FINAL WORK PLAN FOR REMEDIATION OF LOCATIONS IN GRANITE CITY, MADISON, AND VENICE, ILLINOIS, ASSOCIATED WITH NL INDUSTRIES/ TARACORP SUPERFUND SITE

RAPID RESPONSE CONTRACT NO. DACW45-89-D-0516
DELIVERY ORDER NO. 58

Submitted to:

United States Army Corps of Engineers
Omaha, Nebraska

Submitted by:

OHM Remediation Services Corp.
a subsidiary of

OHM Corporation

February 16, 1993
Project 13407

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Dale Krageschmidt

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TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

1.1 SITE HISTORY 1-1
1.2 DESCRIPTION 1-2
1.3 PROJECT OBJECTIVES 1-2

2.0 SCOPE OF WORK 2-1

2.1 WORK PLAN DEVELOPMENT 2-2
2.2 SITE ADMINISTRATION/LOGISTICAL SUPPORT 2-2
2.3 MOBILIZATION/DEMOBILIZATION 2-3
2.4 SITE PREPARATION AND TEARDOWN 2-3
2.5 EXCAVATION OF CONTAMINATED SOILS AND RESTORATION OF SITES 2-4
2.6 SAMPLING AND ANALYSIS 2-6
2.7 TRANSPORTATION AND DISPOSAL 2-7
2.8 FINAL PROJECT REPORT 2-7

TABLE 2.1, DATA SUPPLIED BY USACE 2-5

3.0 TECHNICAL APPROACH 3-1

3.1 SCHEDULE MONITORING AND CONTROL 3-1
3.2 PRECONSTRUCTION ACTIVITIES 3-5
3.3 CONSTRUCTION ACTIVITIES 3-5
3.4 WASTE TRANSPORTATION AND DISPOSAL 3-9

FIGURE 3.1, PROPOSED PROJECT SCHEDULE 3-2

FIGURE 3.2, PROPOSED PROJECT SCHEDULE LOGIC DIAGRAM 3-4

4.0 SUBCONTRACTOR MANAGEMENT 4-1

5.0 PROJECT TEAM AND ORGANIZATION 5-1

EXHIBIT I - WOODWARD-CLYDE SAMPLE/ANALYTICAL INFORMATION

APPENDIX A - CONTRACTOR SAMPLING AND ANALYSIS PLAN

APPENDIX B - SITE-SPECIFIC HEALTH-AND-SAFETY PLAN

1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE) has tasked OHM Remediation Services Corp. (OHM), a wholly owned subsidiary of OHM Corporation, under the Rapid Response Contract No. DACW45-89-D-0516, Delivery Order No. 58, to perform removal of hard rubber battery case material at various locations associated with the NL Industries/Taracorp Superfund Site (NL Site) in Granite City, Madison, and Venice, Illinois.

This final work plan (WP) is intended to detail the methods which will be employed to perform the work. This WP includes a discussion of the scope of work in Section 2.0 and OHM's technical approach in Section 3.0. Section 4.0 discusses OHM's subcontractor management plan. OHM's project team and organization is presented in Section 5.0. The Contractor's Sampling and Analysis Plan (CSAP) is included as Appendix A and the Site-Specific Health-and-Safety Plan is included as Appendix B.

1.1 SITE HISTORY

The NL Site includes the NL Industries/Taracorp Plant, a former secondary lead smelting operation located at 16th Street and Cleveland Boulevard in Granite City, Illinois. Prior to 1903, the plant included various smelting related equipment and processes. From 1903 to 1983, secondary lead smelting occurred on site. These activities were discontinued during 1983 and the equipment dismantled.

In July 1981, St. Louis Lead Recyclers, Inc. (SLLR) began using equipment on adjacent property owned by Trust 454 to separate components of the Taracorp waste pile. The objective was to recycle lead bearing materials to the furnaces at Taracorp and send hard rubber off site for recycling. SLLR continued operations until March 1983 when it shut down its equipment. Residuals from the operation remain on Trust 454 property as does some equipment.

A State Implementation Plan for Granite City, Illinois, was published in September 1983 by the Illinois Environmental Protection Agency (IEPA). The IEPA's report indicated that the lead nonattainment problem for air emissions in Granite City, Illinois, was in large part due to emissions associated with the operation of the secondary lead smelter operated by Taracorp and lead reclamation activities conducted by SLLR. The IEPA procured Administrative Orders by Consent with Taracorp, SLLR, Stackorp, Inc., Tri-City Truck Plaza, Inc., and Trust 454 during March 1984. The orders required the implementation of remedial activities relative to air quality.

NL Industries as former owner of the location, voluntarily entered into an Agreement and Administrative Order by Consent with the United States Environmental Protection Agency (USEPA) and IEPA in May 1985 to implement a Remedial

Investigation/Feasibility Study (RI/FS) for the location and other potentially affected areas. Taracorp was not a party to the agreement due to the fact that it filed for bankruptcy. The USEPA determined that the location was a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) facility and it was placed on the National Priorities List on June 10, 1986.

1.2 DESCRIPTION

This action requires the excavation and disposal of fill material placed in alleys, parking lots, driveways, and yards in residential communities. The communities include Granite City, Madison, and Venice, Illinois. The Record of Decision (ROD) established the action levels for this project at 500 parts per million (ppm) of lead for residential areas and visibly clean for driveways, alleys, etc. Following the removal of the contaminated material, the impacted areas will be restored. This restoration will include sodding the yards and paving the alleys, driveways, and parking lots.

1.3 PROJECT OBJECTIVES

The objectives of this field effort are to excavate any visible lead battery casings and slag and confirm that all contaminated soils have been removed to the action level of 500 ppm. Investigative sampling has been performed by Woodward-Clyde Consultants (WOODWARD-CLYDE) and reported in the WOODWARD-CLYDE Draft Final Report, NL/Taracorp Superfund Site, Granite City, Illinois, October 1992. Data summary information from the WOODWARD-CLYDE report is included as Exhibit I to this work plan. Quantity determinations used for estimating amounts and costs of hazardous and nonhazardous materials for unearthing and disposal are based on the WOODWARD-CLYDE report. Based on the initial study, the areas of excavation have been generally defined. OHM will follow the direction of the USEPA on-site representative to determine the limits of the excavation(s). OHM will incorporate X-Ray Fluorescence (XRF) screening to assist in the removal action. After the material has been excavated, an estimated 176 confirmatory samples will be collected. Samples of the excavated material will be obtained to determine appropriate disposal options.

The type of data needed to meet the project objectives will be generated through the installation of hand auger soil borings. The analyses required to meet the project objectives are total lead using SW-846 Methods 3050/7421 and Toxicity Characteristics Leachate Procedure (TCLP) Resource Conservation and Recovery Act (RCRA) metals using SW-846 Methods 1311/6010 and 7000 Series methods. Six TCLP samples, one from each nonhazardous site will be collected. In addition, 205 lead only TCLP composite samples, one composite sample from each stored truck load, will be collected and analyzed for TCLP lead. One sample of the backfill will be analyzed for volatile and semivolatile organics, pesticides, and RCRA metals.

The cleanup criteria outlined in the ROD dated March 30, 1990, as defined by the USEPA, requires the removal of all visual contamination from the alleyways, driveways, etc., and a cleanup criteria of 500 ppm of lead for the residential locations.

2.0 SCOPE OF WORK

This section has been prepared based upon the scope of work delineated by the document provided to OHM by USACE entitled:

FINAL SCOPE OF WORK FOR
CONTRACT NO. DACW45-89-D-0516
DELIVERY ORDER NO. 58
RAPID RESPONSE
NL INDUSTRIES/TARACORP
GRANITE CITY, ILLINOIS
NOVEMBER 17, 1992

The scope of work in general encompasses the following tasks:

- Work plan development
- Site visit
- Site administration
- Mobilization/demobilization
- Site preparation and teardown including the setup and teardown of decontamination facilities, support equipment trailers, clearing and grubbing of brush, paving, and landscaping
- Excavation of contaminated soils and restoration of contaminated areas
- Sampling and laboratory analysis as necessary to procure proper disposal of wastes
- Storage of nonhazardous wastes for classification and authorization for disposal as an IEPA special waste
- Transportation and disposal of hazardous and special wastes
- Final project report

2.1 WORK PLAN DEVELOPMENT

The project work plan describes how the work will be performed according to the scope of work as delineated by USACE and environmental, industrial standard, and health-and-safety requirements.

The work plan also consists of a CSAP, included as Appendix A. The Site-Safety and Health Plan (SSHP) is included as Appendix B. Site-Specific Advance Agreements (SSAA) are included with the cost proposal submitted under separate cover.

Prior to preparation of this work plan, a site visit was made on September 22, 1992. Representatives from WOODWARD-CLYDE, USACE, and OHM met for this site visit and toured each location. After the tour a telecommunication conference was conducted with USEPA Region V, IEPA, and tour participants to discuss remediation strategies and expectations.

The information provided by the site visit, previous characterization work performed by WOODWARD-CLYDE, and the scope of work provided by USACE served as the basis for the preparation of this work plan and associated documents.

2.2 SITE ADMINISTRATION/LOGISTICAL SUPPORT

Prior to full-scale mobilization to the location, logistical preparation activities will be performed. These activities are expected to include:

- Preconstruction meeting
- Arrange for waste hauling licenses
- Meet with property owners
- Locate utilities at each property
- Establish transportation routes between each property and support area
- Coordination with local agencies and hospital, including Brett Hanke, Granite City, Illinois, Engineer; Tyrone Echols, Mayor of Venice, Illinois; and Eddie Salmond of Eagle Park Acres prior to excavation for coordination and information regarding city ordinances, load limits, etc.

The project site administration will be centrally established at the former USACE maintenance facility. Site administrative activities performed from this location will include:

- Site supervision
- Cost tracking/reporting
- Health and safety
- Waste tracking/documentation
- Field sampling/analytical support
- Field purchasing/subcontract management
- Logistical support

2.3 MOBILIZATION/DEMOBILIZATION

This task involves the actual transportation of personnel, equipment, materials, and other resources to and from the project site. A majority of the personnel and equipment will be mobilized at the beginning of the project and demobilized at the end of the project. This is especially true for the supervisory/administrative personnel and the support equipment such as vehicles and decontamination/office trailers. Most personnel and equipment will be mobilized from OHM's St. Louis, Missouri, division. Subcontractor mobilization and demobilization will be managed by the OHM project manager in close conjunction with site supervisory and USACE identified site-specific needs.

All necessary permits and licenses will be secured before site mobilization. The only permit needed for this project is a waste hauling license on each truck transporting waste in Madison County. The one-time $50.00 per truck fee and license will be arranged by OHM. The transporter companies and disposal facilities will be USEPA licensed operations. Also, prior to mobilization, all on-site employees will have completed Occupational Safety and Health Administration (OSHA) 40-hour hazardous materials training.

2.4 SITE PREPARATION AND TEARDOWN

The command post/project on-site office and equipment staging area will be set up at the former USACE maintenance facility. The USACE-owned location has been chosen for its security, accessibility, and storage area attributes. The area will be fenced with a locking gate. This area is in a location accessible to all of the work areas and has sufficient office and equipment storage space.

For security reasons the machinery used for excavation will be moved to the USACE site at the close of business each day. The machines will be driven to the edge of the contaminated zone, scraped clean to remove gross contamination, and loaded on a lowboy trailer. Once the machine is loaded on the trailer, the tires or tracks will be

wrapped in visqueen to keep from contaminating clean ground or roadways. The bucket of the machine will also be wrapped before transport. If equipment is left on site during the off shift, a watchman will be retained for surveillance.

While loading materials for disposal or stockpiling, the tires of the trucks may come in contact with contaminated material. When this occurs a portable decontamination pad will be utilized. It will be set up at the exit point and the tires will be sprayed off with a high-pressure water laser as the vehicle exits the site. The decontamination rinsate will be collected and will be applied to contaminated soil as it is loaded into containers as a dust control measure.

At the conclusion of the project all equipment used on the site will be decontaminated before demobilization. Portable decontamination pads will again be used. Gross contamination will be scraped from the machines prior to being washed with a high-pressure water laser. The decontamination rinsewater will be collected and will be applied to the last loads of contaminated soil as a dust control measure.

2.5 EXCAVATION OF CONTAMINATED SOILS AND RESTORATION OF SITES

The 16 locations are quite variable in area and depth of excavation. Table 2.1 lists estimated volumes and depths of excavation based on information supplied by USACE Statement of Work, Appendix G. Exhibit I provides the data obtained for the WOODWARD-CLYDE "Draft Final Report, NL/Taracorp Superfund Site, Granite City, Illinois, October 1992," which provides sample locations, depths, and analytical results.

The excavation techniques employed at each location will vary according to location accessibility and the depth and extent of material to be removed. Minimization of disturbances to adjoining properties/areas will also be a key consideration in performing each excavation. OHM anticipates using tracked excavators, backhoes, Bobcats, and manual removal methods.

Dust control will be a major effect. A water truck equipped with a spray bar and hand nozzle will be available at all times to prevent fugitive emissions. Water from decontamination sources will be recycled this way.

No waste including special nonhazardous waste will be placed in open piles during removal efforts. All wastes will be loaded directly into containers (i.e., bags, rolloff boxes, tractor trailers, etc.). Nylon reinforced polyethylene (1-cubic-yard) bags will be used to contain the excavated soil at the residential areas for dust control and temporary storage purposes. All wastes excavated as anticipated nonhazardous waste based upon the WOODWARD-CLYDE report will be stored in the poly bags during the 90-day IEPA special waste classification period.

OHM's schedule (as discussed in Section 3.1) for excavation has been developed to facilitate logistics management and limit the time required to transport equipment and

TABLE 2.1

DATA SUPPLIED BY USACE

Location	Estimated Average Depth of Excavation (feet)	Estimated Nonhazardous Volume (cubic yards)	Estimated Hazardous* Volume (cubic yards)
Missouri Avenue	1.5	80	1,790
Sand Road	1.0	1,415	0
Schaeffer Road	1.0	0	918
Venice Alleys			
Abbott Avenue	3.5	0	1,410
Klein Avenue	1.5	389	0
Slough Road	1.5	0	460
Weber Avenue	3.0	589	109
2230 Cleveland	1.0	0	51
3108 Colgate	0.5	0	6
1628 Delmar	0.5	7	0
Eagle Park Acres			
108 Carver	1.0	56	0
111 Carver	No remediation	0	0
202A Harrison	2.0	29	310
203/205 Harrison	3.0	1,274	0
100/201 Hill	2.0	24	59
128 Roosevelt	1.0	417	0
203/205 Terry	1.0	0	438
208 Terry	1.0	511	0

* For purposes of this action, the term "hazardous" denotes materials that exceeded the standard for lead under the TCLP test

crews from location to location. During excavation activities, engineering controls and security measures such as surrounding the exclusion zones with fluorescent orange PVC barrier fencing will be employed to prevent cross contamination and unauthorized entry to exclusion zones.

