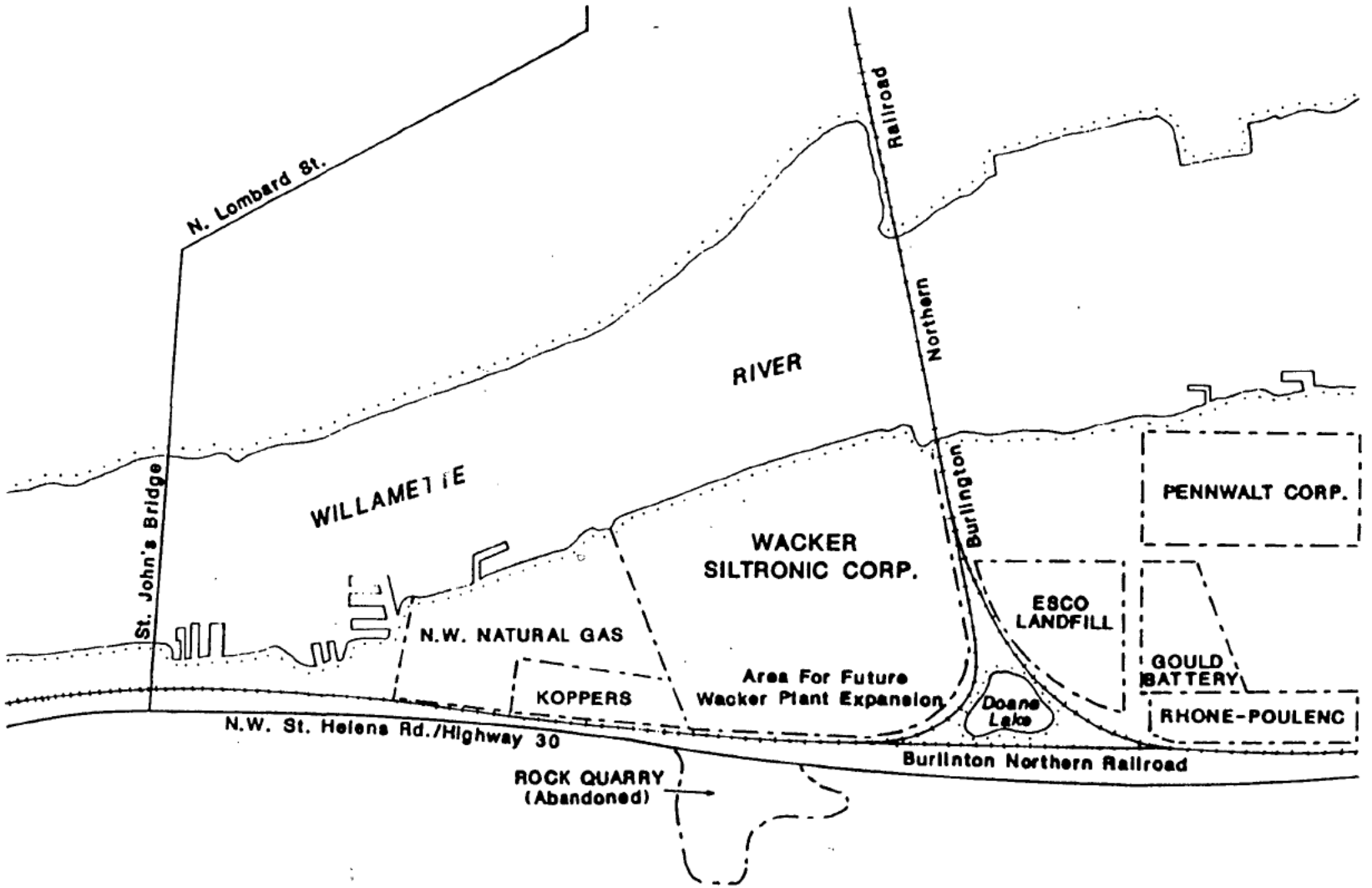
FIGURE 1
LOCATION MAP
WACKER SILTRONIC CORP.
Portland, OR



ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/26/1987

FIGURE 2
SITE MAP
WACKER SILTRONIC CORP.
Portland, OR

Source: CH2M Hill



LEGEND

— · — · — Property line

0 500 1000 2000

scale in feet

N

ecology & environment, inc.	
Job: F10-8709-17	Waste Site: OR 0192
Drawn by: B.T.	Date: 10/27/1987

FIGURE 3
VICINITY MAP (1983)
WACKER SILTRONIC CORP.
Portland, OR

SCOEPA00004043

REFERENCES

1. Memo from F. Hansen to Governor V. Atiyeh, June 19, 1985. ODEQ Site Files.

2. Willamette Week, Vol. 11, No. 4, August 8-14, 1985. Portland's Toxic Armpit. USEPA Region X, Gould, Inc. Superfund Site File.

3. Memo and RCRA inspection checklist from E. Woods to File, September 4, 1987. ODEQ Site Files.

4. Correspondence from F. Hansen to J. Pittman, February 18, 1987. ODEQ Site Files.

5. Correspondence from M. Tilson to G. Davis, February 11, 1987. ODEQ Site Files.

6. The Oregonian, June 24, 1985. Wacker plant deferment points to other problems. USEPA, Region X, Gould, Inc. Superfund Site File.

7. Ecology and Environment, Inc. (E&E), 1987. Preliminary Assessment Report for Koppers Site, Portland, Oregon. TDD F10-8709-09, Draft Copy.

8. Memo from S. Carter to File, February 12, 1979. ODEQ Site Files.

9. CH_2M Hill Northwest, Inc., June 1985. A Preliminary Report Soil Investigation for Proposed Polysilicon Plant, Wacker Siltronic Corporation, Portland, Oregon. ODEQ Site Files.

10. Memo from C. Humphrey to P. Storm, October 23, 1985. USEPA Region X, Gould, Inc. Superfund Site File.

11. Personal Communication, Tom Miller, ODEQ, October 20, 1987.

12. Memo from R. Bach to F. Hansen, July 14, 1985. ODEQ Site Files.

13. Personal Communication, Todd Humphrey, Engineer, City of Portland, October 28, 1987.

14. U.S. Department of Commerce, NOAA, Climatic Atlas of the United States, 1968.

15. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper No. 40, 1963.

16. Correspondences from J. Ellis to S. Carter, July 14, 1980 and December 22, 1980. ODEQ Site Files.

17. Correspondences from G. Carr to C. Clinton, January 6, 1984 and June 4, 1984. ODEQ Site Files.

SCOEPA00004044

REFERENCES (Cont.)

18. Correspondence from J. Gillaspie to J. Ellis, April 16, 1985. ODEQ Site Files.

19. Correspondence from M. Tilson to G. Davis, July 2, 1987. ODEQ Site Files.

SCOEPA00004045

APPENDIX A

EPA FORM 2070-12

SCOEPA00004046

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION	
01 State	02 Site Numbe
OR	D096253737

II. SITE NAME AND LOCATION

01 Site Name (Legal, common, or descriptive name of site)	02 Street, Route No., or Specific Location Identifier				
Wacker Siltronic Corporation	7200 N. W. Front Avenue				
03 City	04 State	05 Zip Code	06 County	07 County Code	08 C
Portland	OR	97229	Multnomah	051	D 0

09 Coordinates Latitude	Longitude
45° 35' 18.0"	122° 45' 39.0"

10 Directions to Site (Starting from nearest public road)
Highway 30 NW from downtown Portland, approximately 5 miles. Highway 30 becomes St. Helens Road. Wacker is loc in the 7000 block of N.W. Front Street, 2 blocks north of St. Helens Road past the railroad bridge and 1 mile SE St. Johns Bridge in the North Doane Lake industrial area.

III. RESPONSIBLE PARTIES

01 Owner (if known)	02 Street (Business, mailing, residential)		
Wacker Siltronic Corporation	7200 N. W. Front Avenue		
03 City	04 State	05 Zip Code	06 Telephone Number
Portland	OR	97229	(503) 243-2020
07 Operator (if known and different from owner)	08 Street (Business, mailing, residential)		
09 City	10 State	11 Zip Code	12 Telephone Number
			( )

13 Type of Ownership (Check one)
[X] A. Private [ ] B. Federal _____ (agency name) [ ] C. State [ ] C. County [ ] E. Municipal
[ ] F. Other _____ (specify) [ ] G. Unknown

14 Owner/Operator Notification on File (Check all that apply)
[ ] A. RCRA 3001 Date Received: / / (Month Day Year) [X] B. Uncontrolled Waste Site (CERCLA 103c) Date Received: 06 / 14/ 85 (Month Day Year) [ ] C. None

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 On-Site Inspection
[ ] Yes Date / / (Month Day Year)
[X] No
[ ] A. EPA [ ] B. EPA Contractor [ ] C. State [ ] D. Other Contractor
[ ] E. Local Health Official [ ] F. Other _____ (specify)
Contractor Names(s): _____

02 Site Status (Check one)
[X] A. Active [ ] B. Inactive [ ] C. Unknown

03 Years of Operation
Unknown - may be as early as 1940s (Beginning Year) Present (Ending Year) [ ] Unknown

04 Description of Substances Possibly Present, Known, or Alleged
Wastes and spillage from industrial activities in the Doane Lake area, including petroleum products, coal tar, pesticides. Compounds of concern include: polyaromatic hydrocarbons; 2,4-dichlorophenol; 2,4-D; lead; benzene and toluene.

05 Description of Potential Hazard to Environment and/or Population

Ground water contamination, possible seepage to the Willamette River and potential direct contact to workers du construction at the site.

V. PRIORITY ASSESSMENT

01 Priority for Inspection (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part Description of Hazardous Conditions and Incidents)
[ ] A. High (Inspection required promptly) [ ] B. Medium (Inspection required) [ ] C. Low (Inspect on time available basis) [X] D. None (No further action needed, complete current disposition f

VI. INFORMATION AVAILABLE FROM

01 Contact	02 Of (Agency/Organization)			03 Telephone
Deborah Flood	USEPA Region X, Superfund			(206) 442-27
04 Person Responsible for Assessment	05 Agency	06 Organization	07 Telephone No.	08 Date
Timothy L. Syverson	EPA/FIT	E&E, Inc.	(206)624-9537	09 /22 / (Month Day)

SCOEPA00004047

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION	
01 State	02 Site Numb
OR	D096253737

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 Physical States (Check all that apply)

- [ ] A. Solid
- [ ] B. Powder, Fines
- [x] C. Sludge
- [x] D. Other Unknown (Specify)
- [ ] E. Slurry
- [x] F. Liquid
- [ ] G. Gas

02 Waste Quantity at Site (Measure of waste quantities must be independent)

Tons _____

Cubic Yards Unknown

No. of Drums _____

03 Waste Characteristics (Check all that apply)

- [x] A. Toxic
- [ ] B. Corrosive
- [ ] C. Radioactive
- [x] D. Persistent
- [ ] E. Soluble
- [ ] F. Infectious
- [ ] G. Flammable
- [ ] H. Ignitable
- UNKNOWN
- [ ] I. Highly Volati
- [ ] J. Explos
- [ ] K. Reacti
- [ ] L. Incomp ible
- [ ] M. Not Applic

III. WASTE TYPE

Category	Substance Name	01 Gross Amount	02 Unit of Measure	03 Comments
SLU	Sludge	Unknown		Industrial wastes and spillage including petroleum products, coa tar, and pesticides. Materials disposed of on site prior to owne ship by Wacker. *Current waste generated on site includes Trichloroethylene, Freon and Chromic Acid.
OLW	Oily Waste	Unknown		
SOL	Solvents	Unknown		
PSD	Pesticides	Unknown		
OCC	Other Organic Chemicals	Unknown		
IOC	Inorganic Chemicals			
ACD	Acids			
BAS	Bases			
MES	Heavy Metals			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 Category	02 Substance Name	03 CAS Number	04 Storage/Disposal Method	05 Concentration	06 Measure Concentrat
*	Waste Trichloroethylene		Recycled through VanWaters and Rogers.		4,000 gal per month
*	Waste Freon		Recycled through McClary Columbia.		5 - 10 dr per month
*	Chromic Acid		Acid is neutralized and reduced to Cr+3. Liquid fraction is pumped to the wastewater treatment unit. Sludge is dried and sent to Arlington.		2 - 3 dru per year

NOTE: Wacker has a wastewater treatment unit (WWTV) on site. WWTV discharge to the city sewer and the Willamette River are included under NPDS Permit #99527 issued by the Oregon DEQ.

V. FEEDSTOCKS (See Appendix for CAS Numbers)

Category	01 Feedstock Name	02 CAS Number	Category	01 Feedstock Name	02 CAS Numb
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Oregon Department of Environmental Quality, RCRA Generator Inspection, 09/04/87.
CH_2M Hill Northwest, Inc.; A Preliminary Report Soil Investigation for Proposed Polysilicon Plant, Wacker Siltronic Corporation, Portland, Oregon, 06/85.

SCOEPA00004048

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 State	02 Site Numb
OR	D096253737

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 [X] A. Ground Water Contamination — 02 [X] Observed (Date: approx. 1940's to Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

Disposal of petroleum products, coal tar, and pesticides during industrial activity in the North Doane Lake area Recent spills (post 1980) include Trichloroethylene (TCE) and Chromic Acid. Sampling (1985) of shallow monitori wells (<40') in the undeveloped southern portion of the site detected low levels of semi-volatile organics. Dep to ground water is < 15 feet.

01 [X] B. Surface Water Contamination — 02 [X] Observed (Date: 1980 - Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

The site is adjacent to the Willamette River. Leakage and spills at the Wacker facility enter the river via out from the plant's wastewater treatment unit. Documented spills of hazardous materials to the river include: Chr Acid (07/80, 12/80, and 05/84); TCE (12/83 anid 12/84); and wastewater (06/87).

01 [X] C. Contamination of Air — 02 [X] Observed (Date: Unknown-Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

The Wacker facility has an Air Contaminant Discharge Permit (#26-3002) issued by the Oregon DEQ. However, there reports of odors and skin irritation from fumes originating from wastes landfilled at the site and in the adjace Doane Lake.

01 [X] D. Fire/Explosive Conditions — 02 [ ] Observed (Date:) [X] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

Petroleum products of an unknown type and quantity have been landfilled at the site.

01 [X] E. Direct Contact — 02 [X] Observed (Date: Present) [ ] Potential [ ] Alle
03 Population Potentially Affected: Unknown — 04 Narrative Description

Skin and eye irritation have been reported in the site area. The potential exists for exposure to buried pesticides, and petroleum products, if excavation is conducted at the site.

01 [X] F. Contamination of Soil — 02 [X] Observed (Date: approx. 1940's to Present) [ ] Potential [ ] Alle
03 Area Potentially Affected (Acres) Unknown — 04 Narrative Description

Petroleum products, coal tar, and pesticides were disposed of and/or spilled at the site. Soil borings done in confirm the presence of petroleum products and pesticides in sediments < 20 feet below the surface.