After receiving analytical result(s) that confirm the cleanup criteria of 500 ppm has been achieved, OHM will restore the locations to preremedial conditions. Excavations will be backfilled with clean soils and paving as required by the Scope of Work. Fencing and other structures removed during remediation will be replaced and seeding and revegetation performed where necessary.

OHM will utilize a local fill source chosen for quality of fill and price. OHM will collect one sample of the backfill source to be used for the restoration activities. Additional backfill samples may be necessary if the soil composition/appearance changes noticeably. The anticipated analyses for the backfill sample include volatile and semivolatile organics, pesticides, and RCRA metals.

2.6 SAMPLING AND ANALYSIS

At the residential areas, OHM will screen samples on site to quickly determine the levels of lead using XRF technology. The XRF screening will be performed to assist in removal of all material in the residential areas above 500 ppm lead. Sampling locations will be randomly selected on each wall and/or the floor of the excavation area.

A minimum of three verification samples from each excavation at the residential locations will be sent to an off-site laboratory for analysis. The CSAP has the explicit formula for determining the number of samples and the estimated number of samples per location. The areas will be backfilled and restored after visual/verification sampling.

Composite samples for disposal will be collected from the two segregated wastestream types (hazardous and nonhazardous) of contaminated soil and analyzed for disposal parameters. The purpose of two segregated wastestreams is to separate soils that are expected to be more contaminated (based on the previous analytical results from the investigative study) from the areas that are less contaminated. OHM will identify the disposal facility(ies) to be used for this work effort and the required disposal parameters for the facility(ies). The expected analysis for disposal is TCLP RCRA metals. Quality assurance (QA) samples will not be required for these samples because the acceptance of the disposal facility validates the data.

The decontamination water will be used for dust control during the loadout of contaminated soils. OHM does not anticipate that the disposal of any decontamination liquids will be required for this reason.

2.7 TRANSPORTATION AND DISPOSAL

The waste associated with the locations which the WOODWARD-CLYDE supplied data indicates all soil as nonhazardous will be placed in 1-cubic-yard nylon reinforced bags and temporarily staged at the Taracorp and/or Trust 454 property to await approval for disposal by the IEPA. This is a 90-day approval process. Upon approval, this waste will be transported to a properly permitted nonhazardous landfill for disposal.

The waste from all of the other sites will be transported directly to a properly permitted RCRA hazardous-waste landfill.

2.8 FINAL PROJECT REPORT

OHM will issue a final report at the completion of the project. The report will be prepared in draft final form for USACE review. The report will contain a summary of the work performed at each location, photographic documentation, survey data, analytical report, and transportation and disposal documentation.

3.0 TECHNICAL APPROACH

This section discusses the operational methods, types of personnel, and equipment which will be utilized to complete the scope of work.

3.1 SCHEDULE MONITORING AND CONTROL

The work tasks will be performed according to the schedule developed for the project (see Figure 3.1). A network logic diagram is provided as Figure 3.2. Any major modifications to the work plan will be submitted to USACE for review prior to the actual implementation of the modification.

The schedule will be monitored and controlled in conjunction with the tracking of costs through the use of computerized cost/resource tracking and project management techniques developed by OHM.

3.1.1 Submittals

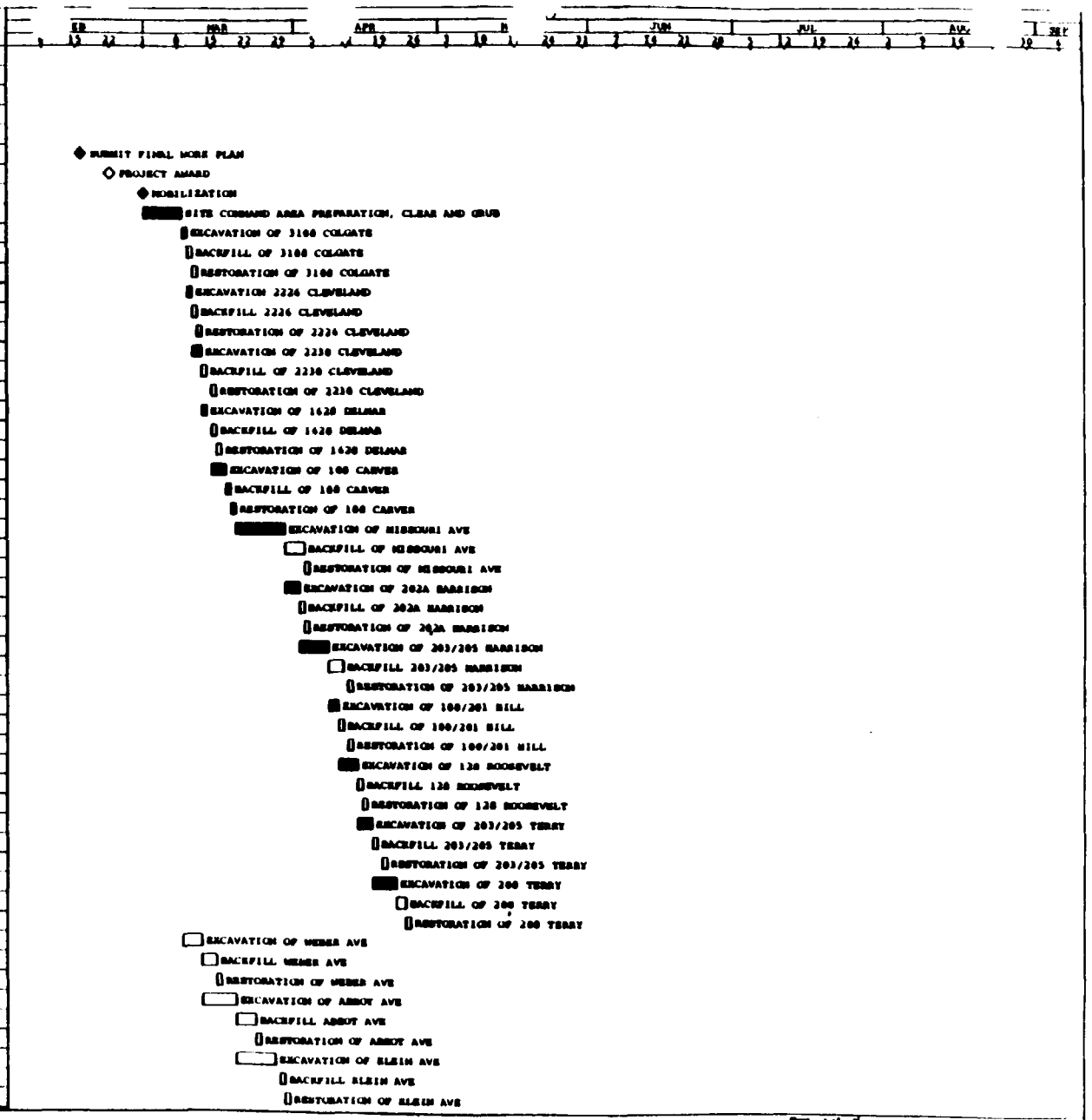
Submittals include this final project work plan submitted as per the USACE scope of work dated November 17, 1992; daily submittals; weekly status reports; hazardous-waste manifest biannual reports; hazardous-waste manifests; and a final report.

Weekly status reports will be prepared in accordance with the requirements of the scope of work and submitted by 0700 Central Standard Time on each Monday to the locations specified in Table 1 of the scope of work.

OHM will submit to USACE estimates of the amounts and types of wastes generated at the location for disposal in the weekly status reports and annual and biannual hazardous-waste manifest reports. OHM will obtain currently required reporting forms related to the shipment and disposal of hazardous waste as per the scope of work.

OHM will prepare hazardous-waste profiles and manifests for USACE review, approval, and signature prior to the scheduled shipment of any hazardous wastes. OHM will also submit relevant shipping papers for nonhazardous wastes which may require transportation and disposal from this project. OHM's Midwest Region Transportation and Disposal Department will prepare hazardous-waste manifests and nonhazardous waste shipping papers. OHM's transportation and disposal coordinator, will review all waste profiles, land disposal restriction notifications, certifications, and waste manifests prior to their submittal to USACE.

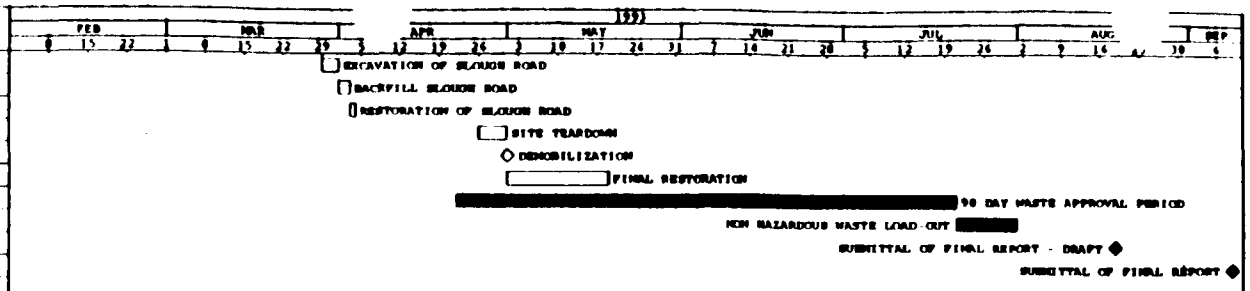
ACTIV DESCRIPT.	EARLY START	EARLY FINISH
SITE VISIT	22SEP92	22SEP92
SCOPE OF WORK REVIEW	9OCT92	
PREPARATION OF WORK PLANS	14OCT92	24OCT92
SUBMITTAL OF WORK PLAN AND COST EST.	28OCT92	27OCT92
NEGOTIATE DELIVERY ORDER	28OCT92	
SUBMIT FINAL WORK PLAN	16FEB93	
PROJECT AWARD	22FEB93	
MOBILIZATION	1MAR93	
SITE COMMAND AREA PREPARATION, CLEAR	1MAR93	8MAR93
EXCAVATION OF 3100 COLGATE	8MAR93	8MAR93
BACKFILL OF 3100 COLGATE	10MAR93	10MAR93
RESTORATION OF 3100 COLGATE	11MAR93	11MAR93
EXCAVATION 2226 CLEVELAND	10MAR93	10MAR93
BACKFILL 2226 CLEVELAND	11MAR93	11MAR93
RESTORATION OF 2226 CLEVELAND	12MAR93	12MAR93
EXCAVATION OF 2230 CLEVELAND	11MAR93	12MAR93
BACKFILL OF 2230 CLEVELAND	13MAR93	13MAR93
RESTORATION OF 2230 CLEVELAND	15MAR93	15MAR93
EXCAVATION OF 1620 DELMAR	13MAR93	13MAR93
BACKFILL OF 1620 DELMAR	15MAR93	15MAR93
RESTORATION OF 1620 DELMAR	16MAR93	16MAR93
EXCAVATION OF 100 CARVER	15MAR93	17MAR93
BACKFILL OF 100 CARVER	18MAR93	18MAR93
RESTORATION OF 100 CARVER	19MAR93	19MAR93
EXCAVATION OF MISSOURI AVE	20MAR93	29MAR93
BACKFILL OF MISSOURI AVE	30MAR93	2APR93
RESTORATION OF MISSOURI AVE	3APR93	3APR93
EXCAVATION OF 202A HARRISON	29MAR93	1APR93
BACKFILL OF 202A HARRISON	2APR93	2APR93
RESTORATION OF 202A HARRISON	3APR93	3APR93
EXCAVATION OF 203/205 HARRISON	2APR93	7APR93
BACKFILL 203/205 HARRISON	8APR93	10APR93
RESTORATION OF 203/205 HARRISON	12APR93	12APR93
EXCAVATION OF 100/201 HILL	8APR93	9APR93
BACKFILL OF 100/201 HILL	10APR93	10APR93
RESTORATION OF 100/201 HILL	12APR93	12APR93
EXCAVATION OF 120 ROOSEVELT	10APR93	12APR93
BACKFILL 120 ROOSEVELT	14APR93	14APR93
RESTORATION OF 120 ROOSEVELT	15APR93	15APR93
EXCAVATION OF 203/205 TERRY	14APR93	16APR93
BACKFILL 203/205 TERRY	17APR93	17APR93
RESTORATION OF 203/205 TERRY	19APR93	19APR93
EXCAVATION OF 200 TERRY	17APR93	21APR93
BACKFILL OF 200 TERRY	22APR93	22APR93
RESTORATION OF 200 TERRY	26APR93	26APR93
EXCAVATION OF WEBER AVE	9MAR93	12MAR93
BACKFILL WEBER AVE	13MAR93	15MAR93
RESTORATION OF WEBER AVE	16MAR93	16MAR93
EXCAVATION OF ABBOT AVE	13MAR93	19MAR93
BACKFILL ABBOT AVE	20MAR93	23MAR93
RESTORATION OF ABBOT AVE	26MAR93	26MAR93
EXCAVATION OF ELGIN AVE	20MAR93	27MAR93
BACKFILL ELGIN AVE	29MAR93	29MAR93
RESTORATION OF ELGIN AVE	30MAR93	30MAR93



GRANITE CITY LEAD REMEDIATION
GRM PROPOSAL # 0104920

Project Schedule

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
EXCAVATION OF SLOUGH ROAD	29MAR93	31MAR93
BACKFILL SLOUGH ROAD	1APR93	2APR93
RESTORATION OF SLOUGH ROAD	3APR93	3APR93
SITE TEARDOWN	26APR93	30APR93
DEMOBILIZATION		30APR93
FINAL RESTORATION	1MAY93	10MAY93
90 DAY WASTE APPROVAL PERIOD	22APR93	20JUL93
NON HAZARDOUS WASTE LOAD OUT	21JUL93	31JUL93
SUBMITTAL OF FINAL REPORT - DRAFT	19AUG93	18AUG93
SUBMITTAL OF FINAL REPORT	9SEP93	8SEP93



GRANITE CITY LEAD REMEDIATION
OHM PROPOSAL # 0104920

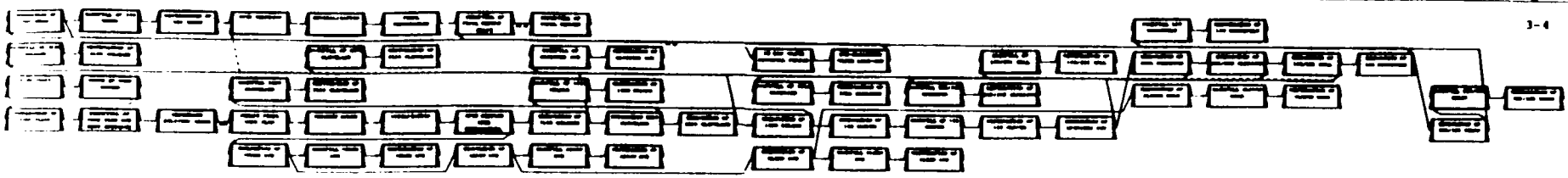


FIGURE 3.2
NETWORK LOGIC
DIAGRAM

OHM's transportation and disposal coordinator will submit all relevant supporting documentation such as analytical reports and material safety data sheets with the above-mentioned documents, accompanied with a cover letter which describes the logic by which specific waste disposal alternatives are suggested by OHM to USACE. OHM will not ship any wastes without prior approval and signature of waste manifests by USACE on behalf of the USEPA.

The preparation of the final report is discussed in Section 2.8 of this work plan.

3.2 PRECONSTRUCTION ACTIVITIES

Preconstruction activities for this project include the following items:

- Attending a preconstruction meeting with USACE
- Issuing subcontracts for subcontracted work which can be defined prior to initiation of the project
- Communicating with JULIE to locate potential utilities at the job site
- Obtain permits as needed
- Obtain soil samples for waste characterization
- Others as needed
- Videotaping of residential property so that it can be properly restored following completion of the project

OHM understands that USACE has arranged for right of entry to the contaminated areas from the USEPA and adjoining land owners as necessary.

3.3 CONSTRUCTION ACTIVITIES

The primary construction activities for this project include the following:

- Mobilization of personnel and equipment
- Site preparation including clearing and grubbing of support areas and the set up of site office, support zones, decontamination stations, and exclusion zones.
- Site preparation and fencing of the nonhazardous storage area at Taracorp/Trust 454 property.

- Excavation of contaminated soil
- Visual and/or analytical determinations of removal criteria fulfillment
- Backfill and compaction
- Paving and/or landscaping

3.3.1 Site Preparation

Site preparation includes the setup of a support office near the work area and the establishment of support zones, decontamination stations, and exclusion zones.

The office will be set up in buildings owned by the USACE located at the former USACE maintenance facility. Electrical power is already available at this site and telephone lines will be arranged by OHM. The off-shift storage of secured equipment will also be at this location. A secure, fenced area for the storage of the nonhazardous wastes will be constructed on Taracorp/Trust 454 property.

Many areas, mainly in Eagle Park, will need to be grubbed prior to excavation. An advance crew with appropriate equipment such as brush-hogs will clean and prepare these locations.

Dust control will be a major effect. A water truck equipped with a spray bar and hand nozzle will be available at all times to prevent fugitive emissions. Water from decontamination sources will be recycled this way.

All sampling equipment utilized at the locations will be decontaminated according to the procedures described in the CSAP.

3.3.2 Site Excavation

Each of the 16 locations has unique characteristics which mandate particular methodologies of remediation. But, in general, the locations can be separated into two categories: residential yards and alleys/driveways/parking lots. This section describes the general remediation methodology for these two categories and the following sections describe each individual location's nuances that need to be addressed.

3.3.2.1 Residential Areas

Most of the residential yards that need to be remediated will include the removal of sod and a varying depth of soil. These wastes will be excavated using a Caterpillar 215 tracked excavator, Case 580 backhoe, and/or a Bobcat. At some locations hand digging will be necessitated. The largest piece of equipment that can be utilized given

the logistics of the location will be used. Because of the sensitivity of the areas, the possibility of fugitive emissions, and the need for security, materials will be loaded into 1-cubic-yard reinforced bags rather than directly into haul trucks. The bags will then be loaded into the licensed hauler trucks for transportation to the hazardous-waste landfill for these wastes excavated as hazardous as indicated by the WOODWARD-CLYDE report. For those wastes suspected to be nonhazardous, each bag will be sampled and the aliquots from each bag on a truck load (approximately 14 bags) will be composited into one sample for TCLP lead analysis. These bags will be transported to the non-hazardous storage area at the Taracorp/Trust 454 property to await analytical results and regulatory authorization for disposal at an IEPA special waste site. After visual and/or analytical confirmation of contamination removal, the residences will be backfilled, compacted to 90 percent, and landscaped to match their pre-remediation flora and appearance.

3.3.2.2 Alleys/Driveways/Parking Lots

Most of the alleys, driveways, and parking lots to be remediated are aggregate/soil mixtures. Most locations are accessible to the tracked excavator but some will require smaller equipment and hand digging. The wastes removed from the alleys and parking lots will be segregated as to hazardous or nonhazardous waste according to the WOODWARD-CLYDE report and handled as described above for the residential properties. The Missouri Avenue property and the Venice Alleys hazardous waste will be directly loaded into licensed haul trucks. The wastes generated from residential driveway excavations will be handled as the yard wastes and loaded into the 1-cubic-yard bags for the reasons stated above. Alleys will be paved with 6-inch-thick concrete with wire mesh reinforcement at street intersections per the specifications. Driveways will be paved with 5-inch-thick concrete with wire mesh reinforcement per the specifications. However, if a resident requests asphalt paving in lieu of concrete, the driveways will be backfilled with stone in 6-inch loose lifts, compacted to 95 percent, and overlayed with a 2-inch asphalt cap. The alleys will require minor landscaping at the edges of the pavement (i.e., top soil, raking, and seeding).

3.3.3 Location-Specific Remediation

- Missouri Avenue--The Missouri Avenue location is a large location with good access for the tracked excavator. It is a driveway/parking lot location and will be remediated by directly loading into licensed haul trucks for disposal at a hazardous-waste landfill. There are a couple of tight areas near the out buildings which will require hand digging. Caution will be needed to avoid a possible UST, a buried gas pipeline, and buried water line in the excavation area.

- Abbott Avenue Alley--This location will be handled as described above for alleys. It includes two spillage areas to the north and

south of the alley plus an extended alley/driveway off Hampden Avenue. A tracked excavator will be used with some hand digging, as necessary.

- Klein Avenue--This location may require trench shoring as contaminated material is suspected at 4 feet and possibly as deep as 9 feet.

- Slough Road--This location includes a parking lot and a vegetation overgrown roadway. The location may need advance brush and trash removal. Only the parking lot area will be remediated, the abandoned roadway will not be remediated. Remediation will be as described in Section 3.3.2.2.

- Weber Avenue--This location encompasses two blocks and will be remediated as described in Section 3.3.2.2.

- 2230 Cleveland--This is a driveway and garage floor between two residences. Access in this location is tight and will require use of a Bobcat and hand excavation. There are gardens next to the residences which will be impacted and need relandscaped.

- 3108 Colgate--This location will require all hand digging. The contamination is at the property border. Access will only be from the remediated property and care must be taken not to trespass or impact the adjacent property. The location will require relandscaping (mostly sod placement) at the completion of remediation.

- 1628 Delmare--This location poses a problem in that a gazebo-like out building impairs remediation. The location will need to be hand excavated.

- Eagle Park Areas--The following seven locations are part of the subdivision and have some similar characteristics. These include: they are residential or near residential locations; most need advance brush and/or trash removal prior to remediation; they have rear surface septic systems; and battery-casing material was used as fill for a low, slough-like area. The low filled area reportedly has an affinity for collection of runoff and will be virtually inaccessible during rainy periods.

  - 108 Carver--Driveway, backyard, and foundation area that will require tracked excavator. Paving and landscaping will be required.

- 202A Harrison--Driveway and yard/garden. Paving and landscaping will be required.

- 203/205 Harrison--Yard and field. Fence will need to be removed and either reconstructed or replaced, landscaping required.

- 100/201 Hill--Open field or former home location. Much pre-excavation brush and trash removal required, landscaping required.

- 128 Roosevelt--This location in particular has potential septic system interference for remediation. The septic tank and some drain field lines are visible at the surface. This system may have to be replaced as part of the remediation, landscaping necessary, but this work is not included as part of the scope of work.

- 203/205 Terry--Driveway, yard, and adjacent field impacted by material. Will require paving, landscaping, and possibly fence replacement.

- 208 Terry--An abandoned home location, easily accessed by tracked excavator, landscaping required.

3.4 WASTE TRANSPORTATION AND DISPOSAL

The wastes associated with those locations that the WOODWARD-CLYDE supplied data indicates all soil as nonhazardous will be placed into 1-cubic-yard nylon reinforced bags and loaded into a polyethylene lined rolloff container. The polyethylene liner will be secured and this material will be transported to the Taracorp and/or Trust 454 site for off loading and temporary staging to await approval by the IEPA for special waste disposal. This is a 90-day approval process. Upon approval, this material will be transported to a permitted nonhazardous landfill (Chain of Rock Landfill, Granite City, Illinois).

The wastes associated with those sites that the WOODWARD-CLYDE supplied data indicate have hazardous characteristics will be loaded and transported directly to a permitted RCRA hazardous-waste landfill (Peoria Disposal, Peoria, Illinois).

4.0 SUBCONTRACTOR MANAGEMENT

OHM plans to manage any procurement under this project as a traditional prime/subcontractor relationship. This includes formal subcontract agreements, fixed-price procurement, and defined work packages. OHM anticipates subcontracting transportation and disposal and laboratory analysis.

The subcontractor will report directly to the project manager or assigned designate. The project manager will also approve any reports generated by the subcontractor prior to delivery to USACE.

OHM will formally report on subcontractor activities at intervals specified in the delivery order or as subsequently agreed upon. At this time, USACE only requires a final report and the QC Daily Report. The reports will include the following:

- Narrative of work accomplished
- Obstacles or challenges and how they were overcome
- Percent of work complete
- Estimated time to completion
- Other information, as required

OHM recognizes that delivery of materials or services to the location is often a critical-path activity. Monitoring and control of issued purchase orders are necessary to assure timely completion within the estimated budget.

Purchases of materials are anticipated for this project. Monitoring for delivery is the responsibility of the project control technician (PCT), who maintains a master log of issued purchase orders, scheduled deliveries, and actual deliveries. The PCT notifies the site supervisor, project manager, and other key project staff of any delinquencies. Normally, the PCT will also telephone the supplier for a status report.

If the situation is not immediately corrected, the project manager contacts OHM's contracts administrator and purchasing department to develop and implement an action plan. The action plan can include invoking penalties in the subcontract or canceling the original purchase order and issuing a new purchase order to a different supplier.

5.0 PROJECT TEAM AND ORGANIZATION

The major positions and individuals responsible for this project are as follows:

- Deputy Program Manager: James Darnall
- Project Manager: Dale Krageschmidt
- Site Supervisor: George Hamra

OHM will select other individuals from its staff for the following positions: truck driver, site-safety officer, transportation and disposal coordinator, procurement specialist, chemist, recovery technician, equipment operator, and operations foreman.

EXHIBIT I

WOODWARD-CLYDE SAMPLE/ANALYTICAL INFORMATION

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

Each sample has a unique sample identification. The identification consists of sample matrix code, street code, lot number, boring number, sample depth code, and sample type. All of the codes are listed in the following tables with their appropriate description. An example follows to demonstrate the operation of the sample identification.

SMP1629200B00L

S	Sample Matrix (In this case, the sample matrix is soil, see SAMPLE MATRICES table.)
MP	Street Code (In this case, the sample location is on Maple Street, see STREET CODE table.)
1629	Lot Number (In this case, the sample was taken at lot/house number 1629.)
2	Boring Number (In this case, the sample was taken from the 2nd boring on the property.)
00B	Sample Depth (In this case, the sample was taken between 3 - 6 inches from the boring indicated, see SAMPLE DEPTHS table.)
00L	Sample Type (In this case, the sample was analyzed for Total Lead, see SAMPLE TYPES table.)