01 [ ] G. Drinking Water Contamination — 02 [ ] Observed (Date:) [ ] Potential [ ] Alle
03 Population Potentially Affected: — 04 Narrative Description

The area is served by the City of Portland public water supply. Contamination of ground water at the site is unlikely to affect local drinking water supplies.

01 [X] H. Worker Exposure/Injury — 02 [ ] Observed (Date:) [X] Potential [ ] All
03 Workers Potentially Affected: Unknown — 04 Narrative Description

Direct contact with buried wastes is possible for workers during any construction or excavation at the site.

01 [X] I. Population Exposure/Injury — 02 [X] Observed (Date: Present) [X] Potential [ ] All
03 Population Potentially Affected: Unknown — 04 Narrative Description

The Doane Lake area has a history of waste disposal problems. The potential exists for exposure if there are a uncontained or unknown disposal areas.

SCOEPA00004049

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 State: OR
02 Site Number: D096253737

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 [ ] J. Damage to Flora — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Allege
04 Narrative Description

None reported, observed, or suspected.

01 [ ] K. Damage to Fauna — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Allege
04 Narrative Description (Include name(s) of species)

None reported, observed, or suspected.

01 [ ] L. Contamination of Food Chain — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Allege
04 Narrative Description

None reported or observed. Contamination of the Willamette River has the potential to affect fishing resources.

01 [X] M. Unstable Containment of Wastes (Spills/runoff/standing liquids, leaking drums) — 02 [ ] Observed (Date: _____) [ ] Potential [ ] Allege
03 Population Potentially Affected: _____ 04 Narrative Description

Petroleum products and coal tar were landfilled at, or adjacent to, the site causing soil contamination.

01 [X] N. Damage to Off-site Property — 02 [ ] Observed (Date: _____) [X] Potential [ ] Allege
04 Narrative Description

Adjacent property has the potential to be affected by subsurface migration of wastes.

01 [X] O. Contamination of Sewers, Storm Drains, WWTPs — 02 [X] Observed (Date: 12/27/83) [ ] Potential [ ] Allege
04 Narrative Description

Wastewater spill at the facility was diverted to the municipal sewer system. The water contained 2.02 ppm chromi

01 [X] P. Illegal/Unauthorized Dumping — 02 [ ] Observed (Date: approx. 1940's to 1980) [ ] Potential [ ] Allege
04 Narrative Description

The exact quantity and types of materials disposed of or spilled on site during past practices are unknown.

05 Description of Any Other Known, Potential, or Alleged Hazards

Due to the long history of petroleum and chemical manufacturing in the site area, and unknown waste handling practices, the potential exists for the discovery of additional hazardous materials and conditions in the site are

III. TOTAL POPULATION POTENTIALLY AFFECTED: Unknown

IV. COMMENTS

The Wacker site is located in the heavily industrialized North Doane Lake area of northwest Portland. East of the site is the Gould, Inc. Superfund site. The Doane Lake area has a history of waste disposal and operational problems. The Wacker site will be included in a North Doane Lake study, to be conducted by Wacker, Northwest Natural Gas, and Koppers, Inc., under the guidance of the Oregon DEQ.

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

CH_2M Hill N.W., Inc., A Preliminary Soil Investigation, Wacker Siltronic Corporation, 06/85; Memos from J. Ellis, Wacker Siltronic, to S. Carter, ODEQ, dated 07/14/80 and 12/22/80; Memo from G. Carr, Wacker Siltronic, to C. Carter, ODEQ, dated 06/04/84; Memo from G. Carr, Wacker Siltronic, to C. Clinton, ODEQ, dated 01/06/84; Memo fr J. Gillaspie, ODEQ, to J. Ellis, Wacker Siltronic, dated 04/16/85; Memo from M. Tillson, Wacker Siltronic, to G. Davis, ODEQ, dated 07/02/87; Memo from M. Tillson, Wacker Siltronic, to G. Davis, ODEQ, dated 02/11/87; Tom Mille ODEQ, Personal Communication, 10/20/87.

Rick Reiter
G/3

STATE OF OREGON
DEPARTMENT OF ENVIRONMENTAL QUALITY

Memorandum

To: LDPatterson, RPReiter
RFGates

Date: 20 June 1985

From: JAGillaspie jag

HW 9.50 (New file)

Subject: Wacker Siltronics Sampling - Attached Preliminary Numbers

The attached monitoring results show the level of various contaminants in the soil at varying depths at the Wacker Siltronics site. Soil samples were done because the company plans on building a new facility on this piece of property.

Please call me or Chuck Clinton with your thoughts.

We have also asked Michael Heumann at the Health Division to scan the national data bases for information about these chemicals at these concentrations.

JAG/mb
Attachments
cc: Michael Heumann

Hazardous & Solid Waste Division
Dept. of Environmental Quality
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DEO-4

Project: Hacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1985

PRELIMINARY

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NORTHWEST REGION

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											
Chloroethane											DC
Bromoethane											DC
Vinyl Chloride											DC, PDW(*)
Chloroethane											DC
Methylene Chloride											DC
Trichlorofluoromethane											DC
1,1-Dichloroethene											DC, PDW(*)
1,1-Dichloroethane											DC
Trans-1,2-Dichloroethene											DC
Chloroform											DC, PDW
1,2-Dichloropropane											DC
1,1,1-Trichloroethane	0.01	BD	BD	BD	BD	BD	BD	BD	BD	0.01	DC, PDW(*)
Carbon Tetrachloride											DC, PDW(*)
Bromodichloromethane											DC, PDW
1,2-Dichloroethane	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.01	DC, PDW(*)
Trans-1,3-Dichloropropene											DC
Trichloroethylene											DC, PDW(*)
Benzene											DC, PDW(*)
Dibromochloromethane											DC
1,1,2-Trichloroethane											DC
Cis-1,2-Dichloropropene											DC
2-Chloroethyl vinyl ether											DC
Bromoform											DC, PDW
1,1,2,2-Tetrachloroethane	2.2	11	BD	BD	BD	0.14	BD	BD	BD	0.05	DC
Tetrachloroethylene											DC, PDW(*)
Toluene	1.2	28	0.11	BD	BD	0.2	BD	BD	BD	0.1	DC
Chlorobenzene	0.24	BD	BD	BD	BD	BD	BD	BD	BD	0.04	DC
Ethyl Benzene	17	5.4	BD	BD	BD	BD	BD	BD	0.05	0.04	DC
Acrylonitrile											DC
Acrolein											DC
Dichlorodifluoromethane											DC
o Acid Extractables											
Phenol	0.35	3.1	0.2	0.3	0.17	0.27	0.25	0.26	0.08	NR	DC, SWQ
2-Chlorophenol	ND	7.8	ND	ND	ND	ND	0.13	ND	0.14	NR	DC, SWQ
2-Nitrophenol	ND	0.2	ND	ND	ND	ND	ND	ND	ND	NR	DC, SWQ
2,4-Dimethylphenol	ND	3.1	ND	ND	ND	0.22	0.17	ND	ND	NR	DC, SWQ
2,4-Dichlorophenol	ND	2.7	0.09	0.26	ND	0.24	ND	ND	ND	NR	DC, SWQ
p-Chloro-m-cresol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	DC
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	0.22	ND	ND	ND	NR	DC, SWQ
2,4-Dinitrophenol	ND	ND	ND	ND	ND	0.81	ND	ND	ND	NR	DC, SWQ
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	DC, SWQ
4,6-Dinitro-o-cresol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	DC
Pentachlorophenol	ND	ND	ND	ND	0.31	6.9	5.1	ND	ND	NR	DC, SWQ, S-W

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Project: Wacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1985

PRELIMINARY

CHEMICAL COMPOUNDS	MW-1, S-3 (15-16.5 ft.)	MW-2, S-4 (22-23.5 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
Miscellaneous Analysis											
o Non-PP Phenols/Cresols											
3-Chlorophenol											SHW, SWQ
4-Chlorophenol	0.44	17.5	0.2			1.7	2.32				SHW, SWQ
2,4,5-Trichlorophenol		1.9									SHW, SWQ
2,3,4,5-Tetrachlorophenol	4.9	256		0.4		0.23	4.7	0.05	0.25		SHW, SWQ
2,3,4,6-Tetrachlorophenol	0.24			0.58							SHW, SWQ
2,3,5,6-Tetrachlorophenol		4			0.11	0.32	0.55		0.46		SHW, SWQ
o-Cresol	0.04	3.4		0.02		0.19	2.25				
m-Cresol (***)											
p-Cresol (***)	0.226			0.08							
o Non-PP Pesticides (EP Toxicity)											
Methoxychlor	BD	BD	BD	BD	BD	BD	BD	BD	BD	2.1	SHW, PDW
2,4-D	BD	BD	BD	BD	BD	12	152	BD	BD	12	SHW, PDW
2,4,5-TP (Silvex)	BD	BD	BD	BD	BD	BD	BD	BD	BD	1	SHW, PDW
o Non-PP Volatiles											
Xylene	146	116	BD	BD	BD	1.5	BD	2.8	1.2	1	
o Non-PP Inorganics											
Barium											SHW, SWQ
Boron											SWQ
Fluoride											PDW, SWQ
Iron											SWQ
Manganese											SWQ
o Misc. Constituents/Parameters											
pH											
Specific Conductivity (mhos)											
Total Organic Carbon											
Total Dissolved Solids											
Redox Potential											

Notes:
PP - Priority Pollutant
PDW- National Interim Primary Drinking Water Regulations
PDW(*)- Proposed N.I.P.D.W.R.
SDW- National Secondary Drinking Water Regulations
SHW- State of Oregon Hazardous Waste Administrative Rules
SWQ- State of Oregon Water Quality Administrative Rules

Unless otherwise specified, all units are mg/kg (mg/L).
BD- Parameter detected, but below analytical quantification limits.
ND- Analyzed, but not detected.
NR- Not reported.
(***)- Reported as sum of two compounds.

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Project: Wacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1985

PRELIMINARY

PRELIMINARY

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
N-nitrosodiethylamine											DD
Bis (chloroethyl) ether											DD
o Pesticides (EP Toxicity)											
Aldrin											DD
Alpha BHC											DD
Beta BHC											DD
Gamma BHC (Lindane)	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.24	DD, SHW, SWD
Delta BHC											DD
Chlordane											DD
4,4'-DDD											DD
4,4'-DDE											DD
4,4'-DDT											DD
Dieldrin											DD
Alpha Endosulfan											DD
Beta Endosulfan											DD
Endosulfan Sulfate											DD
Endrin	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.222	DD
Endrin Aldehyde											DD
Heptachlor											DD
Heptachlor Epoxide											DD
Toxaphene	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.25	DD
o PCBs											
1016											DD
1221											DD
1232											DD
1242											DD
1248											DD
1254											DD
1260											DD
Inorganic Analyses (EP Toxicity)											
Antimony											DD
Arsenic	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	DD, SHW, SWD, PDW
Beryllium											DD
Cadmium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	DD, SHW, SWD, PDW
Chromium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	DD, SHW, SWD, PDW
Copper											DD, SWD, SDW
Nickel											DD
Lead	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	DD, SHW, SWD, PDW
Zinc											DD, SWD, SDW
Thallium											DD
Selenium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	DD, SHW, PDW
Mercury	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	DD, SHW, PDW
Silver	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.25	DD, SHW, PDW
Cyanides											DD, SWD

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Project: Wacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1985

PRELIMINARY

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
o Base Neutral Extractables											
Bis (2-chloroethyl)ether											DD
1,3-Dichlorobenzene											DD
1,4-Dichlorobenzene											PP, PCW(*)
1,2-Dichlorobenzene											DD
Bis (2-Chloroisopropyl)ether											DD
Hexachloroethane											DD
N-nitroso-di-n-propylamine											DD
Nitrobenzene											DD
Isophorone											DD
Bis (2-Chloroethoxy)methane											DD
1,2,4-Trichlorobenzene											DD
Naphthalene	6.7	360	BD	BD	BD	230	BD	BD	BD	1	DD
Hexachlorobutadiene											DD
Hexachlorocylopentadiene											DD
2-Chloronaphthalene											DD
Acenaphthalene	5.6	230	BD	BD	BD	24	BD	BD	BD	1	DD
Dimethylphthalate											DD
2,6-Dinitrotoluene											DD
Acenaphthene	8	560	BD	BD	BD	28	BD	BD	BD	1	DD
2,4-Dinitrotoluene											DD
Fluorene	5	290	BD	BD	BD	20	BD	BD	BD	1	DD
4-Chlorophenyl phenyl ether											DD
Diethyl phthalate											DD
N-nitrosodiphenylamine											DD
1,2-Diphenylhydrazine											DD
4-Bromophenyl phenyl ether											DD
Hexachlorobenzene											DD
Phenanthrene (***)											DD
Anthracene (***)	32	1400	3	BD	BD	150	BD	1.6	BD	1	DD
Dibutyl phthalate											DD
Fluoranthene	16	530	BD	BD	BD	50	BD	1.1	BD	1	DD
Pyrene	18	550	BD	BD	BD	57	BD	1.2	BD	1	DD
Benzidine											DD
Butyl benzyl phthalate											DD
2,3,7,8-Tetrachlorodibenzo-p-dioxin											DD
Benzo (a) anthracene											DD
Chrysene	12	92	BD	BD	BD	36	BD	1.7	BD	1	DD
3,3'-Dichlorobenzidine											DD
Bis (2-ethylhexyl) phthalate											DD
Di-n-octyl phthalate											DD
Benzo (b) fluoranthene (***)											DD
Benzo (k) fluoranthene (***)	6	120	BD	BD	BD	200	BD	BD	BD	1	DD
Benzo (a) pyrene	19	120	BD	BD	BD	100	BD	BD	BD	1	DD
Indeno (1,2,3-CD) pyrene (***)											DD
Dibenzo (a,b) anthracene (***)	BD	270	BD	BD	BD	7	BD	BD	BD	1	DD
Benzo (ghi) perylene	BD	360	BD	BD	BD	25	BD	BD	BD	1	DD

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Project: Wacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1985

PRELIMINARY

Dept. of Environmental Quality
RECEIVED
JUN 20 1985
NORTHWEST REGION

RCO
CHG

HLW 9.50
Wacker Siltronic
Ry

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											
Chloromethane											PP
Bromomethane											PP
Vinyl Chloride											PP, PDW(*)
Chloroethane											PP
Methylene Chloride											PP
Trichlorofluoromethane											PP
1,1-Dichloroethene											PP, PDW(*)
1,1-Dichloroethane											PP
Trans-1,2-Dichloroethene											PP
Chloroform											PP, PDW
1,2-Dichloropropane											PP
1,1,1-Trichloroethane	0.01	BD	BD	BD	BD	BD	BD	BD	BD	0.01	PP, PDW(*)
Carbon Tetrachloride											PP, PDW(*)
Bromodichloromethane											PP, PDW
1,2-Dichloroethane	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.01	PP, PDW(*)
Trans-1,3-Dichloropropene											PP
Trichloroethylene											PP, PDW(*)
Benzene											PP, PDW(*)
Dibromochloromethane											PP
1,1,2-Trichloroethane											PP
Cis-1,2-Dichloropropene											PP
2-Chloroethyl vinyl ether											PP
Bromoform											PP, PDW
1,1,2,2-Tetrachloroethane	2.2	11	BD	BD	BD	0.14	BD	BD	BD	0.05	PP
Tetrachloroethylene											PP, PDW(*)
Toluene	1.2	20	0.11	BD	BD	0.2	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
Acrylonitrile											PP
Acrolein											PP
Dichlorodifluoromethane											PP
o Acid Extractables											
Phenol	0.35	3.1	0.2	0.3	0.17	0.27	0.25	0.26	0.08	NR	PP, SWQ
2-Chlorophenol	ND	7.8	ND	ND	ND	ND	0.13	ND	0.14	NR	PP, SWQ
2-Nitrophenol	ND	0.2	ND	ND	ND	ND	ND	ND	ND	NR	PP, SWQ
2,4-Dimethylphenol	ND	3.1	ND	ND	ND	0.22	0.17	ND	ND	NR	PP, SWQ
2,4-Dichlorophenol	ND	2.7	0.09	0.26	ND	0.24	ND	ND	ND	NR	PP, SWQ
p-Chloro-m-cresol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	PP
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	0.22	ND	ND	ND	NR	PP, SWQ
2,4-Dinitrophenol	ND	ND	ND	ND	ND	0.81	ND	ND	ND	NR	PP, SWQ
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	PP, SWQ
4,6-Dinitro-o-cresol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NR	PP
Pentachlorophenol	ND	ND	ND	ND	0.31	6.9	5.1	ND	ND	NR	PP, SWQ, SHW

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Project: Wacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1985

PRELIMINARY

CHEMICAL COMPOUNDS	MW-1, S-3 (15-16.5 ft.)	MW-2, S-4 (22-21.5 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
Miscellaneous Analysis											
o Non-PP Phenols/Cresols											
3-Chlorophenol											SHW, SWQ
4-Chlorophenol	0.44	17.5	0.2			1.7	0.32				SHW, SWQ
2,4,5-Trichlorophenol		1.9									SHW, SWQ
2,3,4,5-Tetrachlorophenol	4.9	256		0.4		0.23	4.7	0.05	0.25		SHW, SWQ
2,3,4,6-Tetrachlorophenol	0.24			0.58							SHW, SWQ
2,3,5,6-Tetrachlorophenol		4			0.11	0.33	0.55		0.46		SHW, SWQ
o-Cresol	0.04	3.4		0.02		0.19	0.25				
m-Cresol (***)											
p-Cresol (***)	0.286			0.08							
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	12	152	BD	BD	12	SHW, PDW
2,4,5-TP (Silvex)	BD	BD	BD	BD	BD	BD	BD	BD	BD	1	SHW, PDW
o Non-PP Volatiles											
Xylene	146	116	BD	BD	BD	1.5	BD	2.6	1.2	1	
o Non-PP Inorganics											
Barium											SHW, SWQ
Boron											SWQ
Fluoride											PDW, SWQ
Iron											SWQ
Manganese											SWQ
o Misc. Constituents/Parameters											
pH											
Specific Conductivity (ehos)											
Total Organic Carbon											
Total Dissolved Solids											
Redox Potential											

Notes:

PP - Priority Pollutant
PDW- National Interim Primary Drinking Water Regulations
PDW(*)- Proposed N.I.P.D.W.R.
SDW- National Secondary Drinking Water Regulations
SHW- State of Oregon Hazardous Waste Administrative Rules
SWQ- State of Oregon Water Quality Administrative Rules

Unless otherwise specified, all units are mg/kg (mg/L).
BD- Parameter detected, but below analytical quantification limits.
ND- Analyzed, but not detected.
NR- Not reported.
(***)- Reported as sum of two compounds.

NOTE: The values indicated on this page have not been subjected to Quality Assurance/Quality Control Procedures. For this reason, all data shown must be considered preliminary and must be used only for purposes consistent with this reporting data.

Project: Wacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1985

PRELIMINARY

PRELIMINARY

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
Nitrosodimethylamine											PP
Bis (chloromethyl) ether											PP
o Pesticides (EP Toxicity)											
Aldrin											PP
Alpha BHC											PP
Beta BHC											PP
Gamma BHC (Lindane)	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.04	PP, SHW, PDW
Delta BHC											PP
Chlordane											PP
4,4'-DDD											PP
4,4'-DDE											PP
4,4'-DDT											PP
Dieldrin											PP
Alpha Endosulfan											PP
Beta Endosulfan											PP
Endosulfan Sulfate											PP
Endrin	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.002	PP
Endrin Aldehyde											PP
Heptachlor											PP
Heptachlor Epoxide											PP
Toxaphene	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP
o PCBs											
1016											PP
1221											PP
1232											PP
1242											PP
1248											PP
1254											PP
1260											PP
Inorganic Analyses (EP Toxicity)											
Antimony											PP
Arsenic	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP, SHW, SWO, PDW
Beryllium											PP
Cadmium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP, SHW, SWO, PDW
Chromium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP, SHW, SWO, PDW
Copper											PP, SWO, SDW
Nickel											PP
Lead	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP, SHW, SWO, PDW
Zinc											PP, SWO, SDW
Thallium											PP
Selenium	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP, SHW, PDW
Mercury	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP, SHW, PDW
Silver	BD	BD	BD	BD	BD	BD	BD	BD	BD	0.05	PP, SHW, PDW
Cyanides											PP, SWO

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PRELIMINARY

Project: Wacker Siltronic, Poly Building Soils Investigation
Source: Coffey Laboratories, Inc.
Date: May 14, 1995

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
c Base Neutral Extractables											
Bis (2-chloroethyl)ether											DD
1,3-Dichlorobenzene											DD
1,4-Dichlorobenzene											DD, PDW(*)
1,2-Dichlorobenzene											DD
Bis (2-Chloroisopropyl)ether											DD
Hexachloroethane											DD
N-nitroso-di-n-propylamine											DD
Nitrobenzene											DD
Isophorone											DD
Bis (2-Chloroethoxy)methane											DD
1,2,4-Trichlorobenzene											DD
Naphthalene	6.7	360	BD	BD	BD	230	BD	BD	BD	1	DD
Hexachlorobutadiene											DD
Hexachlorocyclopentadiene											DD
2-Chloronaphthalene											DD
Acenaphthalene	5.6	230	BD	BD	BD	24	BD	BD	BD	1	DD
Dimethylphthalate											DD
2,6-Dinitrotoluene											DD
Acenaphthene	8	560	BD	BD	BD	28	BD	BD	BD	1	DD
2,4-Dinitrotoluene											DD
Fluorene	5	290	BD	BD	BD	20	BD	BD	BD	1	DD
4-Chlorophenyl phenyl ether											DD
Diethyl phthalate											DD
N-nitrosodiphenylamine											DD
1,2-Diphenylhydrazine											DD
4-Bromophenyl phenyl ether											DD
Hexachlorobenzene											DD
Phenanthrene (***)											DD
Anthracene (***)	32	1400	3	BD	BD	150	BD	1.6	BD	1	DD
Dibutyl phthalate											DD
Fluoranthene	16	530	BD	BD	BD	50	BD	1.1	BD	1	DD
Pyrene	18	550	BD	BD	BD	57	BD	1.2	BD	1	DD
Benzidine											DD
Butyl benzyl phthalate											DD
2,3,7,8-Tetrachlorodibenzo-p-dioxin											DD
Benzo (a) anthracene											DD
Chrysene	12	92	BD	BD	BD	36	BD	1.7	BD	1	DD
3,3'-Dichlorobenzidine											DD
Bis (2-ethylhexyl) phthalate											DD
Di-n-octyl phthalate											DD
Benzo (b) fluoranthene (***)											DD
Benzo (k) fluoranthene (***)	6	120	BD	BD	BD	200	BD	BD	BD	1	DD
Benzo (a) pyrene	19	120	BD	BD	BD	100	BD	BD	BD	1	DD
Indeno (1,2,3-CD) pyrene (***)											DD
Dibenzo (a,b) anthracene (***)	BD	270	BD	BD	BD	7	BD	BD	BD	1	DD
Benzo (ghi) perylene	BD	360	BD	BD	BD	25	BD	BD	BD	1	DD

NOTE: The values indicated on this page have not been subjected to Quality Assurance/Quality Control Procedures. For this reason, all data shown must be considered preliminary and must be used only for purposes consistent with this reporting status.

ENVIRONMENTAL CLEANUP SITE INFORMATION
SITE SUMMARY REPORT

December 13, 1991 09:34 am

SITE ID: 183 **SITE NAME:** Wacker Siltronic Corp. **CERCLIS NO:** 096253737

ADDRESS: 7200 NW Front Ave, Portland,

COMMENTS: Between Front Ave and Hwy 30 (St. Helens Rd) at the NW 7200 Block

COUNTY: MULTNOMAH **REGION:** NWR **STATUS:** Active

PROPERTY: **TWNSHP/RANGE/SECT:** 1N,1W,13 **TAX LOTS:** 1

LATITUDE: 0 deg.0'0" **LONGITUDE:** 0 deg.0'0" **SITE SIZE:** 84.6 acres

SITE CONTACT:
Rudolf Staudigl
President
Wacker Siltronic Corp
P.O. Box 83180
Portland, OR 97283-0180
PHONE: (503)243-2020

PROGRAM CONTACTS: RCRA,

FACILITIES: Semiconductor products

YEARS OF OPERATION: **SIC CODES:** 3674,

PERMITS:

PERMIT NO.	PERMIT TYPE	ISSUED BY	COMMENTS
Unknown	Unknown	Unknown	generates more than 1000 kg/mo

RELEASE AREAS:

HAZARDOUS SUBSTANCES/WASTE TYPES:

PAHs, xylene, toluene, phenols, benzene, ethylbenzene, 2,4-D

CONTAMINATION INFORMATION:

Much of the soil contamination (especially PAHs) is from the past practice of placing industrial wastes on the site for fill or disposal - Portland Gas & Coke. BTEX contamination probably results from coal tar wastes placed on the site and leaks or spills from a pipeline that crosses the site.

OTHER INFORMATION:

Soil and groundwater contamination, possibly surface water and groundwater hazards.

ASSOCIATED PARTIES

PARTY NAME AND ADDRESS	AFFILIATION	DATES OF AFFILIATION*	INFORMATION AS OF DATE
Northwest Natural Gas Northwest Natural Gas 220 N.W. 2nd Ave. Portland, OR COMMENTS:	Owner/Operator	Prior	02-MAY-88
Wacker Siltronic Corp. Rudolf Staudigl President Wacker Siltronic Corp P.O. Box 83180 Portland, OR 97283-0180 (503)243-2020 COMMENTS:	Legal Owner	Current	06-AUG-91
Wacker-Chemie GNBH Wacker-Chemie, GNBH Prinzregentenstrasse 22 800 Munich 22, COMMENTS:	Owner	Current	02-MAY-88

* indicates approximate dates

INFORMATION REVIEWED:

- "A Preliminary Report Soil Investigation for Proposed Polysilicon Plant" by CH2M Hill, June 1985.
- Preliminary Assessment Report prepared by Ecology and Environment, Inc., Oct., 1987.
- Laboratory data, Pacific Environmental Laboratory, Inc., July 25, 1990
- "Findings Report Groundwater and Soil Gas Investigation" prepared by CH2M Hill, December, 1990

DATA SOURCES: CERCLIS File Program: , Region: HQ

HAZARDOUS SUBSTANCES

SUBSTANCE	RELEASE AREAS	COMMENTS
BENZENE ( )		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 07-AUG-91
BENZO(a)PYRENE		Effective Date of Data: 02-MAY-88
CHLOROPHENOL (3&4-chlorophenol)		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 02-MAY-88
DIMETHYLPHENOL,2,4- ( )		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 07-AUG-91
ETHYLBENZENE		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 02-MAY-88
PENTACHLOROPHENOL		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 02-MAY-88
PETROLEUM HYDROCARBONS (Total petroleum hydrocarbons (TPH))		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 07-AUG-91
POLYNUCLEAR AROMATIC HYDROCARBONS (PAH) ( )		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 07-AUG-91
TETRACHLOROETHYLENE (1,1,2,2-tetrachloroethylene)		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 02-MAY-88
TOLUENE		Date released: unknown Quantity Released: unknown Effective Date of Data: 02-MAY-88
TOLUENEDIAMINE,2,4- (2,4-D)		Date released: Unknown Quantity Released: Unknown Effective Date of Data: 02-MAY-88
XYLENEs (xylene)		Date released: unknown Quantity Released: unknown

Effective Date of Data: 02-MAY-88

SUBSTANCE CONTAMINATION

SUBSTANCE	MEDIA CONTAMINATED	CONCENTRATION LEVEL	CERT	EVIDENCE	OBSERV. DATE
BENZENE	Groundwater	Up to 23,300 ug/l	E	Laboratory Data	
	Soil	Up to 29 mg/kg	E	Laboratory Data	
BENZO(a)PYRENE	Groundwater	Up to 760 ug/l	E	Laboratory Data	
	Soil	Up to 240 mg/kg	E	Laboratory Data	
CHLOROPHENOL	Soil	17.5 mg/kg	E	Laboratory Data	
DIMETHYLPHENOL,2,4-	Groundwater	Up to 27 ug/l	E	Laboratory Data	
	Soil	Up to 3.1 mg/kg	E	Laboratory Data	
ETHYLBENZENE	Groundwater	Up to 4680 ug/l	E	Laboratory Data	
	Soil	Up to 55 mg/kg	E	Laboratory Data	
PENTACHLOROPHENOL	Soil	Up to 6.9 mg/kg	E	Laboratory Data	
PETROLEUM HYDROCARBONS	Groundwater	Up to 89 mg/l	E	Laboratory Data	
POLYNUCLEAR AROMATIC HYDROCARBONS (PAH)	Groundwater	Up to 11,800 ug/l (total PAHs)	E	Laboratory Data	
	Soil	Up to 9970 mg/kg (total PAHs)	E	Laboratory Data	
TETRACHLOROETHYLENE	Soil	Up to 11 mg/kg	E	Laboratory Data	
TOLUENE	Groundwater	Up to 5960 ug/l	E	Laboratory Data	
	Soil	Up to 26 mg/kg	E	Laboratory Data	
TOLUENEDIAMINE,2,4-	Soil	Up to 160 mg/kg	E	Laboratory Data	
XYLENEs (m,p,o)	Groundwater	Up to 6450 ug/l	E	Laboratory Data	
	Soil	Up to 146 mg/kg	E	Laboratory Data	

Certainty = (E)st. (C)ert. (U)ncert. (N)ot Assigned

ENVIRONMENTAL/HEALTH THREATS:

Site is located in heavy industrial area. Significant soil and groundwater contamination, but contaminated soil is under surface and groundwater not used. Greatest threat may be to Willamette River and to on-site workers who dig into contaminated soil without adequate personal safety equipment.

MANNER OF RELEASE:

Past practices.

TIME PERIOD OF RELEASE:

Unknown

STATUS OF INVESTIGATIVE OR REMEDIAL ACTION:

Responsible party investigation

REMEDIAL ACTION FUNDING:

Owner, operator or other person under agreement, order or consent decree under ORS 465.200 or 465.420.