SAMPLE MATRICES

S	Soil Sampled for Chemical Analysis &/or Geotechnical
W	Groundwater Sampled from Monitoring Wells

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

STREET CODES

RESIDENTIAL

AD	ADAMS	OH	OHIO
AL	ALTON	OL	OLIVE
BE	BENTON	RE	REYNOLDS
BR	BRYAN	RR	ROCK ROAD
CH	CHESTNUT	SA	SALVETER
CL	CLEVELAND	SP	SPRUCE
DE	DELMAR	ST	STATE
DV	DENVER	WA	WALNUT
ED	EDISON	WS	WASHINGTON
EL	ELIZABETH		
ER	EDWARDSVILLE ROAD	ET	18th
GR	GRAND	FI	5th
GW	GREENWOOD	NT	19th
IO	IOWA	TL	12th
KE	KENNEDY	SN	2nd
LE	LEE	TW	20th
MA	MADISON	TS	22nd
MP	MAPLE	WT	W. 20th
MC	McCAMBRIDGE		
ME	MEREDOCIA		
NI	NIEDRINGHAUS		

INDUSTRIAL AND REMOTE FILL AREAS

BV	BV & G TRANSPORT	CA	CARVER
OR	OTHER REMOTE FILL AREAS	CO	COLGATE
		HA	HARRISON
RO	RICH OIL	HI	HILL
TA	TARACORP	RS	ROOSEVELT
TR	TRUST 454	TE	TERRY
VE	VENICE ALLEYS		

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

SAMPLE DEPTH

CODE	DEPTH
00A	0-3 inches
00B	3-6 inches
00C	6-12 inches
00D	1-2 feet
00E	2-3 feet
00F	3-4 feet
00G	4-5 feet
00H	5-6 feet
00I	6-7 feet
00J	0-2 feet
00K	2-4 feet
00L	4-6 feet
00M	6-8 feet
00N	8-10 feet
00P	10-12 feet
00R	12-14 feet
00S	14-15 feet
00T	13-15 feet
00U	10-11 feet
00V	15-16 feet
00W	20-21 feet
00X	25-26 feet
0AB	0-6 inches
0AC	0-1 feet
0GG	Top of Groundwater

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

SAMPLE TYPE

00G	Geotechnical Sample
0GD	Geotechnical Duplicate
0GQ	Geotechnical QA Sample
00L	Total Lead Sample
0LD	Total Lead Duplicate Sample - Boring 1
0LQ	Total Lead Quality Assurance
0XM	Total Lead, Boring 2, Duplicate - # 1
0XX	Total Lead, Boring 2, Duplicate - # 2
00T	TCLP Lead Sample
0TD	TCLP Lead Duplicate
0TQ	TCLP Lead Quality Assurance
0TM	TCLP Lead Matrix Spike
0TX	TCLP Lead Matrix Spike Duplicate
00W	Groundwater Sample
0WD	Groundwater Duplicate
0WB	Groundwater Rinsate Blank
0WM	Groundwater Matrix Spike
0WX	Groundwater Matrix Spike Duplicate
0WQ	Groundwater QA Sample
0WR	Groundwater QA Matrix Spike
0WS	Groundwater QA Matrix Spike Duplicate
0WT	Groundwater QA Rinsate Blank
0TB	Trip Blank
0RS	Re-Sample

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TABLE 24
EAGLE PARK DATA SUMMARY

NL/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 02, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SCA0108100C00L	Total Lead	05/19/1992	07/29/1992	154	U	MG/KG	6.1	Moisture Content	07/08/1992	19.7	%WET W
SCA0108100A00T	TCLP Lead	05/19/1992		4		MG/L					
SCA0108200C00L	Total Lead	05/19/1992	07/29/1992	1810	U	MG/KG	5.3	Moisture Content	07/08/1992	9.9	%WET W
SCA010820AB00L	Total Lead	05/19/1992	07/29/1992	4350	U	MG/KG	29.0	Moisture Content	07/08/1992	14.5	%WET W
SCA011110AB00L	Total Lead	05/19/1992	07/29/1992	471	U	MG/KG	5.4	Moisture Content	07/08/1992	9.1	%WET W
SCA011120AB00L	Total Lead	05/19/1992	07/29/1992	445	U	MG/KG	5.2	Moisture Content	07/08/1992	9.2	%WET W
SHA0202100C00L	Total Lead	05/27/1992	07/30/1992	2320		MG/KG	6.1	Moisture Content	07/10/1992	23.3	%WET W
SHA0202100C00T	TCLP Lead	05/27/1992		11.7		MG/L	0.2				
SHA0202100D00L	Total Lead	05/27/1992	07/30/1992	103		MG/KG	5.9	Moisture Content	07/10/1992	22.1	%WET W
SHA0202100E00L	Total Lead	05/27/1992	07/30/1992	198		MG/KG	6.0	Moisture Content	07/10/1992	21.1	%WET W
SHA020210AB00L	Total Lead	05/27/1992	07/30/1992	68400		MG/KG	261	Moisture Content	07/10/1992	10.2	%WET W
SHA020210AB00T	TCLP Lead	05/27/1992	09/15/1992	440		MG/L	0.18				
SHA0202200C00T	TCLP Lead	05/27/1992	09/15/1992	2.34		MG/L	0.18				
SHA0202200F00L	Total Lead	05/27/1992	07/30/1992	19.4		MG/KG	6.1	Moisture Content	07/10/1992	22.9	%WET W
SHA020220AB00L	Total Lead	05/27/1992	07/30/1992	1240		MG/KG	5.1	Moisture Content	07/10/1992	10.0	%WET W
SHA020220AB00T	TCLP Lead	05/27/1992	09/15/1992	1.47		MG/L	0.18				
SHA0202300C00L	Total Lead	05/27/1992	07/30/1992	752		MG/KG	6.1	Moisture Content	07/10/1992	22.7	%WET W
SHA0202300E00L	Total Lead	05/27/1992	07/30/1992	622		MG/KG	6.6	Moisture Content	07/10/1992	28.3	%WET W
SHA0202300F00T	TCLP Lead	05/27/1992	09/15/1992	0.93		MG/L	0.18				
SHA0202300F0TD	TCLP Lead	05/27/1992	09/15/1992	1.13		MG/L	0.18				
SHA0202300G00L	Total Lead	05/27/1992	07/30/1992	177		MG/KG	6.9	Moisture Content	07/10/1992	28.3	%WET W
SHA020230AB0L	Total Lead	05/27/1992	07/30/1992	937		MG/KG	5.5	Moisture Content	07/10/1992	9.1	%WET W
SHA020230AB0LD	Total Lead	05/27/1992	07/30/1992	536		MG/KG	5.3	Moisture Content	07/10/1992	11.6	%WET W
SHA0202400C00L	Total Lead	05/27/1992	07/30/1992	151		MG/KG	5.8	Moisture Content	07/10/1992	19.1	%WET W
SHA020240AB00L	Total Lead	05/27/1992	07/30/1992	106		MG/KG	5.6	Moisture Content	07/10/1992	15.2	%WET W
SHA0203100D00L	Total Lead	05/22/1992	07/29/1992	49.8	U	MG/KG	6.6	Moisture Content	07/09/1992	27.9	%WET W
SHA020310AC00L	Total Lead	05/22/1992	07/29/1992	92.9	U	MG/KG	6.1	Moisture Content	07/09/1992	20.9	%WET W

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TABLE 24
EAGLE PARK DATA SUMMARY

NI/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 02, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SHA0203200D00L	Total Lead	05/22/1992	07/29/1992	101	U	MG/KG	6.1	Moisture Content	07/09/1992	23	%WET W
SHA020320AC00L	Total Lead	05/22/1992	07/29/1992	848	U	MG/KG	6.2	Moisture Content	07/09/1992	22.1	%WET W
SHA0203300D00L	Total Lead	05/22/1992	07/29/1992	1540	U	MG/KG	6.3	Moisture Content	07/09/1992	24.7	%WET W
SHA0203300D0LD	Total Lead	05/22/1992	07/29/1992	1220	U	MG/KG	6.3	Moisture Content	07/09/1992	23.7	%WET W
SHA0203300D00T	TCLP Lead	05/22/1992		0.54		MG/L	0.2				
SHA0203300E00L	Total Lead	05/22/1992	07/29/1992	507	U	MG/KG	6.9	Moisture Content	07/09/1992	29.8	%WET W
SHA0203300E00T	TCLP Lead	05/22/1992		0.31		MG/L	0.2				
SHA0203300F00L	Total Lead	05/22/1992	07/29/1992	95.9	U	MG/KG	6.6	Moisture Content	07/09/1992	30.8	%WET W
SHA0203400D00L	Total Lead	05/22/1992	07/29/1992	1800	U	MG/KG	7.1	Moisture Content	07/09/1992	34	%WET W
SHA0203400D00T	TCLP Lead	05/22/1992		< 0.20		MG/L	0.2				
SHA0203400E00L	Total Lead	05/22/1992	07/29/1992	148	U	MG/KG	7.1	Moisture Content	07/09/1992	30.8	%WET W
SHA0203400F00L	Total Lead	05/22/1992	07/29/1992	178	U	MG/KG	7.0	Moisture Content	07/09/1992	30.6	%WET W
SHA020340AC00L	Total Lead	05/22/1992	07/29/1992	186	U	MG/KG	5.9	Moisture Content	07/09/1992	21.8	%WET W
SHA0205100D00L	Total Lead	05/21/1992	07/29/1992	1030	U	MG/KG	6.5	Moisture Content	07/09/1992	24.8	%WET W
SHA0205100E00L	Total Lead	05/21/1992	07/29/1992	223	U	MG/KG	7.2	Moisture Content	07/09/1992	30.2	%WET W
SHA0205200D00L	Total Lead	05/21/1992	07/29/1992	529	U	MG/KG	5.9	Moisture Content	07/09/1992	18.4	%WET W
SHA0205200D0LD	Total Lead	05/21/1992	07/29/1992	832	U	MG/KG	6.1	Moisture Content	07/09/1992	21.3	%WET W
SHA0205200E00L	Total Lead	05/21/1992	07/29/1992	216	U	MG/KG	6.9	Moisture Content	07/09/1992	28.4	%WET W
SHA0205200F00L	Total Lead	05/21/1992	07/29/1992	20.4	U	MG/KG	6.4	Moisture Content	07/09/1992	25.9	%WET W
SHA0205300D00L	Total Lead	05/21/1992	07/29/1992	782	U	MG/KG	5.8	Moisture Content	07/09/1992	19.1	%WET W
SHA0205300D00T	TCLP Lead	05/21/1992		0.22		MG/L	0.2				
SHA0205300D0TD	TCLP Lead	05/21/1992		0.32		MG/L	0.2				
SHA0205300E0L	Total Lead	05/21/1992	07/29/1992	500	U	MG/KG	6.8	Moisture Content	07/09/1992	29.4	%WET W
SHA0205300E0T	TCLP Lead	05/21/1992		<0.19		MG/L	0.19				
SHA020530AC00L	Total Lead	05/21/1992	07/29/1992	45	U	MG/KG	6.1	Moisture Content	07/09/1992	22.2	%WET W
SH#0100100C00L	Total Lead	05/20/1992	07/29/1992	1580	U	MG/KG	5.8	Moisture Content	07/08/1992	16.4	%WET W
SH#0100100D00L	Total Lead	05/20/1992	07/29/1992	843	U	MG/KG	6.1	Moisture Content	07/08/1992	18.8	%WET W
SH#010010AB00L	Total Lead	05/20/1992	07/29/1992	17900	U	MG/KG	51.1	Moisture Content	07/08/1992	7.9	%WET W
SH#010010AB00T	TCLP Lead	05/20/1992		152		MG/L	0.2				

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NL/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 02, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SH0100200C00L	Total Lead	05/20/1992	07/29/1992	90.2	U	MG/KG	6.2	Moisture Content	07/08/1992	20.5	%WET W
SH010020AB00L	Total Lead	05/20/1992	07/29/1992	360	U	MG/KG	5.8	Moisture Content	07/08/1992	21.3	%WET W
SH010020AB00T	TCLP Lead	05/20/1992		1.36		MG/L	0.2				
SRS0128100C00L	Total Lead	05/27/1992	07/30/1992	197		MG/KG	5.3	Moisture Content	07/10/1992	10	%WET W
SRS0128100D00L	Total Lead	05/27/1992	07/30/1992	1670		MG/KG	6.0	Moisture Content	07/10/1992	21.7	%WET W
SRS012810AB00L	Total Lead	05/27/1992	07/30/1992	53.2		MG/KG	5.2	Moisture Content	07/10/1992	6.4	%WET W
SRS0128200C00L	Total Lead	05/27/1992	07/30/1992	474		MG/KG	5.9	Moisture Content	07/10/1992	19.5	%WET W
SRS0128200D00L	Total Lead	05/27/1992	07/30/1992	163		MG/KG	5.4	Moisture Content	07/10/1992	12.6	%WET W
SRS0128200D00T	TCLP Lead	05/27/1992	09/15/1992	0.3		MG/L	0.18				
SRS0128200E00L	Total Lead	05/27/1992	07/30/1992	60.9		MG/KG	5.0	Moisture Content	07/10/1992	22.9	%WET W
SRS0128300C00L	Total Lead	05/27/1992	07/30/1992	745		MG/KG	5.5	Moisture Content	07/10/1992	13.3	%WET W
SRS0128300C00T	TCLP Lead	05/27/1992	09/15/1992	< 0.18		MG/L	0.18				
SRS0128300D00L	Total Lead	05/27/1992	07/30/1992	117		MG/KG	5.9	Moisture Content	07/10/1992	22.6	%WET W
SRS0128300D00T	TCLP Lead	05/27/1992		0.37							
SRS0128300E00L	Total Lead	05/27/1992	07/30/1992	57.2		MG/KG	6.4	Moisture Content	07/10/1992	22.1	%WET W
STE0203100C00L	Total Lead	05/20/1992	07/29/1992	10100	U	MG/KG	59.7	Moisture Content	07/08/1992	21.6	%WET W
STE0203100C0LD	Total Lead	05/20/1992	07/29/1992	5930	U	MG/KG	31.5	Moisture Content	07/08/1992	20.7	%WET W
STE0203100C00T	TCLP Lead	05/20/1992		71.6		MG/L					
STE0203100D00L	Total Lead	05/20/1992	07/29/1992	292	U	MG/KG	6.3	Moisture Content	07/08/1992	24.6	%WET W
STE020310AB00L	Total Lead	05/20/1992	07/29/1992	45200	U	MG/KG	105	Moisture Content	07/08/1992	6.1	%WET W
STE020310AB0LD	Total Lead	05/20/1992	07/29/1992	37700	U	MG/KG	108	Moisture Content	07/08/1992	7.4	%WET W
STE020310AB00T	TCLP Lead	05/20/1992		156		MG/L					
STE0203200C00L	Total Lead	05/20/1992	07/29/1992	820	U	MG/KG	5.7	Moisture Content	07/08/1992	16.7	%WET W
STE0203200D00L	Total Lead	05/20/1992	07/29/1992	44.2	U	MG/KG	6.1	Moisture Content	07/08/1992	21.5	%WET W
STE020320AB00L	Total Lead	05/20/1992	07/29/1992	8060	U	MG/KG	26.1	Moisture Content	07/08/1992	5.3	%WET W
STE020320AB00T	TCLP Lead	05/20/1992		52.3		MG/L	0.2				
STE0203300C00L	Total Lead	05/20/1992	07/29/1992	126	U	MG/KG	6.1	Moisture Content	07/08/1992	21	%WET W
STE0203300D00L	Total Lead	05/20/1992	07/29/1992	41.5	U	MG/KG	6.1	Moisture Content	07/08/1992	23.5	%WET W
STE020330AB00L	Total Lead	05/20/1992	07/29/1992	5430	U	MG/KG	28.1	Moisture Content	07/08/1992	12.9	%WET W
STE020330AB0LD	Total Lead	05/20/1992	07/29/1992	9140	U	MG/KG	28.5	Moisture Content	07/08/1992	13.3	%WET W

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TABLE 24
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NI/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 02, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
STE020330AB05/20/	TCLP Lead	05/20/1992		32.2		MG/L	0.2				
STE0203400C00L	Total Lead	05/20/1992	07/29/1992	971	J	MG/KG	6.5	Moisture Content	07/08/1992	23.4	%WET WT
STE0203400D00L	Total Lead	05/20/1992	07/29/1992	59.8	J	MG/KG	6.6	Moisture Content	07/08/1992	25.2	%WET WT
STE020340AB00L	Total Lead	05/20/1992	07/29/1992	37500	J	MG/KG	101	Moisture Content	07/08/1992	7.5	%WET WT
STE020340AB00T	TCLP Lead	05/20/1992		101		MG/L	0.2				
STE0208100C00L	Total Lead	05/21/1992	07/29/1992	52	J	MG/KG	6.1	Moisture Content	07/09/1992	21.3	%WET WT
STE020810AB00L	Total Lead	05/21/1992	07/29/1992	2170	J	MG/KG	6.1	Moisture Content	07/08/1992	21.9	%WET WT
STE020810AB00T	TCLP Lead	05/21/1992		1.79		MG/L	0.2				
STE0208200C00L	Total Lead	05/21/1992	07/29/1992	88.9	J	MG/KG	6.3	Moisture Content	07/09/1992	21.7	%WET WT
STE020820AB00L	Total Lead	05/21/1992	07/29/1992	474	J	MG/KG	6.2	Moisture Content	07/09/1992	23.5	%WET WT
STE020820AB00T	TCLP Lead	05/21/1992		0.88		MG/L	0.2				
STE0208300C00L	Total Lead	05/21/1992	07/29/1992	19.4	J	MG/KG	5.7	Moisture Content	07/09/1992	19.4	%WET WT
STE020830AB00L	Total Lead	05/21/1992	07/29/1992	90.7	J	MG/KG	6.8	Moisture Content	07/09/1992	26.4	%WET WT
STE0208400C00L	Total Lead	05/21/1992	07/29/1992	2100	J	MG/KG	6.1	Moisture Content	07/09/1992	20.6	%WET WT
STE020840AB00L	Total Lead	05/21/1992	07/29/1992	2790	J	MG/KG	29.7	Moisture Content	07/09/1992	22.9	%WET WT
STE020840AB00T	TCLP Lead	05/21/1992		0.51		MG/L	0.2				
STE0208500C00L	Total Lead	05/21/1992	07/29/1992	4070	J	MG/KG	27.3	Moisture Content	07/09/1992	16.9	%WET WT
STE020850AB00L	Total Lead	05/21/1992	07/29/1992	1180	J	MG/KG	6.3	Moisture Content	07/09/1992	24.3	%WET WT
STE020850AB00T	TCLP Lead	05/21/1992		0.53		MG/L	0.2				

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TABLE 28
2230 CLEVELAND DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SCL2230100A00L	Total Lead	04/22/1992	06/03/1992	525		MG/KG –	5.8	Moisture Content	06/10/1992	19 4	%WET W
SCL2230100B00L	Total Lead	04/22/1992	06/03/1992	422		MG/KG –	6.2	Moisture Content	06/10/1992	19 4	%WET W
SCL2230100C00L	Total Lead	04/22/1992	06/03/1992	148		MG/KG –	5.9	Moisture Content	06/10/1992	18 6	%WET W
SCL2230200A00L	Total Lead	04/22/1992	06/03/1992	1020		MG/KG –	5.2	Moisture Content	06/10/1992	20 9	%WET W
SCL2230200B00L	Total Lead	04/22/1992	06/03/1992	613		MG/KG –	8.1	Moisture Content	06/10/1992	19.1	%WET W
SCL2230200C00L	Total Lead	04/22/1992	06/03/1992	433		MG/KG –	6.0	Moisture Content	06/10/1992	18 7	%WET W
SOR0001100A00T	TCLP Lead	04/22/1992		10.3		MG/L					
SOR0001100A0TD	TCLP Lead	04/22/1992		11.2		MG/L					
SOR0002100A00T	TCLP Lead	04/22/1992		72.8		MG/L					
SOR0003100A00T	TCLP Lead	04/22/1992		15.6		MG/L					

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TABLE 29
3108 COLGATE DATA SUMMARY

NL/TARACORP 89MCANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SOR0026100A00L	Total Lead	05/13/1992	07/28/1992	3390	J	MG/KG –	26.5	Moisture Content	07/05/1992	9 3	%WET W
SOR0026100B00L	Total Lead	05/13/1992	06/26/1992	11900		MG/KG –	53.4	Moisture Content	07/05/1992	13 3	%WET W
SOR0026100C00T	TCLP Lead	05/13/1992		10.9		MG/L					
SOR0026200A00L	Total Lead	05/13/1992	06/26/1992	81.1		MG/KG –	5.2	Moisture Content	07/05/1992	9 6	%WET W
SOR0026200B00L	Total Lead	05/13/1992	06/26/1992	70.1		MG/KG –	5.5	Moisture Content	07/05/1992	11 5	%WET W
SOR0026200C00L	Total Lead	05/13/1992	06/26/1992	64.9		MG/KG –	5.5	Moisture Content	07/05/1992	12 9	%WET W

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TABLE 30
1628 DELMAR AVENUE DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 10, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SDE1628100A00L	Total Lead	03/03/1992	03/18/1992	1620		MG/KG -	5.9	Moisture Content	03/05/1992	18.4	%WET W
SDE1628100A0LD	Total Lead	03/03/1992	03/18/1992	1730		MG/KG -	6.0	Moisture Content	03/05/1992	18	%WET W
SDE1628100B00L	Total Lead	03/03/1992	03/18/1992	722		MG/KG -	5.7	Moisture Content	03/05/1992	17	%WET W
SDE1628100B0LD	Total Lead	03/03/1992	03/18/1992	680		MG/KG -	5.8	Moisture Content	03/05/1992	17.5	%WET W
SDE1628100C00L	Total Lead	03/03/1992	03/18/1992	278		MG/KG -	5.7	Moisture Content	03/05/1992	16.5	%WET W
SDE1628100C0LD	Total Lead	03/03/1992	03/18/1992	280		MG/KG -	5.5	Moisture Content	03/05/1992	16.7	%WET W
SDE1628200A00L	Total Lead	03/03/1992	03/18/1992	1250		MG/KG -	6.2	Moisture Content	03/05/1992	22.7	%WET W
SDE1628200B00L	Total Lead	03/03/1992	03/18/1992	833		MG/KG -	6.3	Moisture Content	03/05/1992	22.4	%WET W
SDE1628200C00L	Total Lead	03/03/1992	03/18/1992	107		MG/KG -	6.4	Moisture Content	03/05/1992	22.5	%WET W
SOR0025300A00T	TCLP Lead	05/13/1992		0.47		MG/L					
SOR0025400A00T	TCLP Lead	05/13/1992		0.11		MG/L					

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TABLE 25
MISSOURI AVENUE DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SOR000710AB00T	TCLP Lead	12/10/1991	01/07/1992	180		MG/L	0.65
SOR000810AB00T	TCLP Lead	12/10/1991	01/07/1992	<0.65		MG/L	0.65
SOR000910AB00T	TCLP Lead	12/10/1991	01/07/1992	235		MG/L	0.65
SOR001010AB00T	TCLP Lead	12/10/1991	01/07/1992	82.5		MG/L	0.65
SOR0013100K00T	TCLP Lead	06/29/1992		3.94		MG/L	
SOR0014100K00T	TCLP Lead	06/29/1992		< 0.17		MG/L	
SOR0015100J00T	TCLP Lead	06/29/1992		< 0.19		MG/L	
SOR0015100K00T	TCLP Lead	06/29/1992		0.68		MG/L	

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TABLE

SAND ROAD DATA SUMMARY

NL/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SOR0022100C00L	Total Lead	05/20/1992	07/29/1992	318	J	MG/KG	6.0
SOR002210AB00L	Total Lead	05/20/1992	07/29/1992	1030	J	MG/KG	5.8
SOR0023100C00L	Total Lead	05/20/1992	07/29/1992	98	U	MG/KG	6.6
SOR002310AB00L	Total Lead	05/20/1992	07/29/1992	712	J	MG/KG	6.5
SOR0024100C00L	Total Lead	05/20/1992	07/29/1992	3490	J	MG/KG	32.1
SOR0024100D00L	Total Lead	05/20/1992	07/29/1992	141	J	MG/KG	6.8
SOR002410AB00L	Total Lead	05/20/1992	07/29/1992	7130	J	MG/KG	31.3
SOR002410AB0LD	Total Lead	05/20/1992	07/29/1992	4200	J	MG/KG	29.6

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TABLE
SCHAEFFER ROAD DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SOR000410AB00T	TCLP Lead	12/10/1991	01/07/1992	13		MG/L	0.65
SOR000510AB00T	TCLP Lead	12/10/1991	01/07/1992	1.41		MG/L	0.65
SOR000610AB00T	TCLP Lead	12/10/1991	01/07/1992	4.86		MG/L	0.65

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TABLE

VENICE ALLEYS DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SVE0002100J00T	TCLP Lead	12/02/1991	01/07/1992	<0.65		MG/L	0.65
SVE0004100J00T	TCLP Lead	12/02/1991	01/07/1992	6.8		MG/L	0.65
SVE0005100L00T	TCLP Lead	12/02/1991	01/07/1992	7.52		MG/L	0.65
SVE0008100L00T	TCLP Lead	12/03/1991	01/07/1992	<0.65		MG/L	0.65
SVE0009100J00T	TCLP Lead	12/03/1991	01/07/1992	1.53		MG/L	0.65
SVE0009100J0TD	TCLP Lead	12/03/1991	01/07/1992	0.92		MG/L	0.65
SVE0011100J00T	TCLP Lead	12/03/1991	01/07/1992	5.64		MG/L	0.65
SVE0013100J00T	TCLP Lead	12/03/1991	01/07/1992	<0.65		MG/L	0.65
SVE0015100K00T	TCLP Lead	12/03/1991	01/07/1992	<0.65		MG/L	0.65
SVE0017100J00T	TCLP Lead	12/03/1991	01/07/1992	93.4		MG/L	0.65
SVE0020100J00T	TCLP Lead	12/04/1991	01/07/1992	2.59		MG/L	0.65

APPENDIX B

SITE-SPECIFIC HEALTH-AND-SAFETY PLAN

TABLE OF CONTENTS (CONTINUED)

TABLE 4.2, ANALYTICAL REQUIREMENTS WASTEWATER TREATMENT DISPOSAL FOR LIQUIDS . 4-12

FIGURE 4.1, BACON BOMB SAMPLER 4-8

5.0 BACKFILL SAMPLING 5-1

5.1 OBJECTIVES 5-1
5.2 TECHNICAL APPROACH 5-1
5.3 METHODOLOGY 5-1
5.4 DECONTAMINATION PROCEDURES 5-3
5.5 SAMPLE CONTROL 5-4
5.6 ANALYSES 5-6
5.7 EQUIPMENT REQUIREMENTS 5-6

6.0 ANALYTICAL REQUIREMENTS 6-1

6.1 METHODOLOGY 6-1
6.2 METHOD SPECIFIC DATA QUALITY OBJECTIVES 6-3
6.3 DELIVERABLES 6-5

TABLE 6.1, SAMPLE TYPES AND NUMBERS 6-2

~~EXHIBIT I - PREVIOUS ANALYTICAL RESULTS PROVIDED BY WOODWARD-CLYDE CONSULTANTS~~

EXHIBIT II - OPERATING MANUAL FOR THE SPECTRACE 9000 PORTABLE XRF ANALYZER

EXHIBIT III - STANDARD METHOD D-2216-80, MOISTURE CONTENT OF SOIL

1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE) has tasked OHM Remediation Services Corp. (OHM), a wholly owned subsidiary of OHM Corporation, under the Rapid Response Contract No. DACW45-89-D-0516, Delivery Order No. 58, to perform removal of hard rubber battery case material at various locations associated with the NL Industries/Taracorp Superfund Site (NL Site) in Granite City, Madison, and Venice, Illinois.

This Contractor's Sampling and Analysis Plan (CSAP) describes OHM's responsibilities with respect to the sampling and analysis associated with the work effort. OHM intends this document to be a site-specific guidance for use by the field team(s) while performing the project-required sampling and analysis.

1.1 SITE HISTORY

The NL Site includes the NL Industries/Taracorp Plant, a former secondary lead smelting operation located at 16th Street and Cleveland Boulevard in Granite City, Illinois. Prior to 1903, the plant included various smelting related equipment and processes. From 1903 to 1983, secondary lead smelting occurred at the plant. These activities were discontinued during 1983 and equipment dismantled.

In July 1981, St. Louis Lead Recyclers, Inc. (SLLR) began using equipment on adjacent property owned by Trust 454 to separate components of the Taracorp waste pile. The objective was to recycle lead bearing materials to the furnaces at Taracorp and send hard rubber off site for recycling. SLLR continued operations until March 1983 when it shut down its equipment. Residuals from the operation remain on Trust 454 property as does some equipment.

A State Implementation Plan for Granite City, Illinois, was published in September 1983 by the Illinois Environmental Protection Agency (IEPA). The IEPA's report indicated that the lead nonattainment problem for air emissions in Granite City, Illinois, was in large part due to emissions associated with the operation of the secondary lead smelter operated by Taracorp and lead reclamation activities conducted by SLLR. The IEPA procured Administrative Orders by Consent with Taracorp, SLLR, Stackorp, Inc., Tri-City Truck Plaza, Inc., and Trust 454 during March 1984. The Orders required the implementation of remedial activities relative to air quality.

NL Industries as former owner of the location, voluntarily entered into an Agreement and Administrative Order by Consent with the United States Environmental Protection Agency (USEPA) and IEPA in May 1985 to implement a Remedial Investigation/ Feasibility Study (RI/FS) for the location and other potentially affected areas. Taracorp was not a party to the agreement due to the fact that it filed for bankruptcy.

FINAL CONTRACTOR'S SAMPLING AND ANALYSIS PLAN FOR REMEDIATION OF LOCATIONS IN GRANITE CITY, MADISON, AND VENICE, ILLINOIS, ASSOCIATED WITH NL INDUSTRIES/TARACORP SUPERFUND SITE

Submitted to:

United States Army Corps of Engineers
Omaha, Nebraska

OHM Remediation Services Corp.