INVESTIGATIVE AND REMEDIAL ACTIONS

ACTION	START DATE	COMPL. DATE	RESP. STAFF	LEAD SECT.

ADMINISTRATIVE ACTIONS

ACTION	DATE	RESPONSIBLE STAFF	LEAD SECT.	COMMENTS
Site Discovery	02-MAY-88	Michael Zollitsch	SAS	DEQ contact: Mike Downs
Listing Review Completed	06-AUG-91	Mike Downs	SRS	
Recommend proposing for Confirmed Release List	07-AUG-91	Mike Downs	SRS	
Recommend proposing for Inventory	07-AUG-91	Mike Downs	SRS	
Facility proposed for Confirmed Release List	15-NOV-91	Mike Downs	SRS	
Facility proposed for Inventory List	15-NOV-91	Mike Downs	SRS	

NOTIFICATION ACTIONS

NOTIFICATION DESCRIPTION	DATE SENT	PARTY NAME
	30-NOV-88	Wacker Siltronic Corp.

LAST UPDATED BY: OPS$DMC DATE: 07-NOV-91

(site_report.rpt)

Wacker Siltronic Corporation

WACKER

Wacker Siltronic Corporation
P.O. Box 83180
Portland, OR 97283-0180
Phone (503) 243-2020
FAX (503) 226-0052

February 11, 1992

Fred Hansen, Director
Oregon Department of Environmental Quality
Att'n: Site Assessment Section
Environmental Cleanup Division
811 SW 6th Avenue, 9th Floor
Portland, OR 97204

Re: DEQ Proposal to List Wacker Siltronic Corporation Property on Confirmed Release List and Inventory (SDDB ID #183)

Dear Mr. Hansen:

On November 21, 1991 Wacker Siltronic Corporation (Wacker) received your letter of November 15, 1991 notifying it that the Department of Environmental Quality (DEQ) proposes to list Wacker's plant site in Portland on DEQ's "Confirmed Release List" and on its "Inventory" under Oregon's Environmental Cleanup Law (ORS 465.200 et seq.) Your letter stated that Wacker had 45 days from receipt of the notice to provide comments and that an extension of up to 45 additional days could be given for appropriate reason. Wacker applied for and was given an extension of an additional 45 days. This letter provides Wacker's comments on DEQ's proposed listings of Wacker's Portland plant site.

Enclosed with the notice letter was a "Facility Report" which the letter states "identifies the hazardous contamination at this property as well as other information we plan to include on the lists". The letter also says that the " site assessment report referenced in the caption above provides the basis for the determination that further investigation or cleanup is needed at the site." The report referenced in the caption is "CH2M Hill Findings Report, 12/1/90", a Groundwater and Soil Gas Investigation Report prepared for Wacker to assess the possibility that the Olympic pipeline crossing the Wacker property in a utilities corridor is the source of some hydrocarbons found in the soil along portions of the corridor. The CH2M Hill report was provided to DEQ by Wacker pursuant to its continued cooperation with the DEQ.

Wacker's comments on the proposed listings are as follows:

a. The Facilities Report lists Wacker Siltronic Corporation as "Current Legal Owner" of the plant site, which is correct, but it also lists Wacker-Chemie Gmbh as "Current Owner", which is incorrect. Wacker Siltronic Corporation, an American

corporation, is the owner of the plant site in every respect,and is its operator as well. Wacker-Chemie Gmbh, a German company, is the parent corporation of Wacker Siltronic, but it does not own the plant site, nor any interest in it. All reference to Wacker-Chemie Gmbh should be removed from the Facility Report and should not appear in any DEQ listing about the site.

b. The Facility Report lists Northwest Natural Gas as "Prior Owner/Operator". Northwest Natural Gas was indeed a former owner and operator of the site, but it is not the only former owner or operator. Wacker Siltronic Corporation acquired the property from the Portland Development Commission, which acquired the site from its prior owners and prepared it for use by Wacker. Wacker will be pleased to provide the DEQ any information it has on the chain of title of the property. In addition, available information concerning soil and groundwater contamination at the site indicates that the contamination came from other nearby properties or was caused to be there by other third parties. Wacker is confident that DEQ has the information referred to but would, of course, provide any information available to it which D.E.Q. may not have.

c. The Facility Report lists a number of substances said to have been released at the site, and it appears that all are hazardous substances under Oregon law, except perhaps the TPH if the TPH is not liquid at a temperature of 60° F and a pressure of 14.7 psi absolute. DEQ's information on this subject appears to be from the CH2M Hill report provided to DEQ by Wacker and cited in the caption of DEQ's letter and from certain other reports as well. This information appears to justify inclusion of the site on DEQ's "Confirmed Release List".

d. As stated above, the DEQ notice letter says that the site assessment report referenced in the caption (the CH2M Hill report) "provides the basis for the determination that further investigation or cleanup is needed at the site", and hence provides the basis for listing the site on DEQ's Inventory. There is, however, a great deal more information about the site already known to DEQ, including other information provided by Wacker, information developed by U.S. EPA and by responsible parties in connection with the NL/Gould Superfund site, and information developed by a group of owners of property in the NL/Gould and Doane Lake area pursuant to a consent order with DEQ. On the basis of all available information, it is reasonable to conclude that no further investigation is needed and no remedial action is needed at Wacker's site, and that the property should not be listed on DEQ's inventory.

DEQ has noted on the Facility Report that any contamination at the site is under the surface and that the groundwater under the site is not used. Indeed, any contamination in the soil is many feet under the surface, and appears to be immobile in the subsurface environment. Neither soil nor groundwater contamination at the site poses any threat to any local drinking water.

e. DEQ's notice letter states that "Listing your property does not necessarily mean that you are responsible for the contamination, investigation, or cleanup." In the case of the Wacker property, it is clear from the facts that Wacker has no legal liability for investigation costs, cleanup costs, natural resource damages or other related costs which may arise out of the presence of contamination in the soil or groundwater of its Portland plant site.

The crux of the matter is that Wacker purchased the property from the City of Portland as part of a Portland urban renewal and job development effort in which the Portland Development Commission assembled the property and prepared it for sale to and use by Wacker. Wacker was encouraged to buy the property and build its plant there by Governor Straub of Oregon, Mayor Goldschmidt of Portland, officials of the Port of Portland, the Portland Chamber of Commerce, and many others. Wacker purchased the property long after most of the contamination had come to be in the soil or groundwater. The contamination was buried deep in the site and was not at all evident. Wacker made all appropriate inquiries prior to the purchase but neither knew nor reasonably should have known of any contamination in the site. Some of the hazardous substances which may have come to the site before its purchase and all of the hazardous substances of concern coming to the site after the purchase came by migration from other property not owned by Wacker (including from the Olympic pipeline). All the hazardous substances of concern in the site came there by virtue of acts or omissions of third parties not connected in any way with Wacker.

For all these reasons, under both Oregon and federal law, Wacker is not responsible for any investigation, cleanup, natural resource damage or other similar costs arising from the contamination at the site.

Very truly yours,

WACKER SILTRONIC CORPORATION

John

John Pittman
Director of Engineering
cc: Marvin Durning
Rudy Staudigl
Jim Ellis
Tom McCue

John Pittman

P 338 345 496

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL
(See Reverse)

☆U.S.G.P.O. 1989-234-555

Sent to FRED HANSEN- DEPT ENVIRONMENTAL QUALITY	
Street and No. 811 S.W. 6th AVE- 9th FLOOR	
P.O., State and ZIP Code PORTLAND, OR 97204-1390	
Postage	$ .29
Certified Fee	1.00
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt showing to whom and Date Delivered	1.00
Return Receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	2.29
Postmark or Date	

PORTLAND OR SAINT JOHNS STA. FEB 12 1992 USPS

PS Form 3800, June 1985

SCOEPA00004069

STICK POSTAGE STAMPS TO ARTICLE TO COVER FIRST CLASS POSTAGE, CERTIFIED MAIL FEE, AND CHARGES FOR ANY SELECTED OPTIONAL SERVICES. (see front)

1. If you want this receipt postmarked, stick the gummed stub to the right of the return address leaving the receipt attached and present the article at a post office service window or hand it to your rural carrier. (no extra charge)

2. If you do not want this receipt postmarked, stick the gummed stub to the right of the return address of the article, date, detach and retain the receipt, and mail the article.

3. If you want a return receipt, write the certified mail number and your name and address on a return receipt card, Form 3811, and attach it to the front of the article by means of the gummed ends if space permits. Otherwise, affix to back of article. Endorse front of article **RETURN RECEIPT REQUESTED** adjacent to the number.

4. If you want delivery restricted to the addressee, or to an authorized agent of the addressee, endorse **RESTRICTED DELIVERY** on the front of the article.

5. Enter fees for the services requested in the appropriate spaces on the front of this receipt. If return receipt is requested, check the applicable blocks in item 1 of Form 3811.

6. Save this receipt and present it if you make inquiry.

U.S.G.P.O. 1989-234-555

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.

Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.

1. ☐ Show to whom delivered, date, and addressee's address. *(Extra charge)*
2. ☐ Restricted Delivery *(Extra charge)*

3. Article Addressed to:

FRED HANSEN
DEPT. ENVIRONMENTAL QUALITY
811 S.W. 6th AVE - 9th Floor
PORTLAND, OR 97204-1390

4. Article Number

P 338-345-496

Type of Service:

☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Addressee

X

6. Signature — Agent

X M Fernandez

7. Date of Delivery

2-13-92

8. Addressee's Address *(ONLY if requested and fee paid)*

PS Form 3811, Apr. 1989 ★U.S.G.P.O. 1989-238-815 DOMESTIC RETURN RECEIPT

SCOEPA00004071

UNITED STATES POSTAL SERVICE

OFFICIAL BUSINESS

SENDER INSTRUCTIONS

Print your name, address and ZIP Code in the space below.

- Complete items 1, 2, 3, and 4 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.

U.S.MAIL

PENALTY FOR PRIVATE USE, $300

RETURN TO

Print Sender's name, address, and ZIP Code in the space below.

WACKER SILTRONIC CORP
P.O. BOX 83180
PORTLAND, OR 97283

ATTN—JOHN PITTMAN

Chemical Waste Management, Inc.

GENERATOR'S CERTIFICATION OF REPRESENTATIVE SAMPLE

PLEASE PRINT IN INK OR TYPE (Elite, 12-pitch).

J82851

PDX J 82851

Waste Profile Sheet Code

CWM Location of Original: _____ (SHADED AREAS FOR CWM USE ONLY) CWM Sales Rep. #: 042

This completed form must be returned, with the representative sample, to:

_____

INSTRUCTIONS FOR COMPLETING THIS FORM ARE FOUND ON THE OPPOSITE SIDE. In order to determine whether Chemical Waste Management, Inc. can accept the special waste described in the Generator's Waste Material Profile Sheet referenced above, you must obtain and supply us with a representative sample of the waste. We may analyze the sample to verify the information that you have provided to us. A representative sample is defined as a sample obtained using any of the applicable sampling methods specified in 40 CFR 261-Appendix I or an equivalent method. Collect a representative sample of your waste and complete the form below. Apply the peel off label and ship your sample along with this form to the address noted above. If you have any questions regarding obtaining a representative sample of your waste, please refer to the instructions for this form, or contact your Chemical Waste Management, Inc. sales representative.

A. SAMPLING METHOD (Indicate which method was employed)

If sampling requirement has been waived by Chemical Waste Management, Inc., do not complete this Generator's Certification of Representative Sample form.

1. ☐ I have obtained a representative sample of the waste material described in the Generator's Waste Material Profile Sheet referenced above according to the sampling methods specified in 40 CFR 261-Appendix I.
2. ☒ I have obtained a representative sample of the waste material described in the Generator's Waste Material Profile Sheet referenced above using a method equivalent to the sampling methods described in 40 CFR 261-Appendix I.

B. SAMPLE SOURCE (e.g., drum, lagoon, pit, pond, tank, vat)

Composit from drums

C. SAMPLE LABEL — COMPLETE LABEL BEFORE REMOVING

1. Waste Profile Sheet Code:		1. Waste Profile Sheet Code:
2. [redacted] Generator's Name:	Wacker Siltronic Corporation	2. Generator's Name:
3. [redacted] Name of Waste:	Drilling Mud	3. Name of Waste:
4. [redacted] Sample Hour/Date:	July 30, 1990/ 2:00 pm	4. Sample Hour/Date:
5. [redacted] Sampler's Signature:	Richard G. Gariepy	5. Sampler's Signature:

6. Print Sampler's Name: Richard G. Gariepy
7. Sampler's Title: Environmental Engineer
8. Sampler's Employer (if CWM, see D. below): Wacker Siltronic Corporation

D. WITNESS VERIFICATION (if required) In most circumstances you will be obtaining the sample. However, in those cases in which Chemical Waste Management, Inc. obtains the sample, one of your employees must be present to direct the particular source to be sampled, to witness the sampling, and to complete this Part D.

I was personally present during the sampling described. I directed the waste source to be sampled, and I verify the information noted above.

1. Witness' Signature: _____
2. Witness' Name: _____ 3. Witness' Title: _____
4. Witness' Employer: _____ 5. Date: _____

Form CWM 51 © 1987 Chemical Waste Management, Inc.

SITE HISTORY

WACKER SILTRONIC CORPORATION

PORTLAND, OREGON

MARCH 7, 1985

SITE HISTORY
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INTRODUCTION

The Wacker Siltronic Corporation is located at 7200 N.W. Front Avenue, Portland, Oregon. Recent announcements regarding proposed expansion of Wacker Siltronic has created interest in the history and background of the 85 acre (34 hectares) site purchased by Wacker Siltronic in 1978. The City of Portland Development Commission, which created the urban renewal plan that facilitated the sale of the land to Wacker in 1978, CH2M Hill, the consulting engineering firm involved in the site planning, and Wacker Siltronic Corporation have worked together in researching and supplying information for this history.

Information was obtained from various sources including the Oregon Historical Society, ownership records, interviews with people familiar with the site including former owners, the State Department of Environmental Quality, adjacent businesses, the Corps of Engineers, and the Port of Portland. It is the purpose of this report to present a concise history of the site and immediately surrounding area. The history is intended to provide background information to Wacker Siltronic Corporation as they evaluate the site for their future growth.

WACKER SILTRONIC CORPORATION

Plant Description

In October, 1978, Wacker Siltronic Corporation, a subsidiary of Wacker Chemitronic, a German chemical corporation, began construction in Portland, Oregon, of a $40 million plant to produce silicon wafers. Investment in this plant has reached $70 million by 1985. The start of the wafer production process at the Wacker plant begins with the "growing" of

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cylindrical ingots of silicon. These ingots are sliced into wafers of various diameters. These wafers are then precision-polished. Some of the wafers undergo a further epitaxial growth process in which a thin layer of silicon is grown on the surface. Both the polished and the epitaxial wafers are sold to Wacker's customers who use them as the basic host material on which electronic device chips are produced.