Hearn W. Tidwell
Project Chemist
Midwest Region

February ~~11~~ 16, 1993
Project 13407.2

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

1.1 SITE HISTORY 1-1
1.2 DESCRIPTION 1-2
1.3 PROJECT OBJECTIVES 1-2
1.4 FIELD ACTIVITIES 1-3
1.5 DISPOSAL SAMPLES 1-6
1.6 BACKFILL SAMPLING 1-7

2.0 XRF SCREENING 2-1

2.1 AREA SCREENING 2-1
2.2 CONFIRMATION SCREENING 2-2
2.3 CONFIRMATION SAMPLING 2-2
2.4 ANALYTICAL SERVICES 2-2

3.0 CONFIRMATION SAMPLING 3-1

3.1 OBJECTIVES 3-1
3.2 TECHNICAL APPROACH 3-1
3.3 METHODOLOGY 3-1
3.4 DECONTAMINATION PROCEDURES 3-3
3.5 SAMPLE CONTROL 3-4
3.6 ANALYSIS 3-6
3.7 EQUIPMENT REQUIREMENTS 3-6

4.0 EXCAVATED SOIL AND DECONTAMINATION LIQUID SAMPLING 4-1

4.1 OBJECTIVES 4-1
4.2 TECHNICAL APPROACH 4-1
4.3 SAMPLE COLLECTION FOR DISPOSAL AND APPROVAL 4-1
4.4 SAMPLE COLLECTION FOR DISPOSAL DETERMINATION 4-6
4.5 SOIL SAMPLING METHODOLOGY 4-7
4.6 LIQUID SAMPLING METHODOLOGY 4-7
4.7 SAMPLE PACKAGING 4-9
4.8 SAMPLE CONTROL 4-9
4.9 ANALYSIS 4-11

TABLE 4.1, ANALYTICAL REQUIREMENTS LANDFILL DISPOSAL FOR SOLIDS AND SLUDGES 4-3

APPENDIX A

CONTRACTOR SAMPLING AND ANALYSIS PLAN

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TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

1.1 SITE HISTORY 1-1
1.2 DESCRIPTION 1-2
1.3 PROJECT OBJECTIVES 1-2
1.4 FIELD ACTIVITIES 1-3
1.5 DISPOSAL SAMPLES 1-6
1.6 BACKFILL SAMPLING 1-7

2.0 XRF SCREENING 2-1

2.1 AREA SCREENING 2-1
2.2 CONFIRMATION SCREENING 2-2
2.3 CONFIRMATION SAMPLING 2-2
2.4 ANALYTICAL SERVICES 2-2

3.0 CONFIRMATION SAMPLING 3-1

3.1 OBJECTIVES 3-1
3.2 TECHNICAL APPROACH 3-1
3.3 METHODOLOGY 3-1
3.4 DECONTAMINATION PROCEDURES 3-3
3.5 SAMPLE CONTROL 3-4
3.6 ANALYSIS 3-6
3.7 EQUIPMENT REQUIREMENTS 3-6

4.0 EXCAVATED SOIL AND DECONTAMINATION LIQUID SAMPLING 4-1

4.1 OBJECTIVES 4-1
4.2 TECHNICAL APPROACH 4-1
4.3 SAMPLE COLLECTION FOR DISPOSAL ANALYSIS AND APPROVAL 4-1
4.4 SAMPLE COLLECTION FOR DISPOSAL DETERMINATION 4-6
4.5 SOIL SAMPLING METHODOLOGY 4-6
4.6 LIQUID SAMPLING METHODOLOGY 4-7
4.7 SAMPLE PACKAGING 4-9
4.8 SAMPLE CONTROL 4-9
4.9 ANALYSIS 4-11

TABLE 4.1, ANALYTICAL REQUIREMENTS LANDFILL DISPOSAL FOR SOLIDS AND SLUDGES 4-3

TABLE OF CONTENTS (CONTINUED)

TABLE 4.2, ANALYTICAL REQUIREMENTS WASTEWATER TREATMENT DISPOSAL FOR LIQUIDS . 4-12

FIGURE 4.1, BACON BOMB SAMPLER 4-8

5.0 BACKFILL SAMPLING 5-1

5.1 OBJECTIVES 5-1
5.2 TECHNICAL APPROACH 5-1
5.3 METHODOLOGY 5-1
5.4 DECONTAMINATION PROCEDURES 5-3
5.5 SAMPLE CONTROL 5-4
5.6 ANALYSIS 5-6
5.7 EQUIPMENT REQUIREMENTS 5-6

6.0 ANALYTICAL REQUIREMENTS 6-1

6.1 METHODOLOGY 6-1
6.2 METHOD SPECIFIC DATA QUALITY OBJECTIVES 6-3
6.3 DELIVERABLES 6-5

TABLE 6.1, SAMPLE TYPES AND NUMBERS 6-2

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The USEPA determined that the location was a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) facility and it was placed on the National Priorities list on June 10, 1986.

1.2 DESCRIPTION

This action requires the excavation and disposal of fill material placed in alleys, parking lots, driveways, and yards in residential communities. The communities include Granite City, Madison, and Venice, Illinois. The Record of Decision (ROD) established the action levels for this project at 500 parts per million (ppm) and visibly clean for driveways, alleys, etc. Following the removal of the contaminated material, the areas impacted will be restored. This restoration will include sodding the yards and paving the alleys, driveways, and parking lots.

1.3 PROJECT OBJECTIVES

The objectives of this field effort are to excavate any visible lead battery casings and slag and confirm that all contaminated soils within the areas defined in the USACE Revised Final Scope of Work dated January 27, 1993, as revised, have been removed to the action level of 500 ppm. Investigative sampling has been performed by Woodward-Clyde Consultants (WOODWARD-CLYDE) and reported in the WOODWARD-CLYDE Final Report, NL/Taracorp Superfund Site, Granite City, Illinois, October 1992. Based on the initial study, the areas of excavation have been generally defined. OHM will follow the direction of the USEPA on-site representative to determine the limits of the excavation(s). OHM will incorporate X-Ray Fluorescence (XRF) screening to assist in the removal action. The XRF screening is to be used in the residential areas only under direction by the USEPA. After the material has been excavated, an estimated 176 confirmatory samples will be collected. Samples of the excavated material will be obtained to determine appropriate disposal options. OHM will identify the hazardous and nonhazardous waste based upon previous analytical results provided by WOODWARD-CLYDE which was included as Appendix M to the Final Scope of Work dated January 27, 1993. This document is included as Exhibit I to the project work plan. The quantities of hazardous and nonhazardous soils that OHM anticipates removing from the locations are also based upon this same analytical information provided by WOODWARD-CLYDE.

The type of data needed to meet the project objectives will be generated through the installation of hand auger soil borings or equivalent. The analytical methods required to meet the project objectives are total lead using SW-846 Methods 3050/7420. Two disposal samples will be analyzed by the TCLP RCRA metals analysis. One sample of the backfill will be analyzed for volatile and semivolatile organics, pesticides, and RCRA metals.

The cleanup criteria outlined in the ROD dated March 30, 1990, as defined by the USEPA, requires the removal of all visual contamination from the alleyways, driveways, etc., and a cleanup criteria of 500 ppm for lead for the residential locations

1.4 FIELD ACTIVITIES

A USEPA representative will be on location to assist in defining the removal areas. At the residential areas, OHM will screen samples on location to quickly determine the levels of lead using XRF technology. The XRF screening will be performed to assist in removal of all material in the residential areas above 500 milligrams per kilogram (mg/kg) lead. The XRF screening will be performed approximately every 20 feet in a triangular pattern to be representative of the area.

A minimum of three verification samples from each of the excavations will be sent to an off-site laboratory for analysis. The areas will be backfilled and restored after verification sampling.

The Venice Alley locations will be excavated using visual criteria. The locations that are presently a parking lot, driveway, garage foundation, or similar use will be excavated using visual criteria if restoration of the area involves a barrier (asphalt, concrete, etc.) or to the 500 mg/kg cleanup level if restoration of the area does not involve such a barrier. OHM understands that no final determination can be made until residents are consulted regarding final restoration.

Confirmation sampling will be accomplished in all excavations that do not use visual criteria so that confirmation can be made that the 500 mg/kg cleanup level has been achieved. Extremely quick turnaround time will be used for analysis of all confirmatory samples.

The following sections describe the field activities to be performed as part of the investigation.

1.4.1 3108 Colgate

The contamination at this location appears to be limited to a fill area for the utilities on the east side of the residence. Because this area is residential and the neighboring residents were uneasy with our presence during the location visit, OHM understands it is important that we stay on the 3108 Colgate property only for access. All residents' questions will be referred to the USEPA or the USACE on-site representatives (OSR). OHM anticipates three confirmation samples for total lead analysis from this location based on an estimated 400 square feet to be excavated and resodded.

1.4.2 2226 Cleveland

A portion of the yard at this location will be excavated to remove contamination which is present. An estimated 90 square feet will be removed and resodded as part of the field activities. OHM anticipates three confirmation samples for total lead analysis from this location based on the estimated square feet to be excavated and resodded.

1.4.3 2230 Cleveland

All contaminated material will be removed from the driveway/garage area at this location. Additional contamination is present in the yard, but is not part of this work effort. Three confirmation samples for total lead analysis will be collected from this location in addition to the XRF screening data.

1.4.4 1628 Delmar

The yard is overgrown at this location so it is difficult to define the extent of the visible contamination therefore, the entire yard will be screened. Six confirmation samples (three from two separate areas) are estimated to be collected from this location in addition to the XRF field screening data.

1.4.5 108 Carver

All contaminated material will be removed from the driveway/old garage foundation area at this location. Three confirmation samples will be collected from this location in addition to the XRF screening data.

1.4.6 Missouri Avenue

Based on previous study, the excavation in the driveway will be to a depth of 1.5 to 2.0 feet. The southeast corner of the location will be excavated to a depth of 1 foot. Three confirmation samples will be collected from each location for a total of six samples, in addition to the XRF field screening data.

1.4.7 202A Harrison

OHM understands that personnel from the USEPA will be present to determine the depth of the removal at this location. A total of 11 confirmation samples are estimated to be obtained. Three confirmation samples are anticipated from the southwestern area of the property and eight confirmation samples from the vein of contamination roughly outlined by the gravel driveway are estimated.

1.4.8 203/205 Harrison

OHM understands that personnel from the USEPA will be present to determine the depth of the removal at this location. A total of 14 confirmation samples are anticipated from the area that consists of an old slough where residents indicated fill material was located.

1.4.9 100-201 Hill Street

A large portion of the south corner and a small portion of the northeast corner of the yard at this location will be excavated to remove contamination which is present. An estimated 3,500 square feet will be removed and resodded as part of the field activities. OHM anticipates 12 confirmation samples for total lead analysis from this location based on the estimated square feet to be excavated and resodded.

1.4.10 128 Roosevelt

OHM understands that personnel from the USEPA will be present to determine the depth of the removal at this location. A total of 12 confirmation samples are anticipated from the area based on an estimated 4,800 square feet to be resodded.

1.4.11 203/205 Terry

The western third of the property has visible battery casing material spread on the surface. OHM understands that personnel from the USEPA will be present to determine the depth of the removal at this location. Nineteen confirmation samples are anticipated from this excavation based on estimated square footage.

1.4.12 208 Terry

OHM understands that traces of battery casing material cover the entire location. Tall grass and underbrush cover the majority of the property. The central portion of the property contains trees, a trash pile, piles of dirt, and an abandoned foundation. Sixteen confirmation soil samples are anticipated from the excavation.

1.4.13 Weber Street

The alleyways bordered by First, Third, Granville, and Weber Streets will be excavated. A 2-foot edge along the excavation will be resodded and sampled for confirmation. A total of 12 soil samples are anticipated from the bordering areas (4 by 3).

1.4.14 Abbott Street

The Abbott Street areas include excavation of alleyways and portions of several residential properties. A total of 23 soil samples for confirmation are anticipated based on seven individual excavations associated with the activity.

1.4.15 Klein Avenue

An alleyway bordered by the railroad tracks, Oriole Street, Klein Avenue, and Brown Street will be excavated as part of the activity at this location. A 2-foot border along each side of the alley will be resodded as part of the restoration. Three soil samples for confirmation analysis will be obtained from each side for a total of six samples.

1.4.16 Slough Road

An area of Slough Road north of a trailer and tavern will be excavated and resodded as part of the activity at this location. A total of 8 soil confirmation samples are estimated based on square footage of the proposed excavation.

1.5 DISPOSAL SAMPLES

Composite samples for disposal will be collected from the contaminated soil and analyzed for disposal parameters. OHM will identify the disposal facility to be used for this work effort and the required disposal parameters for the facility. The expected analysis for disposal is TCLP RCRA Metals. Quality assurance (QA) samples will not be required for these samples because the acceptance of the disposal facility validates the data.

Disposal samples may also be collected from the liquids generated as part of the proposed decontamination protocols. OHM anticipates the decontamination liquids will be minimal and collected and stored in a polyethylene aboveground storage tank. The decontamination liquids will be sprayed onto the loaded soils as a dust control measure therefore, OHM anticipates no additional disposal of decontamination water will be required. The expected analysis for disposal is TCLP RCRA Metals. QA samples will not be required for these samples because the acceptance of the disposal facility validates the data.

1.6 BACKFILL SAMPLING

OHM will collect samples of the backfill source to be used for the restoration activities outlined in the Final Scope of Work, dated October 17, 1992. The anticipated analyses for the backfill samples include volatile and semivolatile organics, pesticides, and RCRA metals. OHM intends to collect backfill source samples any time the soil composition and/or appearance changes noticeably. The USACE-OSR will be consulted and approve of any additional analyses.

2.0 XRF SCREENING

At each of the residential locations, OHM will determine remediation boundaries and monitor progress by screening for the target analyte, lead, with a portable XRF analyzer. OHM intends to use the Spectrace 9000 (TN Technologies, Inc., Round Rock, Texas) for XRF screening purposes. During all XRF operations, OHM personnel will record intensity and results data in the XRF instrument log. Please refer to Exhibit I, Operating Manual for the Spectrace 9000 Portable XRF Analyzer, for detailed operating procedures.

2.1 AREA SCREENING

To facilitate rapid determination of remediation boundaries, OHM will screen each residential area with the portable XRF analyzer before any remediation activities begin.

OHM will perform this screening by setting up the portable XRF analyzer in an office provided by USACE. The soil samples will be taken to the unit and analyzed. A microwave oven will be used to dry the samples to be screened. The soil samples will be placed into sample cups and these will be placed on the probe for analysis. The sample cups are made up of three pieces: cup, ring, and a piece of Mylar film. The cup will be filled nearly full with the soil sample to be screened. If the sample is powdered, the cup will be tapped to settle the contents and, if necessary, more sample added until the cup is at least 3/4 full. A piece of Mylar film will be approximately centered and placed over the open cup.

The ring will be placed over the cup with the rounded edge down. The ring will be pushed down slowly until it is flush with the end of the cup. The film will be taut and wrinkle-free. OHM understands that wrinkles cause part of the sample to be held away from the face of the probe and can interfere with the analysis. The filled and sealed sample cup will be inverted and tapped again to thoroughly settle and compact the contents. The sample will be placed film side down on the probe for analysis. The 30-millimeter ring will be placed in the large hole in the shield cup base to locate the sample cup reproducibly over the probe aperture. The OHM field chemist will ensure the sample cup rests in contact with the probe face. The probe button will be depressed and analysis of the sample will begin.

For each sampling location OHM personnel will record intensity and results data obtained from the XRF analyzer. Data from the XRF logs will be used to map the site remediation boundaries and target remediation activities to those areas above the action level of 500 mg/kg. The manufacturer reports that the detection limit for the Spectrace 9000 is typically 50 to 100 mg/kg for most analytes. Area screen soil samples will be acquired according to the procedures detailed in Section 3.3, Methodology.

2.2 CONFIRMATION SCREENING

Throughout the remediation activities, OHM will monitor progress by screening the excavation area with the portable XRF analyzer as previously described. OHM will screen with the portable XRF prior to each sampling event. Sampling locations will be randomly selected on each wall and on the floor of the excavation area. If screening data shows any section of the excavation to be below the lead action level (500 mg/kg), OHM will re-screen the entire area at randomly selected locations to determine remediation consistency. If levels are discovered to be greater than the action level, OHM will notify the OSR for further direction. OHM anticipates excavation to continue until all screening points are below the action level of 500 mg/kg. All XRF screening data, including intensity readings, will be recorded in the XRF instrument log.

2.3 CONFIRMATION SAMPLING

When XRF screening shows an excavated area to be below the action level (500 mg/kg) OHM will confirm this fact by sending several grab samples from each of the areas to be verified to EHRT Laboratory for total lead analysis. OHM will also obtain 10 percent field replicate samples from randomly selected residential excavations. EHRT Laboratory will be required to perform matrix quality control (QC) on one of OHM's QC samples. Please refer to Section 3.0, Confirmation Sampling for detail concerning the acquisition of the confirmation samples.

2.4 ANALYTICAL SERVICES

The name, address, and phone number of EHRT Laboratory is:

EHRT Laboratory
3532 Omni Drive
Cincinnati, OH 45245
513-752-2950
Contact: Dr. Mona Risk

OHM will use EHRT Laboratory to analyze the confirmation samples. OHM will expect EHRT Laboratory to follow in strict accordance to USEPA methods and to provide OHM with documentation which attests to this fact. EHRT Laboratory will be expected to provide OHM with a single-person contact for any discussions concerning OHM samples. This person will be expected to verify receipt, monitor progress, and appraise OHM of the status of its' samples. OHM requires immediate (24-hour) notification of laboratory problems with its' samples. A 24-hour turnaround time (from receipt of samples) will be requested for the confirmation samples.

3.0 CONFIRMATION SAMPLING

Environmental soil samples, plus duplicates, and matrix spike/matrix spike duplicates will be collected to assess the residual contamination remaining after excavation and removal of the contaminated soils.

3.1 OBJECTIVES

This sampling effort is intended to assess the residual contamination remaining at the horizontal and vertical (lower) limits of the excavation. Systematic sampling will be used in combination with judgement sampling to acquire samples representative of the residual contamination remaining.

3.2 TECHNICAL APPROACH

OHM sample technologists will locate the post-excavation sample points after excavation activities are completed. XRF screening may be utilized to determine if verification samples will be taken and composited. Systematic screening techniques will be used to locate the sample points that will make up the samples from each of the areas to be sampled for confirmation analysis. The sample points will be located by using a systematic grid. Fence posts will be used to mark the horizontal limits of the excavation at the corners. A 20- by 20-foot grid will be superimposed over the area to be sampled. The center of each grid will be sampled for confirmation analysis. The center point will be located horizontally by intersecting diagonals from these points and a sample will be obtained at that point. A sample will be acquired at each point and screened with the portable XRF. Duplicate samples will be chosen on a 10 percent basis from the areas for an estimated total of 176 field samples to be submitted for confirmation analysis at the contract laboratory.

3.3 METHODOLOGY

The OHM sample technologist will create a field sketch of the excavation area in a single plane. This sketch will be to approximate scale using the actual dimensions of the completed excavation. The center point of each grid will be located at the intersection of diagonal lines drawn from opposite corners of each grid.

The sample technologist will thoroughly clean a stainless-steel tulip bulb planter (or equivalent) according to the protocols in Section 3.4, Decontamination Procedures, using a soap/water/nitric acid rinse. The sample points will be located horizontally on the surface to the nearest foot using a tape measure. Surveyor's stakes or flags will be used to locate the sample points at the surface. OHM anticipates very shallow excava-

tions. If the excavations are determined to be unsafe to enter based on depth, soil type, slope, and/or compaction, OHM will obtain samples by subsampling the bucket of the excavator. If the excavations are determined to be safe to enter, the sample technologist will use the same techniques outlined below to acquire samples at the grid centers.

The sample technologist will don clean sample gloves, remove a clean disposable stainless-steel spatula from its factory packaging or wrapping, and scrape away the surface layer of soil. The sample technologist will again don clean sample gloves, remove the clean tulip bulb planter from its wrapping, and insert it into the soil to its full depth (approximately 6 inches) and retrieve it.

This material will be transferred to each of one or two precleaned, 8-ounce, wide-mouth, clear glass sample jars with Teflon-lined lids (Eagle-Picher Catalogue No. 131-08C, or equivalent). The jars will be sealed and labeled. Clear tape will be placed over the label and custody seals will be applied to each container. Each sample will be placed into double Ziplock bags, wrapped in sorbent padding, and placed into a sample cooler. A chain-of-custody record form will be completed and the sample will be documented in the field sampling notes. The stainless-steel utensils will be decontaminated again using the protocols detailed in Section 3.4, Decontamination Procedures. The sample will be shipped to the EHRT Laboratory for total lead analysis as detailed in Section 3.3.1, Sample Packaging. A 24-hour turnaround time will be requested (from time of sample receipt at the laboratory) in order to determine, in a timely manner, the residual contaminants remaining in the material.

The sampling items (used gloves, paper towels, disposable sampling gear, etc.) will then be placed in a disposal container. The samples will be labeled, packaged on ice, and their location documented on site sketches. This process will be repeated for each sample point location as well as the randomly selected duplicate sample points.

QA samples will be taken as described above. Every eleventh field sample for confirmation analysis will be split. One split sample will be submitted for duplicate analysis. Three other randomly selected area samples will be submitted for matrix spike/matrix spike duplicate analysis by the selected laboratory. Each QC sample will be labeled and documented as such. If additional matrix spike/matrix spike duplicate samples are deemed prudent because of noticeable soil composition and/or appearance changes, or area/location, the USACE-OSR will be consulted for approval.

3.3.1 Sample Packaging

The samples will be wrapped with sorbent padding to reduce the chance of breakage in shipment and enclosed within a single plastic Ziplock bag. The bottom of the metal, or equivalent strength plastic shipping cooler will be lined with absorbent material, such as sorbent pads. The drain of the shipping container will be securely taped to prevent leakage in shipment. The wrapped containers will then be placed in

the cooler allowing at least 1 inch of spacing between each container. Once the samples are secured, sorbent pads and ice will be placed on top of and among the sample containers. The remaining headspace in the cooler, if any, will then be filled with ice, followed by sorbent pads. Precautions will be taken to assure that the sample labels remain intact and legible. The ice will be secured within Ziplock bags.

The sample technologist will then sign the bottom of each chain-of-custody record form after Transfer Number 1. Under the heading "Transfers Relinquished By," he will fill in the courier's company name (such as Federal Express or UPS) and bill-of-lading number (or airbill number) as well as the date and time of sample custody relinquishment. The now completed chain-of-custody record forms will be enclosed in plastic Ziplock bags and taped to the underside of the lid of the cooler.

Prior to the sealing of the cooler, an OHM Shipment Checklist will be reviewed for completion. The checklist is a tool utilized by OHM to standardize sample packaging procedures during field operations.

A minimum of three custody seals or evidence tape will be fixed to the cooler lid(s). The cooler(s) will then be shipped to the subcontract laboratory via common courier. The cooler will be sealed, addressed, identified, and placarded as environmental samples. A 24-hour turnaround time from time of sample receipt at the laboratory will be requested.

3.4 DECONTAMINATION PROCEDURES

Decontamination of sampling equipment will be performed to ensure the potential for cross contamination is minimized.

3.4.1 Sampling Equipment

The field sampling equipment cleaning and decontamination procedures are as follows:

- Non-phosphate detergent wash and brushing to remove large particles
- Tap water rinse
- Sample glove change
- Ten percent nitric acid rinse (trace metal or higher grade HNO_3 diluted with distilled/deionized H_2O)
- Sample glove change

- Double distilled/deionized water rinse
- Total air dry

3.4.2 Sample Containers

Sample containers will be precleaned by the manufacturer to USEPA cleaning protocols prior to arrival at the project site. The certification number which is in each box of containers will be noted in the field logbook. The certificates of analysis which accompany each box of containers will be retained as part of the project files.

3.5 SAMPLE CONTROL

Field personnel are responsible for the identification, preservation, packaging, handling, shipping, and storage of samples obtained from this site. All samples must be readily identifiable and retain to the extent possible the in-situ characteristics to be determined through testing. All samples collected to be analyzed for disposal parameters will be validated through the following procedures and preparations of a chain-of-custody record form.

3.5.1 Sample Containers

Soil samples taken for total lead analysis will be packaged in precleaned, 8-ounce wide-mouth, clear glass jars secured with a Teflon-lined lid (Eagle Picher No. 131-08C, or equivalent).

3.5.2 Sample Number

All samples obtained during the course of this project will be consecutively numbered. Each sample identification number includes a five-digit project code (OHM project number 13407) and a two-digit (or more as required) sequence number assigned by the sampler(s) at the time of collection. Post excavation samples will be consecutively numbered beginning with 10,001. The sample numbers will be recorded in consecutive order in a sample logbook. Field sketches will include the sample points and dimensions to trace the sample locations to the nearest foot within the excavations.

3.5.3 Sample Label

Correct sample labeling and the corresponding notation of the sample numbers in the field logbook are necessary to prevent misidentification of samples and their eventual

results. All sample labels will be completed legibly with indelible ink. The completed label will be affixed to the sample bottle and covered with clear tape. All sample labels will include at a minimum the following information:

- Name/initials of collector
- Name/initials of witness
- Date and time (in military time) of sample collection
- OHM project number (13407)
- Place of collection
- Sample number (will uniquely identify each sample, i.e., project, station, location, depth interval, etc.)
- Matrix and appearance of sample
- Analysis required
- Preservatives added (if any)
- Designation between "grab" or "composite" sample

3.5.4 Field Log

OHM will record information from the sample collection activities in the sampler's field logbook. The log will be a diary of the sampler's activities and will contain sample point locations, appearance, date and time of sample, sampler's identity, and any other pertinent observations.

3.5.5 Chain-of-Custody Procedures

All samples taken on this site will be verified with chain-of-custody procedures. The procedures followed will be in accordance with USACE Sampling Handling Protocols and USACE procedures. It is very important that the information on the chain-of-custody record form match the information on the sample bottles. The chain-of-custody record forms will be completed, enclosed in a plastic Ziplock bag, and taped to the underside of the lid of the shipping containers utilized. A copy of the chain-of-custody record form will be retained as part of the project files.

3.5.6 Sample Preservation

The post excavation soil samples submitted for confirmation analysis will be placed on ice to maintain each sample's temperature at 4 degrees Celsius.

3.6 ANALYSIS

The soil samples submitted for confirmation analysis will be analyzed according to USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd Edition, September 1986. The soil samples submitted for Total Lead Analysis will be prepared by SW-846 Method 3050, "Acid Digestion of Sediments, Sludges and Soils," followed by the direct aspiration techniques detailed in Method 7420 for lead.

A 24-hour turnaround time from time of sample receipt at the laboratory will be requested. The samples for metals analysis will be analyzed within 6 months, the maximum allowable holding time. Soil and sediment sample results will be calculated and reported on a dry weight basis.

3.7 EQUIPMENT REQUIREMENTS

- Stainless-steel hand auger or equivalent (1)
- Stainless-steel scoops (20)
- Stainless-steel spatulas (VWR Catalogue No. 58575, or equivalent) (250)
- Vinyl sample gloves (1,000)
- Non-phosphate detergent (14 ounces)
- Eight-ounce, wide-mouth, clear glass sample jars with Teflon-lined lids (Eagle-Picher No. 131-08C, or equivalent) precleaned to USEPA Protocol A (250)
- Fifty-four-quart coolers (5)
- Bale sorbent pads (1)
- Ice
- Paper towels

- Field logbook (1)
- Chain-of-custody record forms (150)
- Five-gallon buckets (4)
- 1:10 nitric acid (4 liters)
- Deionized water (20 liters)
- Scrub brush (1)
- Sample labels (250)

4.0 EXCAVATED SOIL AND DECONTAMINATION LIQUID SAMPLING

Excavation of the soils is necessary in the areas impacted from the battery casings. These soils are potentially contaminated and will need to analyzed for treatment and disposal options to be considered.

The soils that are to be removed from the excavated areas will require sampling and analysis to define disposal/treatment options. The liquids generated as a result of decontamination activities will be collected and sampled for disposal/treatment options if they are not completely used for dust control measures.

This section of the CSAP deals with sampling and analysis of the soils and decontamination liquid generated from the excavation activities. All sampling procedures utilized will be in accordance with USACE Sample Handling Protocol (ER 1110-1-263, Appendix E).

4.1 OBJECTIVES

OHM will verify with treatment, storage, and disposal facilities, and define any additional analytical methods necessary for disposal of these wastestreams. OHM understands that all proposed protocols are subject to USACE approval and will inform the USACE-OSR of each step of the process.

4.2 TECHNICAL APPROACH

A flow based composite of the soils removed from each area will be obtained by subsampling selected buckets of the excavator during removal activities. Portable XRF screening may be used to screen and segregate soils removed for cost effectiveness of disposal activities. The soils excavated will be segregated based upon analytical data provided by WOODWARD-CLYDE included as Exhibit I to the project work plan.