The construction of the Wacker plant was undertaken in conjunction with the City of Portland as part of a 360 acre (145 hectares) urban renewal project. The area was characterized by poor access and lack of major utility services. The City of Portland, through the Portland Development Commission, assembled the site, and sold $15 million in urban redevelopment bonds to finance purchase of land, improvement and realignment of streets in the area, relocation of an existing gas main and installation of two major storm sewers which served the surrounding area. The bonds are being repaid through property taxes generated by the Wacker development.

The Portland Development Commission sold Wacker approximately 85 acres (34 hectares) for the construction of the new plant. The Commission was able to make the necessary arrangements for the land and begin construction in preparation for Wacker in a record 75 days (a process that normally requires nine months) allowing Wacker to keep its tight time schedule. Construction was completed in December, 1979, and the plant began operation in March, 1980. Completion of the plant resulted in the creation of 600 new jobs. Currently, Wacker employs approximately 835 workers. (See Appendix, Photos 18 and 19).

In October, 1983, Wacker announced a $60 million, five year expansion program involving the purchase of new equipment and new construction - in April, 1984, the plan was increased to an $85 million investment.

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This was followed by an announcement in October, 1984, of an additional $80 million in new investment to build facilities at the site to produce polycrystalline material from ferrosilicon feedstock. The polycrystalline material is one of the basic components in the wafer production process. Presently the material must be shipped from Germany.

Wacker officials estimate that employment could grow to 1,700 by 1990 with the combination of the two facilities.

Description of Site

The Wacker site is located in the northwest section of the City of Portland on the west bank of the Willamette River. The property is situated between the St. Johns Bridge and the Burlington Northern Railroad Bridge and is essentially rectangular in shape, consisting of a total of approximately 85 acres (34 hectares). The northeast boundary of the property is the Willamette River; the southeast boundary is the Burlington Northern Railroad berm providing the approach to the railroad bridge; the southwest boundary is the main Burlington Northern Railroad track and adjacent N.W. St. Helens Road; and the northwest boundary is the property line shared with Northwest Natural Gas and the Koppers Company.

The property is accessed by an extension of N.W. Front Avenue which terminates on the property. The property is about six miles (10 kilometers) upstream on the Willamette River from the Columbia River.

The initial impression of the site is one of quietness and serenity despite the closeness of the Northwest Portland industrial area. This feeling is created because of the boundaries created by the Willamette River, the railroad berm which is approximately 30 feet (9 meters) above the level of the site, and the nearness of Forest Park, which forms a natural wooded backdrop to the southwest across N.W. St. Helens Road. A map is attached which locates the property in relationship to other landmarks. (See Appendix, Figures 1 and 2).

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Wacker's site is now essentially flat after previous filling and grading operations which are described later. Two oil pipelines of Olympic Pipeline cross the property.

Geology and Hydrology

The physiography in the vicinity of the plant site is dominated by the flood plain of the Willamette River and a row of hills called the Portland Hills, which are also sometimes referred to as the Tualatin Mountains. The northeastern front of the Portland Hills forms a linear bluff that persists for at least fifty miles (80 kilometers) in the Portland area. The Wacker plant site is situated between the base of the Portland Hills and the Willamette River.

Beneath artificial fill material, the uppermost geologic unit at the site is unconsolidated alluvium deposited by the Willamette River. The alluvium is composed of silt, sand, and combinations of these materials. Columbia River Basalt, a hard dense rock layer, occurs at depths less than 100 feet (30 meters) beneath the site.

The depth of groundwater varies across the site and probably fluctuates widely with the river level. Two borings made in 1982 on the Wacker site indicate a groundwater depth of fifteen to twenty feet (4.5 to 6 meters). The general groundwater flow is expected to be parallel to, and toward, the Willamette River.

EARLY HISTORY OF SITE AND AREA (PRE-1900)

Early Inhabitants and Early Description of General Area

Archaeological research has revealed the earliest inhabitants to the Pacific Northwest migrated during the last ice age from Asia to North America about 10,000 years ago. These people settled along the coast and inland rivers. Over thousands of years these aborigines lived in a stone

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age culture of hunters and gatherers. Due to their isolation, different customs emerged with each village and tribe.

Indians living in the vicinity of the Wacker site spoke their own Chinookan language and dialect, and it was difficult for these people to communicate with other tribes. Coastal and inland Indians of Western Oregon enjoyed an unusually rich environment. The land was covered with dense forest of fir, hemlock, and cedar from which they obtained shelter, utensils and clothing. Hollowed out logs became canoes providing transportation along the waterways, which provided salmon and other fish for food.

In April, 1806, the Lewis and Clark Expedition, upon their return up the Columbia River from wintering at Fort Clatsop, were the first white men to enter the Willamette River. The area was described as covered with trees, with game plentiful, mostly deer and elk. The Indians residing on Sauvie Island, (Wapato Island) about three miles (five kilometers) downstream from the current Wacker site, called the river "Multnomah." Lewis and Clark stated in their journals that "fir is the common growth of the uplands. The river provides fish and abundant flowering plants. The land is very fertile."

The Indians were subject to disease, and the entire Multnomah Village died from a pestilence between 1829 and 1831. There is no evidence that the Wacker site itself is of any archaeological interest.

Early Political Background

Disputed Territory

From 1818 to 1846, the boundaries of the Oregon Country were disputed between Great Britain and the United States. The Hudson Bay Company established Fort Vancouver in 1824 and maintained jurisdiction over British subjects and the fur trade. American missionaries and settlers were outside United States jurisdiction, and, hence outside the law. In January, 1841, Senator Lewis F. Linn from Missouri introduced a joint

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resolution in both the Senate and the House "to occupy, settle, grant lands and extend certain laws of the United States to the Oregon Country." Congress took no action.

Attracted by the fertile land, settlers began arriving from Missouri to the Willamette Valley in 1843. An Oregon Provisional Government was established in 1843, dividing the Oregon Country into counties. The territory north of the 45th parallel and west of the Willamette River was designated Tualatin County. Finally on September 29, 1850, assuming the surrender of Indian title to their land, Congress passed the Donation Land Law. Under this law, a one-half section or 320 acres (130 hectares) was granted to every male settler over the age of 18, who was a U.S. citizen and who had occupied and cultivated his land for four consecutive years before December 1, 1850. The law was designed to settle land disputes in the Oregon Country.

Early Settlers on the Site

Milton Doane and William W. Baker established Donation Land Claims on land between the present St. Johns and Burlington Northern Railroad Bridges. These recorded documents reveal Milton Doane settled parts of Sections 12, 13, 14, and 24 in Township One, North of Range One near the present day St. Johns Bridge. The deed awarded the land to (b) (6) and the heirs at law of Milton Doane, (b) (6) A certificate dated 8 March, 1866, and signed by President Andrew Johnson, is recorded in the Deed Records, General Land Office. The Oregon Donation Land Act recognized women's part in pioneering by allowing wives the uncommon privilege of holding real property in their own names.

William W. Baker's 640 acre (260 hectares) Donation Land Claim was also deposited in the General Land Office of the United States at Oregon City, and was signed by President Andrew Johnson.

In 1852, a ferry began operation connecting the eastern and western banks of the Willamette River near the present location of the St. Johns Bridge. (See Appendix, Photo 1).

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History of Railroads on the Site

Ben Holladay, Oregon's first great railroad builder, had at his disposal a large land grant for a railroad line from Portland to Astoria (located at the mouth of the Columbia River), but he lost his fortune in the 1873 economic depression before any work could be done. The plan was picked up, however, by Henry Villard, builder of the Northern Pacific Railroad, who was successful in building a route from Portland to Goble (about one-third of the way to Astoria) in 1883. The line was eventually completed to Astoria in 1898 after formation of the Astoria and Columbia River Railroad in 1895. The double track railroad bridge across Doane Lake and the Willamette River was completed in 1908. The road was transferred to the Spokane, Portland and Seattle Railroad, which was sold and consolidated to become the Burlington Northern Railroad in 1970. Title Company public records began in 1906, showing the property as owned by the Spokane, Portland and Seattle Railroad.

DEVELOPMENT OF AREA - (POST 1900)

Wacker Siltronic Site

With the exception of the railroad building activity, the Wacker site remained essentially undisturbed before 1900. The site was, with the exception of few small buildings on the bank of the river, undeveloped until the Wacker Siltronic construction in 1978.

A portion of the property originally contained part of a small shallow lake called Doane Lake. (See Appendix, Figure 2). The lake was only about five feet (1.5 meters) in depth. The lake appears to have varied in size and shows various configurations on early drawings but seems to have been located on the southwest edge of the property. The lake itself was bisected by the railroad leading to the bridge when that was constructed in 1908.

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The property was swampy, and subject to flooding in the winter. A creek ran through the property which was reported to have contained fish in the early part of the century. Other little streams seemed to have coursed through the property depending on the time of year. The creek came from the hills immediately across N.W. St. Helens Road from the site making up what is now Forest Park and the former rock quarry.

The earliest photos of the site (See Appendix, Photo 3) show the property to be wooded, with the lake split by the railroad berm. The property was partially flooded in the 1948 Vanport Flood, a major flood of the Columbia and Willamette Rivers affecting the Portland area. (See Appendix, Photo 5).

It appears from photos that Portland Gas and Coke (P.G.& C.) may have begun using a low strip along the northwest edge of the property in the late 1940's to dispose of some residual products from their operation. (See Appendix, Photo 6). A description of the P.G.& C. activities is contained in a later section.

P.G.& C. apparently contracted with the conveniently located Jack Eatch Construction Company at the rock quarry to provide fill for the site, make drainage ditches, and perform some clearing operations. Early 1960's photos reveal that logging of the standing timber on the site had begun. By 1969, the logging operation appears to have been completed. (See Appendix, Photos 10, 11, 12, and 13).

Disposal activities appear to have been confined to the P.G.& C. operation based on recollections of various people about the use of the site.

Early photos (1936) show several small buildings on the site directly on the river bank near the railroad bridge. Western Transportation had a river dock with two piers leading to the dock. Five buildings and two fuel storage tanks were located on the river bank. Western Transportation used the facility for refueling tugs, and to tie up log rafts and barges. Land access appears to have been a road which lead from the existing Pennwalt

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property (described later) and under the railroad bridge at a location close to the existing Front Avenue. The dock and piers seem to have been removed in the 1950's (See Appendix, Photo 9) and the buildings were removed by 1973. (See Appendix, Photo 15).

A road parallel to the boundary between the P.G.& C. plant and the present Wacker property boundary on the northwest lead to a Shell Oil Company building and dock which appears in a 1936 photo. P.G.& C. sold a by-product from their gasification process to Shell. Shell shipped the product by river barge from this dock. By 1957, the Shell Oil facility appears to have been abandoned, but the old building remained until about 1973.

The property was purchased by Victor Rosenfeld and H.A. Andersen in 1962. In 1964, an interest in the property was also conveyed to Gilbert Schnitzer.

The purchasers of the property from the railroad agreed to fill the site to a minimum elevation of thirty feet (9 meters) by December 31, 1973, and to construct industrial buildings on the site by December 31, 1978. A topographic map of the 85 acre (34 hectares) site prepared in 1969 shows elevations varying from 47 feet (14 meters) to 12 feet (3.7 meters) on the site. It was estimated that 1,529,400 cubic yards (1,167,480 cu. meters) of fill would be required. Mr. Andersen indicated that the site was filled with material from the rock quarry and dredge material from the Port of Portland. Pits of fourteen to sixteen feet (4.3 to 5.0 meters) deep used by the gas company were also filled. The Port of Portland records indicate that 695,522 cu. yards (530,933 cu. meters) of material dredged from the river was placed on the site in 1974.

The site apparently remained idle until 1978 when the property was purchased by the City of Portland Development Commission as part of an urban renewal project and subsequently sold to Wacker Siltronic Corporation the same year. Construction of their new plant began immediately. (See Appendix, Photos 16 and 17).

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DEVELOPMENT OF ADJACENT PROPERTIES

U.S. Government Moorings

The U.S. Government purchased property to the northwest of the Wacker site in 1903 and 1905 for moorings. Additional property was purchased in 1940. The tract contains an area of eleven acres (4.5 hectares) and is located south of the present day St. Johns Bridge. The various buildings exist on the U.S. Government Moorings property for use by the government for storage and operating facilities for dredges and other floating equipment by the Portland Engineering District. (See Appendix, Photo 14).

Portland Gas and Coke Development

In 1913, Portland Gas and Coke (P.G.& C.) built a gas works of the latest design on property which is located to the northwest of the present day Wacker Siltronic property. (See Appendix, Photo 2). The plant produced Gasco Briquettes, which contributed to the area's solid fuel supply. Gas was manufactured from oil at the site as well as benzol and other by-products, such as naphthalene, tar, and lampblack. The products produced were distributed for commercial and residential use in the City of Portland. The synthetic oil gas was produced by the high temperature reaction of steam with naphtha oil.

A flow diagram describing the gas manufacturing and by-products process is shown in the Appendix, Figure 3. The manufacturing process continued until the 1950's when the petroleum gas production furnaces, faced with rebuilding and the advent of natural gas, were shut down and dismantled. The last full year of gas manufacturing was 1955; natural gas arrived in 1956, and Portland Gas and Coke (P.G.& C.) became Northwest Natural Gas Company in 1958.

Most of the old P.G.& C. facilities were razed in the 1960's, when construction of a liquefied natural gas plant was begun. One portion of the small tank farm was leased to Koppers Company, Inc., Organic Materials

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Division, which is still in use. A few large tanks near the riverbank were reconditioned and leased to Pacific Northern Oil. The remaining tanks and metal structures were sold for scrap. In the early 1970's, all the remaining structures except the old Administration Building were demolished. Underground piping was also removed. The Administration Building still remains and has been placed on the National Register of Historic Places.

Tar bottoms and spent oxide from the oil gas production processes were deposited at several locations on and off the P.G.& C. property during the years of P.G.& C.'s operation. Northwest Natural Gas has indicated in correspondence to the Oregon Department of Environmental Quality that two accumulations of process residue were present at the P.G.& C. site when the plant stopped manufacturing gas in 1955. One accumulation of residue was a pile containing 41,000 cubic yards (31,000 cu. meters) of spent oxide from the gas purification process. This pile was located near the north end of the P.G.& C. property.

The second accumulation of residue was a tar pond of about 30,000 cubic yards (23,000 cu. meters) located on the property upstream of the oxide pile. The pond was at the southeast corner of the P.G.& C. site in an area of low elevation that was particularly prone to flooding. This pond was formed as a result of a long accumulation of tar box and lampblack water overflow from the oil gas operations. Records at the Oregon Department of Environmental Quality indicate that oily residue from the open tar ponds may have leached into the Willamette River on a number of occasions.

A portion of the tar pond was located on property currently owned by Wacker Siltronic. This portion of the pond was located at what is now the junction of the Willamette River and the northwest property boundary of the Wacker property. Aerial photos and Northwest Natural Gas records indicate that this pond was eliminated in the late 1960's. The pond was apparently filled with overburden, and some of the tar material was forced onto the ground near the pond. The material was then consolidated by layering with additional overburden. Photographic records indicate that this

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consolidated material was spread over much of the northern corner of the Wacker site.

During razing and cleanup operations at the P.G.& C. site in the early 1970's, most of the spent oxide pile was hauled to the Scappoose, Oregon, landfill. At approximately the same time, the remaining tar pond, which was located on the P.G.& C. property, was filled with remnants of the spent oxide pile and overburden from the adjacent rock quarry, operated by the Jack Eatch Construction Company. The filled pond was then covered with additional overburden.

In addition to the tar bottoms which were deposited in the tar ponds, there is evidence that other material may have been deposited by P.G.& C. on the Wacker site. Refractory brick, evidentally from the P.G.& C. gas production furnaces, was found at the Wacker site during construction excavation activities. In addition, inspection of aerial photographs of the area suggest that a dark material was deposited at one of the higher elevations of the Wacker property in the late 1950's. (See Appendix, Photo 9).

Although the exact composition of the tar bottoms deposited on site is not known, they are generally assumed to be composed of poly-nuclear aromatic hydrocarbons (PAH's) such as naphthalene, phenolic compounds, and various long chain length organics. Some of these materials are of concern to the government regulatory authorities because of potential toxic characteristics.

Presently, the Northwest Natural Gas facility consists of a liquefied natural gas (LNG) storage and distribution facility.

Pennwalt

To the southeast of the Wacker Siltronic Plant and across the railroad berm is located the Pennwalt Corporation. The first record of the company at this location is in 1949 when it was known as the Pennsylvania Salt Manufacturing Company. The Pennwalt plant produces chlorine, caustic soda,

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sodium and potassium chlorate, hydrochloric acid, and ammonia. The basic raw material used by the plant is salt which is obtained from Baja, California, Mexico.

Although the Pennwalt plant is listed as a hazardous waste generator, the Oregon Department of Environmental Quality indicates that the only hazardous waste generated at the plant in the last five years was two drums of methylene chloride. Five surface impoundments exist on the plant site, close to the northwest boundary of the plant property. The impoundments are about 1,000 feet (300 meters) from the Wacker Siltronic plant site. Two impoundments are used for chlor-alkali production and have a pH of less than twelve. The impoundments are known to contain asbestos from old electrolytic cell casings. Two impoundments are used for waste from the sodium orthosilicate process. The pH in these impoundments is 10.9. One impoundment is used for brine sludge. The impoundment may contain heavy metals such as zinc, lead and chrome. The result of Environmental Protection Administration toxicity tests have shown the material to be non-hazardous.

All surface impoundments on the Pennwalt site are unlined and have no surface outlets. No groundwater monitoring is performed at the site.

Rhone-Poulenc/Chipman Chemical

Rhone-Poulenc is located southeast of the Wacker property, at the junction of N.W. St. Helens Road and the Burlington Northern Railroad line. The Rhone-Poulenc and Wacker sites are separated by the railroad tracks. The Rhone-Poulenc production facility is about 1,700 feet (520 meters) from the Wacker property boundary. The plant was known as Chipman Chemical/ Rhodia Agriculture Division until 1978 when it was named after its parent company, Rhone-Poulenc.

The Chipman Chemical plant began operation in 1948 as a liquid formulation plant and insecticide distribution warehouse. In 1956, a technical 2,4-D herbicide production plant began operation at Chipman and operated until 1982. Between 1956 and 1982, various other herbicides and

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insecticides have been produced at the site, including 2,4,5-T 2,4-DB, Silvex, MCPA, and MCPB. Presently, the only chemical manufactured at the plant is bromoxynil octanoate.

Prior to the mid-1960's, effluent from the Chipman Chemical plant was pumped to nearby Doane Lake. In 1964, a plant visitor's guidebook indicates that the plant suffered its first major water pollution incident. Water from the Chipman side of Doane Lake apparently passed through the railroad berm separating the lake. Vegetation in the north portion of the lake died over a short period of time. Water from the north lake passed into the Willamette River via a stream which ran along the edge of the old P.G.& C. property. Fisherman complained that salmon swimming near the plant site were tainted.

Since 1964, the plant has undertaken numerous measures to reduce the level of chemicals leaving the plant, including the shutdown of many of the production processes and addition of several treatment processes. Major cleanup activities at Doane Lake took place in 1966 and 1980.

The plant has conducted numerous investigations of the extent of pesticide contamination around the site. No chlorophenolic contamination was found in sediment and lake samples taken from Doane Lake north of the railroad mainline during 1980 investigations.

Rhone-Poulenc is conducting on-going groundwater investigations for pesticide contamination. Relatively high levels of chlorophenolic compounds have been detected in an area near the old 2,4-D production building. Lower levels of the compounds have been detected in other areas around the plant. Recently, low levels of chlorophenol compounds were detected in groundwater obtained at the Air Products industrial site east of Rhone-Poulenc. Rhone-Poulenc is considering the installation of several groundwater withdrawal wells for treatment of groundwater.

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ESCO Landfill

ESCO Corporation is a steel manufacturer located in Northwest Portland, which apparently used a location just southeast of the railroad berm for disposal of materials from their manufacturing process. The northwest boundary of the disposal landfill is contiguous to the railroad mainline which runs along Wacker's southeast property boundary. Material disposed of in the landfill included refractory, baghouse casting fines, spent mold material, and furnace slag from ESCO's steel casting operation. Most of the landfill has been filled over, except for an area near the Burlington Northern Railroad mainline. ESCO and the railroad are currently in dispute over the filling of this remaining part of the landfill.

Koppers Company, Inc.

In addition to leasing of chemical storage tanks on the Northwest Natural Gas site, Koppers operates a small chemical processing facility on the property. The plant receives coal tar by rail car and makes customized creosote and coal tar blends for wood treaters. Until the mid 1970's, the plant disposed of waste coal tar distillates in a disposal area close to the Wacker property boundary and N.W. Front Avenue. The area, which is approximately 40 feet x 70 feet (12 meters x 21 meters), is now surrounded by five (5) groundwater monitoring wells. Laboratory analysis of groundwater obtained from the wells in 1982 indicated phenol concentrations ranging from 0.12 to 24 mg./l (ppm).

Gould Battery

The Gould Battery site is located on N.W. Front Avenue approximately 1,400 feet (430 meters) from the Wacker property boundary to the southeast. The site was occupied for many years by a battery recycler, a subsidiary of National Lead Company. The site was acquired by Gould in 1979 and has subsequently been renamed GNB Battery. The battery facility is no longer active; refining was terminated in 1980. A large pile of more than 10,000 tons of battery casings was present on the site in the early 1980's. Gould

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Battery is currently undertaking measures to remove the old casings. The battery recycling facility also handled large quantities of lead wastes, disposing of them in ways that have not been determined. In 1973, the facility was cited for discharging wastewater to Doane Lake.

Hazardous substances of concern at the Gould Battery site include lead oxide dust in the air and lead contamination of surface and groundwater. Contamination of a shallow aquifer in the vicinity of Gould with lead has occurred at the level of 0.5 ppm. No contamination has been detected in the deeper aquifer in the vicinity of the Gould site. The lead in the shallow aquifer is thought to be bound to the clay in the aquifer and may be present for a considerable period of time.

RECENT WACKER SITE INVESTIGATIONS AND ACTIVITIES

Soil Borings

Three sets of soil borings have been conducted at the Wacker Siltronic site in preparation for various stages of construction activity. Soil borings made in 1977 and 1978 were primarily concentrated in the area of the present Wacker facilities near the Willamette River. These borings were located in the areas planned for the first phase of site development.

The third set of soil borings was made in 1982. These borings were made in anticipation of the planned construction of the polysilicon production facility. The southwestern part of the Wacker property is being contemplated for location of this facility.

Comments on a majority of the boring logs note the presence of subsurface oil or black organic material at depths ranging from ten to fifty feet (3 meters to 15 meters). A boring roughly corresponding to the location of tar ponds from the old Portland Gas and Coke Company showed oil saturation in a zone from twenty to fifty feet (6 to 15 meters) in depth. Most of the other borings show thinner zones of oil saturation or presence.

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Logs for the 1982 soil borings taken at the southwestern part of the site indicate strong hydrocarbon odors or oil at all but two borings. The northernmost borings indicate oil at depths as high as five feet (1.5 m.).

Clarifier Excavation/Oil Pipeline

Excavation for the construction of the water treatment portion of the present Wacker facility was started in March, 1979. During the excavation, large quantities of oil and water infiltrated the hole which was prepared for the future clarifier.

Investigative activities were initiated to discover and stop the source of the oil, which was interfering with the construction activity. A portion of the Olympic oil pipeline, which passes through an area immediately adjacent to the clarifier, was exposed during investigative digging. The exposed pipeline had numerous perforations and appeared to be the source of the fresh oil which was infiltrating the excavated hole for the clarifier. The holes in the pipe were patched and the treatment plant construction work proceeded as planned. The portion of the pipeline in the immediate vicinity of the clarifier was exposed and repaired.

The foregoing is a summary of the historical information assembled for this report relating to the Wacker Siltronic plant and the immediate surrounding area. An appendix follows containing figures, a chronology and photos showing changes on the property through the years.

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APPENDIX

1. Figure Showing Wacker Siltronic Plant and Surrounding Vicinity (1983).
2. Figure Showing History of Waste Management Areas Surrounding Wacker Siltronic Plant.
3. Portland Gas and Coke Company Gas Manufacturing and By-Products Flow Diagram.
4. Chronology of Activities - 1850 to 1984.
5. Photographic History of Wacker Site and Surrounding Vicinity.

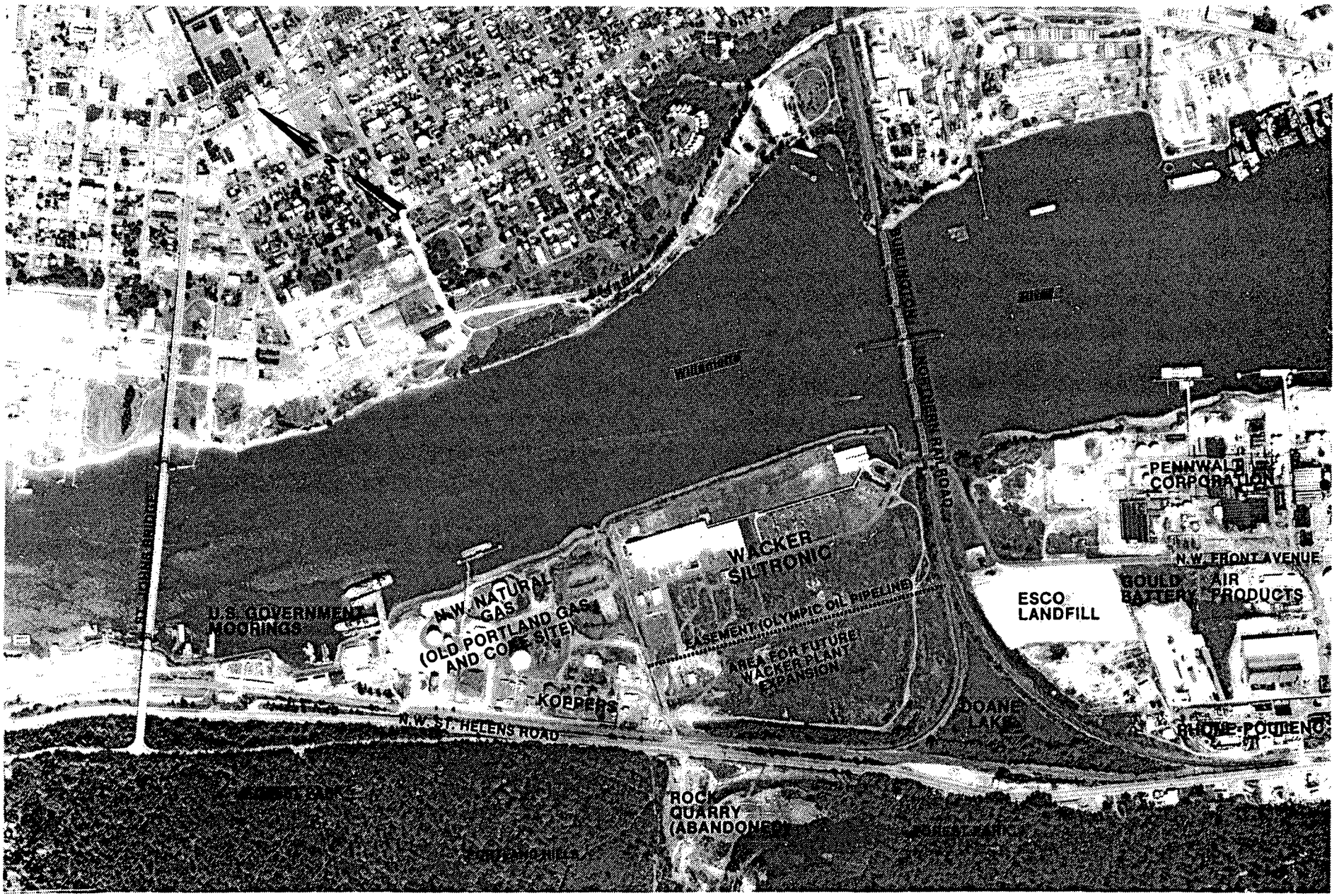


Figure 1 **WACKER SILTRONIC PLANT AND SURROUNDING VICINITY (1983)**

SCALE: 1" = 940 FEET (1 cm : 110 m)

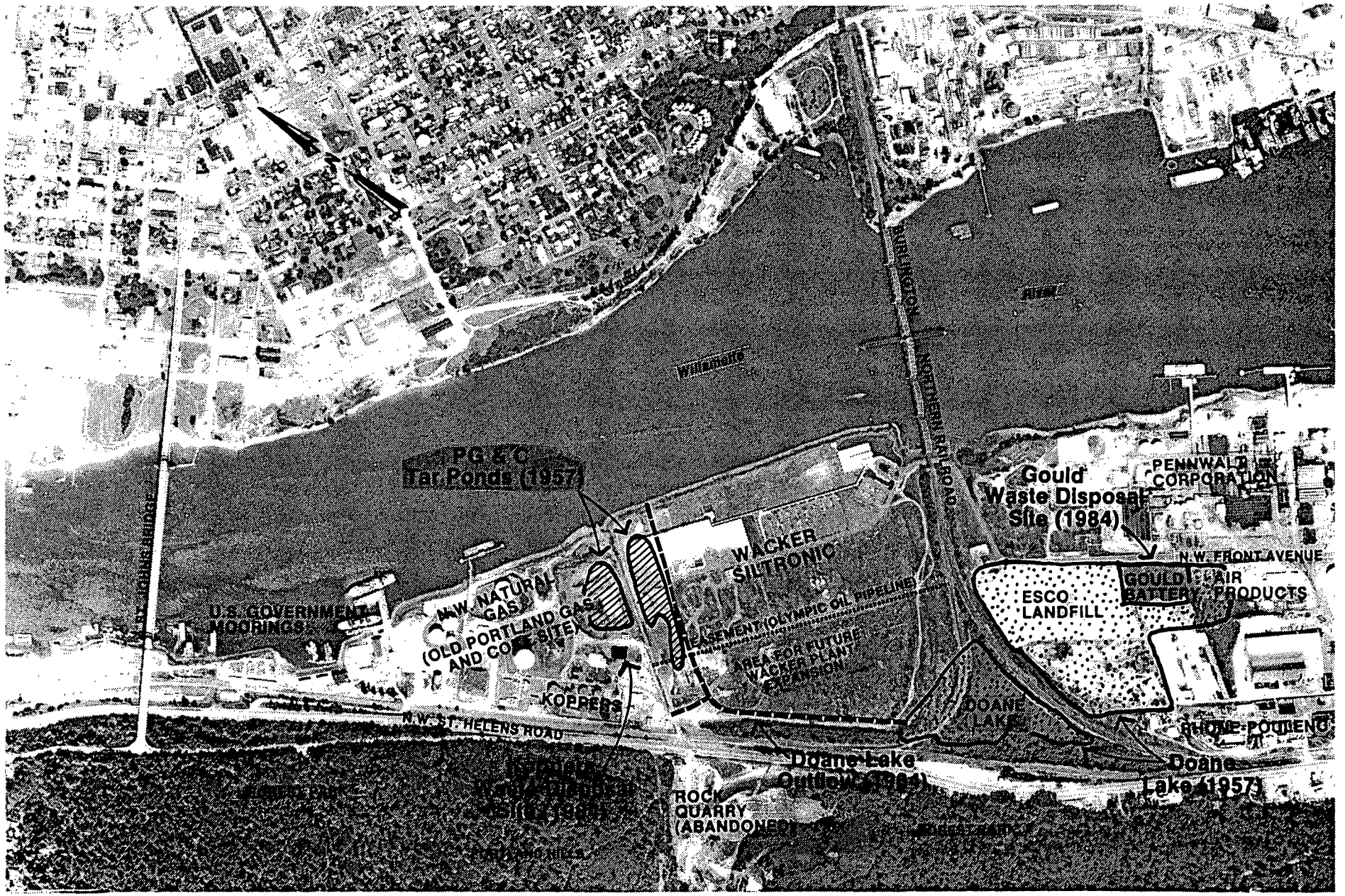
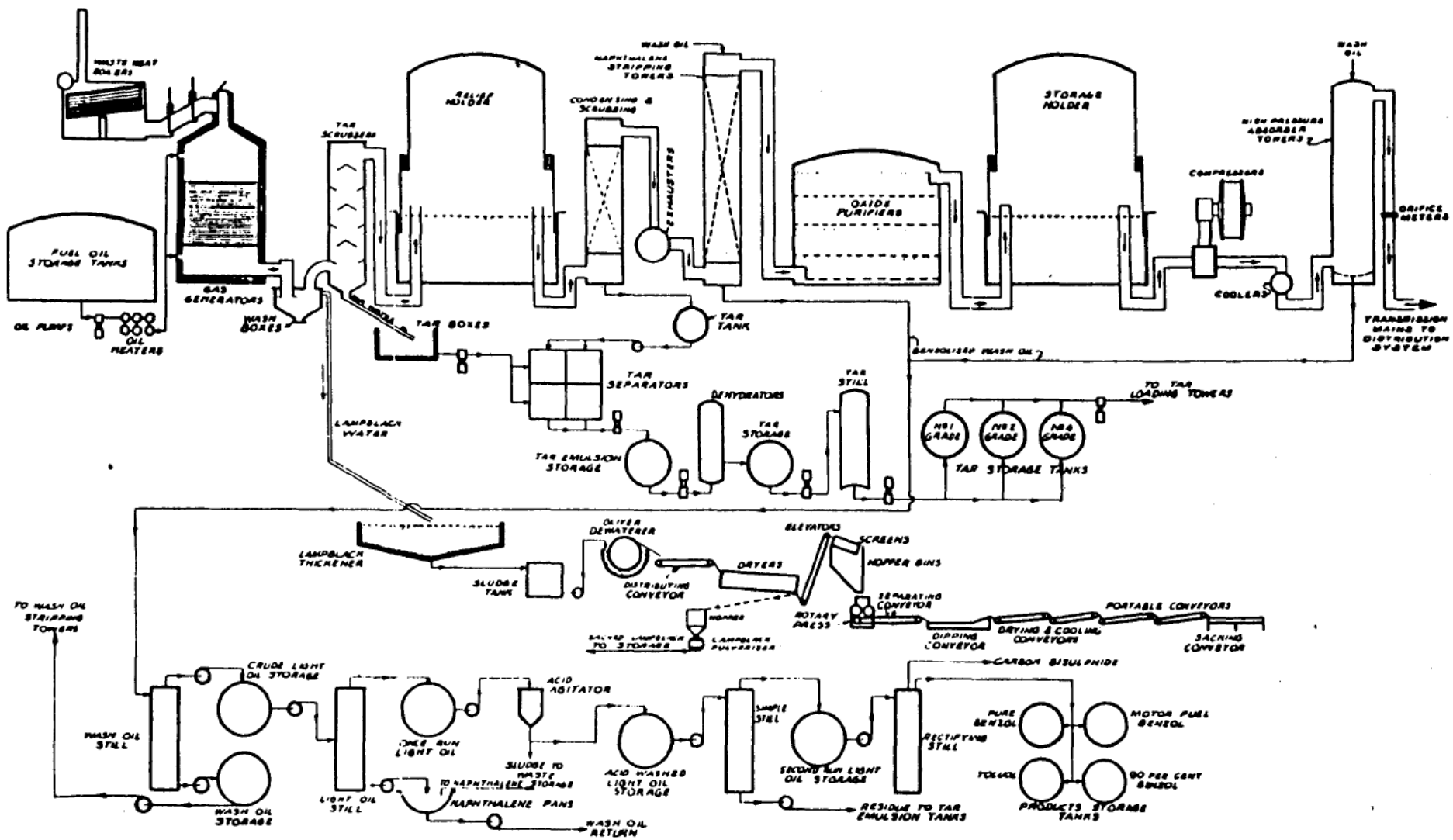


Figure 2 **WACKER SILTRONIC PLANT HISTORIC WASTE MANAGEMENT AREAS**

SCALE: 1" = 940 FEET (1 cm : 110 m)



PORTLAND GAS & COKE COMPANY

GAS MANUFACTURING & BY PRODUCTS FLOW DIAGRAM

Figure 3

CHRONOLOGY OF ACTIVITY INCLUDING DESCRIPTION OF PHOTOS: NORTHWEST ST. HELENS ROAD BETWEEN THE BURLINGTON NORTHERN RAILROAD BRIDGE AND ST. JOHNS BRIDGE

1850	Act to create Office of Surveyor General of Public Lands in Oregon to provide for survey and donation of land to settlers.
1852 (Photo 1)	St. Johns ferry begins operation connecting the eastern and western banks of the Willamette River.
1866	Claim was officially recorded awarding the land to Elizabeth Doane and the heirs at law of Milton Doane, deceased.
1898	Astoria & Columbia River Railroad completed linking Portland and Astoria.
1903-1905	U.S. Government Moorings purchases approximately 6 acres (2.5 hectares) land near present location of St. Johns Bridge.
1908	Double track railroad bridge across Doane Lake and the Willamette River completed.
1913 (Photo 2)	Portland Gas and Coke begins operation. (Notice U.S. Moorings north of P.G.& C. and vacant land to the south).
1915	Area annexed to City of Portland.
1931	St. Johns Bridge completed.
1936 (Photo 3)	First available photograph showing two bridges, U.S. Moorings, Portland Gas & Coke, vacant wooded property, and Doane Lake split by railroad (Note the docks off vacant property in river).
1940 (Photo 4)	Some filling has been done by Portland Gas & Coke adjacent to the south of their facility.
1940	U.S. Government Moorings purchases additional 5 acres (2 hectares).
1948 (Photo 5)	Area is flooded by Vanport Flood; notice flooding of U.S. Moorings, Portland Gas & Coke and the undeveloped property. Pennwalt has begun operation.

1949	(Photo 6)	Photo looking northwest at Portland Gas & Coke with undeveloped site in foreground.
1952	(Photo 7)	Photo looking south at Portland Gas & Coke; standing water on eastern edge of P.G.& C.; Doane Lake visible adjacent to railway tracks; rock quarry in middle of photo on west side of St. Helens Road.
	(Photo 8)	Photo looking north to St. Johns Bridge; notice berm for water flow in foreground forming boundary of pond.
1955		Last full year of gas production at Portland Gas & Coke facility.
1957	(Photo 9)	Holding pond of P.G.& C. is visible in center of photograph with little water in it; dirt roadway visible through undeveloped property.
1961	(Photo 10) (Photo 11)	Logging of portion of undeveloped property has occurred.
1964	(Photo 12)	Rosenfeld and Anderson purchased portion of undeveloped property from railroad and Northwest Natural Gas Company in 1962, and a portion was transferred to Schnitzer in 1964.
1967	(Photo 13)	Aerial; undeveloped site has been completely logged; filling appears to have begun.
1969	(Photo 14)	Portions of Portland Gas & Coke facility have been removed; undeveloped site is logged.
1973	(Photo 15)	Fill and grading done on undeveloped site; portion of Doane Lake on northern side of railroad filled; shore line along undeveloped property straightened; Portland Gas & Coke facility completely removed.
1974		Undeveloped site filled with 695,522 yards (530,933 cu. meters) of dredge material by Port of Portland.
1977	(Photo 16)	Undeveloped site filled and graded.
1978		Undeveloped site purchased by City of Portland.
1978	(Photo 17)	Site development and construction of Wacker plant started.
1980		Wacker plant begins operation.

SCOEPA00004097

1984	(Photo 18)	Color photo looking southeast from St. Johns Bridge.
	(Photo 19)	Color photo of view of Wacker Siltronic Plant.

SCOEPA00004098

STATE OF OREGON

INTEROFFICE MEMO

TO: Gary Calaba

DATE: August 9, 1984

FROM: CHGray

SUBJECT: HW - Northwest Natural Gas
Preliminary Assessment
Multnomah County

The old Portland Gas & Coke Company produced oil and gas by gasification of oil with steam. The tar bottoms were disposed on-site. This operation started sometime in the 1880's and terminated in 1956 when they converted to importing liquified natural gas.

The tar bottoms are covered with at least 10 feet of soil cover. Exact locations of disposal are unknown. The site is next to the Willamette River. The shallow alluvial aquifer (approximately 10 feet deep) discharges to the Willamette River.

The Wacker Siltronics plant was built on top of part of the fill. During excavation for the plant site, oil sheen were encountered.

The presence of the tar bottoms due to their location and age pose a low threat to the environment. I do not feel any further investigation is warranted.

Please note letter from Northwest Natural Gas regarding their knowledge of the site. Their NPDES permit issued in 1974 has required oil and grease sampling from the stormwater pond. Up until 1981 it was weekly and was changed to monthly. They have consistently operated within those oil and grease effluent limitations.

/emc

01-125-1307

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
NORTHWEST NATURAL GAS CO.	7900 N.W. ST. HELENS RD.

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST
PORTLAND	OR	97203	MULTNOMAH		

09 COORDINATES LATITUDE ___ ___ ___.___ LONGITUDE ___ ___ ___.___

10 DIRECTIONS TO SITE (Starting from nearest public road)
NORTH ON N.W. ST. HELENS RD., TAKE DRIVEWAY ON RIGHT JUST BEFORE YOU GO UNDER ST. JOHNS BRIDGE. STAY TO RIGHT ON DRIVEWAY.

III. RESPONSIBLE PARTIES

01 OWNER (If known)	02 STREET (Business, mailing, residential)
WACKER SILTRONIC CORPORATION	7200 N.W. FRONT AVE.

03 CITY	04 STATE	05 ZIP CODE	06 TELEPHONE NUMBER
PORTLAND	OR	97203	(503) 243-2020

07 OPERATOR (If known and different from owner)	08 STREET (Business, mailing, residential)
NORTHWEST NATURAL GAS CO.	202 N.W. 2nd AVE.

09 CITY	10 STATE	11 ZIP CODE	12 TELEPHONE NUMBER
PORTLAND	OR.	97209	(503) 226-4211

13 TYPE OF OWNERSHIP (Check one)
☒ A. PRIVATE ☐ B. FEDERAL: _____ (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER: _____ (Specify) ☐ G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE (Check all that apply)
☐ A. RCRA 3001 DATE RECEIVED: ___/___/___ (MONTH DAY YEAR) ☐ B. UNCONTROLLED WASTE SITE (CERCLA 103 c) DATE RECEIVED: ___/___/___ (MONTH DAY YEAR) ☐ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION
☒ YES DATE 6, 20, 84 (MONTH DAY YEAR)
☐ NO

BY (Check all that apply)
☐ A. EPA ☐ B. EPA CONTRACTOR ☒ C. STATE ☐ D. OTHER CONTRACTOR
☐ E. LOCAL HEALTH OFFICIAL ☐ F. OTHER: _____ (Specify)
CONTRACTOR NAME(S): _____

02 SITE STATUS (Check one)
☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN

03 YEARS OF OPERATION
1889 (BEGINNING YEAR) | 1956 (ENDING YEAR) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED
TAR BOTTOMS FROM GASIFICATION OF OIL WITH STEAM

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION
LOW POTENTIAL HAZARD TO THE ENVIRONMENT AND THE PUBLIC. LOCATION DOES NOT POSE THREAT TO MUNICIPAL WATER SOURCE OR PRIVATE SOURCES.

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)
☐ A. HIGH (Inspection required promptly) ☐ B. MEDIUM (Inspection required) ☐ C. LOW (Inspection time available basis) ☒ D. NONE (No further action needed, complete current disposition form)

VI. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NUMBER
WILLIAM GIBBS	NORTHWEST NATURAL GAS CO.	(503) 226-4211

04 PERSON RESPONSIBLE FOR ASSESSMENT	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NUMBER	08 DATE
CHARLES GRAY	DEQ	STATE OF OR.	(503) 229-5288	7, 30, 84 (MONTH DAY YEAR)

EPA FORM 2070-12 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- ☐ A. SOLID
- ☐ B. POWDER, FINES
- ☐ C. SLUDGE
- ☐ D. OTHER _____ (Specify)
- ☐ E. SLURRY
- ☐ F. LIQUID
- ☐ G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS _____

CUBIC YARDS _____

NO. OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

- ☐ A. TOXIC
- ☐ B. CORROSIVE
- ☐ C. RADIOACTIVE
- ☐ D. PERSISTENT
- ☐ E. SOLUBLE
- ☐ F. INFECTIOUS
- ☐ G. FLAMMABLE
- ☐ H. IGNITABLE
- ☐ I. HIGHLY VOLATILE
- ☐ J. EXPLOSIVE
- ☐ K. REACTIVE
- ☐ L. INCOMPATIBLE
- ☐ M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

SITE VISIT; INTERVIEW WITH BILL GIBBS; DEQ FILES, NW NATURAL GAS FILES.

EPA FORM 2070-12 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ B. SURFACE WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ C. CONTAMINATION OF AIR
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ E. DIRECT CONTACT
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ F. CONTAMINATION OF SOIL
03 AREA POTENTIALLY AFFECTED: _____ (Acres)
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ G. DRINKING WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ H. WORKER EXPOSURE/INJURY
03 WORKERS POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ I. POPULATION EXPOSURE/INJURY
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

EPA FORM 2070-12 (7-81)

HW 7.20

INVENTORY-POSSIBLE SOURCES OF HAZARDOUS WASTE

****

EPA NUMBER: _____ NPDES#: _____
SIC CODE BEG: _____ SIC CODE END: _____ BASIN CODE: _____
STATE: Oregon COUNTY: Multnomah CO CODE: _____

NAME: Northwest Natural Gas
OWNER:
ADDRESS: Wacker and Koppers property ZIP:
CONTACT: Duane Foley PHONE: 226-4211

LOCATION: Portland, Oregon (see map attached)
TOWNSHIP: 1N RANGE: 1E SECTION: 13
USGS MAP NAME: Linnton, Oregon

BUSINESS TYPE

Mfg oil gas from petroleum ended '50s. Now storage facilities

WASTE TYPES

Tars, naphthalenes

DISPOSAL ACTIVITIES

On-site fill

PERIOD OF OPERATION: 1880's - 1950's

HISTORY OF SITE OR PLANT OPERATION

The site covered what is now Wacker and Koppers. The plant manufactured oil gas by the ~~cracking petroleum~~ in brick retorts. There was a benzene plant on the present Koppers area.

Heat obtained by burning oil in same retort
Ref. I.E.C. 21, 1041 (1929)

DETAILS OF WASTE CHARACTERISTICS, VOLUMES AND DISPOSAL OPERATION

Tar bottoms were disposed on-site including filling of Doane Lake. The more liquid material was ponded. It is believed (R. Gitschlag) that there may be 10 to 20 ft of tar over a good deal of the site that has been covered by about 10 feet of fill. A pipe draining the Wacker property (to river just west of RR bridge) shows an oil sheen.

SIC CODES

SCOEPA00004103

INVENTORY-POSSIBLE SOURCES OF HAZARDOUS WASTE

****

EPA NUMBER: _____

WASTE CHARACTERISTICS

IGNITABLE:				SOLID:	X
CORROSIVE:		RADIOACTIVE:		SEMI-SOLID:	X
REACTIVE:		INFECTIOUS:		LIQUID:	X
TOXIC:	X	OTHER:		GASEOUS:	

TOTAL WASTE QUANTITIES

VERY LARGE AMOUNT:	X		COUNTED:	
LARGE AMOUNT:		AMOUNT OF WASTE	ESTIMATED:	
SMALL AMOUNT:			REPORTED:	
VERY SMALL AMOUNT:		TONS,YDS,BBL,ETC	MEASURED:	

WASTE DISPOSAL

REGULATORY CONTROLS: *None*

WASTE TRANSPORTED TO SITES #: _____

WASTE DISPOSED INTO SEWER SYSTEM: *None*

WASTE DISPOSED IN EFFLUENT: _____

WASTE DISPOSED OF ON SITE: *All*

ON SITE DISPOSAL

INCINERATION:		LAND SPREADING:	
SURFACE STORAGE:	X	BURIAL:	X
WELL INJECTION:		OTHER:	

SITE CONDITIONS

GEOLOGIC SETTING

Fill over old lake bed

HYDROLOGIC CONDITIONS

DISTANCE OF LAKE OR MARINE WATER: _____

DISTANCE TO SURFACE STREAM: *Adjacent to Willamette River*

DEPTH TO GROUNDWATER: *5 to 10 feet*

DISTANCE TO WELLS OR SPRINGS: _____

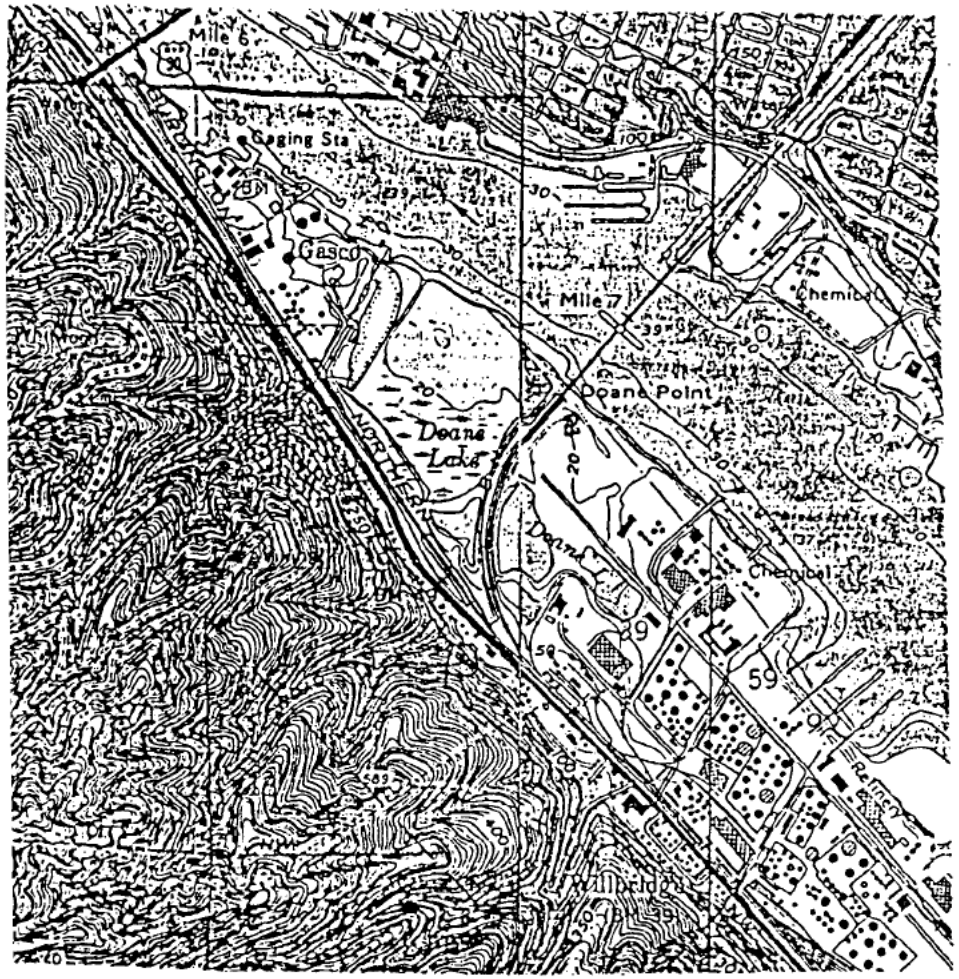
DISTANCE TO NEAREST RESIDENCE: _____

USE OF SITE IF ABANDONED: *New plant site, empty lot*

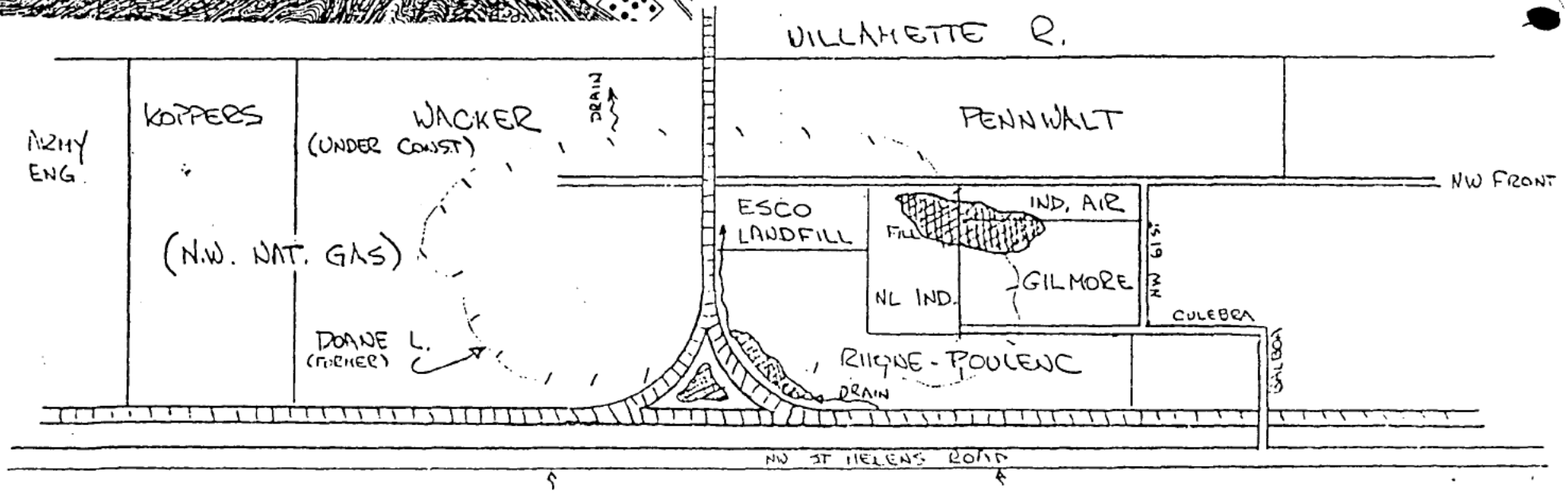
PHYSICAL CONTROLS AT SITE

SOURCES OF INFORMATION: *Dick Gitschlag, Rhone-Poulenc, plant mgr. site visit 8/17/79.*

COMPILER: *Fred Bromfeld* DATE: *August 20, 1979*



DOANE LAKE AREA



SUGGEST FOLLOW-UP

Doane Lake Area

1. It was originally thought that this area consisted of two lakebeds, Doane (east) and Giles (west), created from the old Doane Lake as a result of constructing the railroad bed in 1910. The recognition of Giles Lake as a separate entity, however, never came into common usage and it is not generally referred to on maps. As such, we shall refer to this area simply as Doane Lake.

   This will also avoid confusion with the Guilds Lake area about two miles to the S.E.

2. Almost the entire lake has been covered with 5 - 10 ft. of fill. The area, however, is a natural sump and the water table is only about 5 ft. below the surface. During a wet winter it may surface in some areas. The old Doane Lake fluctuated about 5 ft. in depth.

TRANSFER OF FUNDS
7/16/78

DISPOSITION AND DEVELOPMENT AGREEMENT

THIS AGREEMENT is entered into as of this 26th day of May, 1978, by and between THE CITY OF PORTLAND, acting by and through THE PORTLAND DEVELOPMENT COMMISSION as the duly designated urban renewal agency of the City of Portland ("Agency") and WACKER CHEMICAL CORPORATION and WACKER SILTRONIC CORPORATION (jointly "Developer"). The Agency and the Developer agree as follows:

I. [§ 100] SUBJECT OF AGREEMENT

A. [§ 101] Purpose of the Agreement

The purpose of this Agreement is to effectuate the Urban Renewal Plan (the "Urban Renewal Plan"), for the Northwest Front Avenue Industrial Renewal Project (the "Project"), by providing for the disposition and development of certain hereinafter described portions of the Project area (the "Site"). The development of the Site pursuant to this agreement, and the fulfillment generally of the Agreement are in the vital and best interests of the City of Portland and the health, safety, morals and welfare of its residents, and in accord with the public purposes and provisions of applicable laws and requirements.

B. [§ 102] The Urban Renewal Plan

This Agreement is subject to the provisions of the Urban Renewal Plan which was approved and adopted on May 11, 1978 by the City Council of the City of Portland by Resolution No. 32099. The Urban Renewal Plan is incorporated herein by reference and

SCOEPA00004107

III. No building or other construction within the easement rea reserved, except for paved streets and parking areas and pipe-ines, which would interfere with the operation or maintenance of pproved existing or future utilities, shall be allowed.

IV. Reasonable access to the easement area shall be pro-ided to the owners of the various authorized existing and future tilities for construction and/or maintenance thereof. Owners shall rovide advance notice of their requirement for access (except in ase of emergency) and shall abide by the rules of the Developer pplicable to all persons on the Site.

V. The owner of each authorized utility, after initial onstruction or subsequent maintenance, shall at its expense, restore he ground surface disturbed in the easement area to a condition as xisted prior to such initial construction or maintenance. In ddition, each such owner shall be responsible for any damages esulting from its use of the easement.

VI. The permit for an existing overhead 10,000 ± KV power ine now owned by Portland General Electric Company and located within he easement area shall be revoked (except that portion where it rosses the S P & S Co. right-of-way).

VII. The provisions of paragraphs III, IV and V above hall apply to the storm sewer easements referred to in Section 202 f the Agreement of which this Attachment No. 3 is a part.

Construction

The Agency is deemed the beneficiary of the terms and provisions of this Agreement and of the covenants running with the land. Both for and in its own right and for the purpose of protecting the interests of the community and other parties, public or private, in whose favor and for whose benefit this Agreement and the covenants running with the land shall have been provided. The Agreement and the covenant shall run in favor of the Agency without regard to whether the Agency has been, remains, or is an owner of any land or interest therein in the Site or in the Project Area. The Agency shall have the right, if the Agreement or covenants are breached, to exercise all rights and remedies, and to maintain any actions or suits at law or in equity or other proper proceedings to enforce the curing of such breaches to which it or any other beneficiaries of this Agreement and covenants shall be entitled, such remedies to be exercised in accordance with § 501 through § 512 of this Agreement.

E. [§ 405] Effect of Violation of Certain Terms of This Agreement By Agency

Except as provided in § 511, the Developer shall have the right, if the Agency fails to perform its obligations under § 307, or to issue its Certificate of Completion, in accordance with the terms of this Agreement to exercise all rights and remedies, including, without limitation, the remedy of specific performance, and to maintain any actions or suits at law or in equity or other proper proceedings to enforce the curing of such

is sent to the other party more than thirty (30) days after the commencement of the cause, the period shall commence to run only thirty (30) days prior to the giving of such notice. Times of performance under this Agreement may also be extended in writing by the Agency and the Developer.

VII. [§ 700] SPECIAL PROVISIONS

A. [§ 701] Right of Agency to Repurchase Undeveloped Portion of Site

Developer anticipates further development of the Site within ten (10) years from the date of acquisition. In the event Developer proposes to sell or transfer any undeveloped portion of the Site prior to January 1, 2008, Developer shall give written notice to the Agency of such intent and the Agency shall have the first right to acquire such property at a purchase price of Fourteen Thousand Dollars ($14,000.00) per acre plus eight (8%) percent compounded annually for the period between the time of acquisition by Developer and reacquisition by the Agency. If the Agency does not exercise its right to acquire such property within forty-five (45) days after receipt of notice of intent from the Developer, Agency's right to acquire such property shall terminate. The Developer shall have the right to mortgage all or part of the Site at any time for improvements to be constructed on the Site including, without limitation, the financing of equipment, spare parts and inventories to be used on the Site, but in the event of reconveyance to the Agency, a partial release of the mortgage or other security interest shall be obtained by the Developer of the portion of the Site reconveyed to the