OHM will combine liquids from the decontamination process into a portable bulk container staged at a suitable location (central site). A depth based composite of liquids generated as a result of decontamination activities will be obtained at the completion of this project as well. OHM anticipates that all decontamination liquids will be used for dust control measures and may not need to be sampled.

4.3 SAMPLE COLLECTION FOR DISPOSAL ANALYSIS AND APPROVAL

OHM intends to mobilize two personnel to the locations after delivery order issuance and prior to the mobilization of excavation equipment for the purposes of obtaining soil samples for waste characterization and subcontractor acceptance/

approval(s). One composite of the hazardous areas and one composite of the non-hazardous areas will be created from no less than five grab samples from each respective wastestream. The location of the sample points will be based upon previous analytical results as detailed in Exhibit I to the work plan, Previous Analytical Results provided by WOODWARD-CLYDE. Judgment samples will be obtained at sample points within the areas delineated as hazardous and nonhazardous areas.

The sample technologist will don clean sample gloves and remove a stainless-steel spatula from its' factory packaging. The surface layer of soil in the selected bucket will be scraped away with a disposable stainless-steel spatula. The sample technologist will once again don clean sample gloves and remove a clean stainless-steel hand auger from its' wrapping. The clean hand auger will be inserted into the soil of the bucket to its' full depth (approximately 6 inches) and retrieved.

The sample technologist, using the hand auger, will place the soil obtained into a precleaned, 8-ounce, wide-mouth, clear glass sample jar (Eagle Picher No. 131-08C, or equivalent).

When the samples have been obtained and documented, the sample technologist will once again don clean sample gloves and thoroughly mix the various grab samples for disposal in the stainless-steel mixing bowl (Cole-Parmer Catalogue No. L-07300-50, or equivalent) to homogenize the contents. The grab samples representing the hazardous areas will be separate composites than those from the nonhazardous areas. Large clods will be broken up, if needed, using a gloved hand until no piece is larger than 0.25 inches square. The stainless-steel spatula (VWR Catalogue No. 58575, or equivalent) will be used to thoroughly mix the contents of the bowl for no less than 3 minutes or until the contents are homogenous. The mixture will be spread into a thin layer and quartered. Opposite quarters will be discarded and the mixing, quartering, and splitting process continued until no less than 2 quarts by volume remains in the stainless-steel bowl. This material will be transferred to each of four precleaned, 32-ounce, wide-mouth, clear glass sample jars with Teflon-lined lids (Eagle-Picher Catalogue No. 131-32C, or equivalent). The jars will be sealed and labeled. Clear tape will be placed over the sample label and a custody seal will be applied to each sample container to be shipped. Each sample container will be placed into two Ziplock bags. The containers will be wrapped in sorbent padding and placed into a sample cooler. The stainless-steel utensils will be decontaminated again using the protocols detailed in Section 3.4, Decontamination. One sample of each wastestream is for disposal analysis, the other three samples are for disposal acceptance purposes.

A chain-of-custody record form will be completed and one sample from each wastestream will be documented in the field sampling notes. One sample from each of the two wastestreams will be shipped to EHRT Laboratory in Cincinnati, Ohio, for Landfill Disposal analysis detailed in Table 4.1, the others will be shipped to the Analytical Services Corp., a wholly-owned subsidiary of OHM Corporation, (ASC)

TABLE 4.1

ANALYTICAL REQUIREMENTS
LANDFILL DISPOSAL FOR SOLIDS AND SLUDGES

Physical Tests:

Paint Filter Test, +/-
Color
Phasing
Solids, Total, % by Wt.
Density (bulk), g/cc

Characteristics Tests

Reactivity	Method	LOD (mg/kg)
Reactive Cyanide	9012	10
Reactive Sulfide	9030	10

Corrosivity, Standard Units

pH Test	9041	

Ignitability, Degrees Fahrenheit or Celsius

Flash Point, SF, CC
Flame Test

Organics

Volatile Organics	8240	10/50
Semivolatile Organics	8270	10/50
PCB	8080	1.0

Conventional Tests

Extractable Organic Halogens	9075	1.0
Total Cyanide	9012	1.0
Total Phenols	9065	1.0

TABLE 4.1 (CONTINUED)

ANALYTICAL REQUIREMENTS
LANDFILL DISPOSAL FOR SOLIDS AND SLUDGES

Toxicity Leachate Characteristics Procedure (TCLP)

Metals	Method LOD (ppm)	Reference
Arsenic	0.1	7061
Barium	10.0	7081/6010
Cadmium	0.1	7130/7131/6010
Chromium	0.1	7190/7191/6010
Lead	0.1	7420/7421/6010
Mercury	0.01	7470
Selenium	0.1	7741
Silver	0.1	7760/7761/6010
Volatile Organics		
Benzene	0.05	8260
Carbon tetrachloride	0.05	8260
Chlorobenzene	1.0	8260
Chloroform	0.5	8260
2-Butanone	5.0	8260
Tetrachloroethene	0.05	8260
Trichloroethene	0.05	8260
Vinyl chloride	0.05	8260
Semivolatiles		
o-Cresol	5.0	8270
m-Cresol	5.0	8270
p-Cresol	5.0	8270
Cresol	5.0	8270
1,4-Dichlorobenene	0.5	8260/8270
1,2-Dichloroethane	0.05	8260
1,1-Dichloroethene	0.05	8260
2,4-Dinitrotoluene	0.01	8270
Hexachlorobenzene	0.01	8270
Hexachlorobutadiene	0.05	8270
Hexachloroethane	0.5	8270

TABLE 4.1 (CONTINUED)

ANALYTICAL REQUIREMENTS
LANDFILL DISPOSAL FOR SOLIDS AND SLUDGES

Metals	Method LOD (ppm)	Reference
Semivolatiles		
Nitrobenzene	0.1	8270
Pentachlorophenol	5.0	8270
Pyridine	0.5	8270
2,4,6-Trichlorophenol	0.1	8270

Laboratory in Findlay, Ohio, to be held prior to shipping them to the six potential disposal subcontractors. The six samples to be submitted to the various disposal subcontractors for disposal approvals will be sent with waste profiles upon receipt of the analytical results. A 21-day turnaround time will be requested (from time of sample receipt at the laboratory) for the disposal analysis of the nonhazardous soils. A 24-hour turnaround time (from time of sample receipt at the laboratory) will be requested for the disposal analysis of the hazardous soils.

4.4 SAMPLE COLLECTION FOR DISPOSAL DETERMINATION

The excavated soils will be placed into 1-cubic-yard, reinforced nylon bags (totes). These bags will be loaded into dumptrucks for transport to either a stockpile located in the Taracorp/Trust 454 property, if they originated in an area determined to be nonhazardous, based on the previous analytical results detailed in Exhibit I of the work plan, or transported directly to the selected hazardous-waste disposal subcontractor. The material determined to be hazardous based upon the previous analytical results will be transported directly to the chosen disposal subcontractor and will not be stockpiled. Samples of the excavated materials will be obtained and composited to confirm their hazardous/ nonhazardous properties by analysis for TCLP lead. Duplicate samples will be obtained on a 10 percent basis. The composite number representing each truckload of bags will be spray painted on two sides of each bag with numbers at least 1-foot high.

4.5 SOIL SAMPLING METHODOLOGY

A randomly selected grab sample from one bucketful of material of each tote will be taken and composited with the samples representing each dumptruck load (approximately 14 totes). These composites will be submitted for TCLP lead analysis to EHRT Laboratory. OHM anticipates approximately 205 composite samples for analysis.

To accomplish this task, the sample technologist will don clean sample gloves, remove a disposable stainless-steel spatula from its factory packaging, and scrape away the surface layer of soil in the selected bucket. Then the sample technologist will again don clean sample gloves, remove the clean hand auger or equivalent from its wrapping, and insert it into the soil of the bucket to its full depth (approximately 6 inches) and retrieve it.

The sample technologist will place the soil obtained into a precleaned 8-ounce, wide-mouth, clear glass sample jar (Eagle Picher No. 131-08C, or equivalent). These samples will eventually be composited into samples representing each truckload of totes.

When the excavation activities for the area are complete, the sample technologist will once again don clean sample gloves and thoroughly mix the various grab samples from the individual dumptruck loads in the stainless-steel mixing bowl (Cole-Parmer Catalogue No. L-07300-50, or equivalent) to homogenize the contents. Large clods will be broken up, if needed, using a gloved hand until no piece is larger than 0.25 square

inches. The stainless-steel spatula (VWR Catalogue No. 58575, or equivalent) will be used to thoroughly mix the contents of the bowl for no less than 3 minutes or until the contents are homogenous. The mixture will then be spread into a thin layer and quartered. Opposite quarters will be discarded and the mixing, quartering, and splitting process continued until no less than 2 quarts by volume remains in the stainless-steel bowl. This material will be transferred to one precleaned, 32-ounce, wide-mouth, clear glass sample jar with a Teflon-lined lid (Eagle-Picher Catalogue No. 131-32C, or equivalent). The jar will be sealed and labeled. Clear tape will be placed over the sample label, and a custody seal will be applied to each sample container to be shipped. Each sample container will be placed into two Ziplock bags, wrapped in sorbent padding, and placed into a sample cooler. The stainless-steel utensils will be decontaminated again using the protocols detailed in Section 3.4, Decontamination Procedures.

A chain-of-custody record form will be completed and the sample will be documented in the field sampling notes. The sample will be shipped to the subcontract laboratory for TCLP lead analysis.

4.6 LIQUID SAMPLING METHODOLOGY

OHM expects all decontamination water will be used for dust control during soil load-out operations. If decontamination water is not completely used, the remaining liquids will be sampled for disposal analysis.

The OHM sampling technician, clad in USEPA Level C personal protective equipment, will assemble a pre-cleaned, Teflon Bacon bomb sampler. The Bacon bomb sampler consists of a Teflon cylinder with a hole at the bottom and a weighted plunger to plug the hole (refer to Figure 4.1). The plunger protrudes through the top of the cylinder. There is a hole at the top of this rod where string can be attached to operate the plunger while sampling. The technician will attach a length of new sample string and a length of new 3/8-inch polyethylene rope to the Bacon bomb sampler. The rope will be marked in 1-foot increments or depths which will be needed for a representative sample of the tank. Polyethylene sheeting will be spread in the immediate vicinity of the sample point ensuring the sample string and rope do not touch any surface which may affect the integrity of the sample or the content of any tank. The Bacon bomb sampler will be lowered into the liquid(s) of the tank and an aliquot obtained at several depths by smoothly pulling on the string. This procedure will be repeated until the Bacon bomb sampler is full or the bottom of the tank is reached. Every attempt will be made to obtain equal aliquots at each depth. The Bacon bomb sampler will be retrieved and unloaded into a 1-liter glass sample container by placing it above the sample container and holding the plunger open with the attached string.

It is important that the surface of the liquid be visible to the sample technician at all times, because when the liquid flows into the sampling device, air is forced out of the top. The absence of air bubbles rising to the surface of the liquid lets the sample technician know when the Bacon bomb sampler is full.

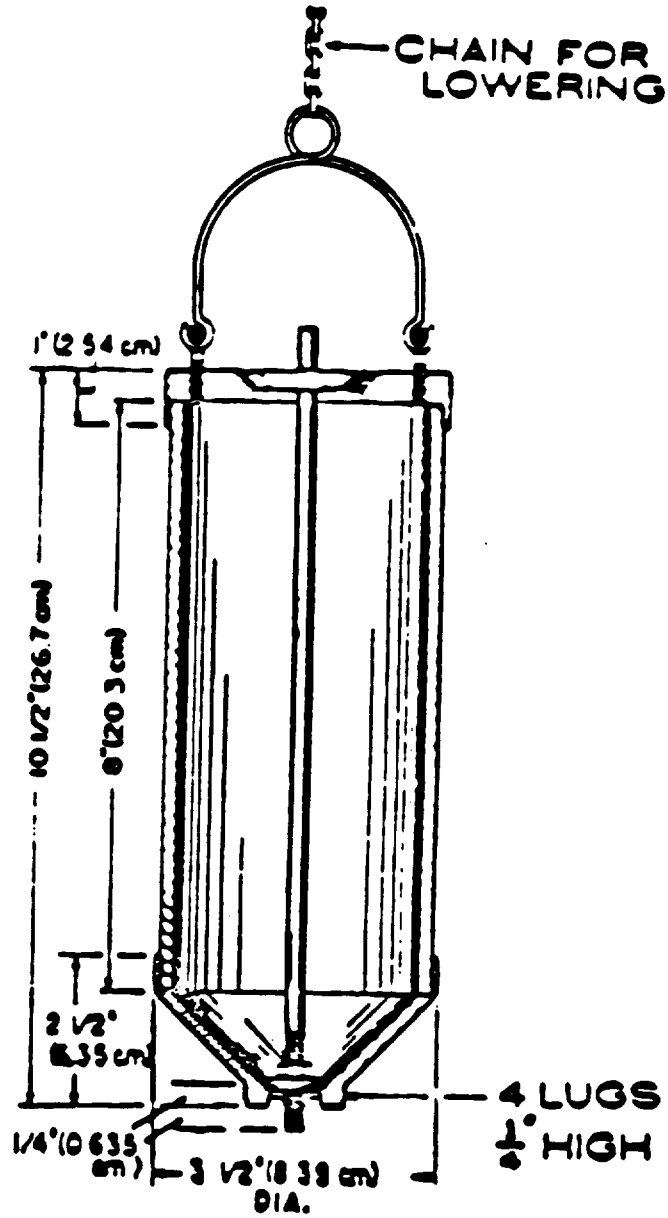

FIGURE 4.1
BACON BOMB SAMPLER

The Bacon bomb sampler will be disassembled and thoroughly decontaminated prior to each use with a soap/water/nitric acid water rinse. The sample string and polyethylene rope used in the acquisition of samples will be discarded after each use.

4.7 SAMPLE PACKAGING

The samples will be wrapped with sorbent padding to reduce the chance of breakage in shipment and enclosed within a single plastic Ziplock bag. The bottom of the metal or equivalent strength plastic shipping cooler will be lined with absorbent material, such as sorbent pads. The drain of the shipping container will be securely taped to prevent leakage in shipment. The wrapped containers will then be placed in the cooler allowing at least 1 inch of spacing between each container. Once the samples are secured, sorbent pads and ice will be placed on top of and among the sample containers. The remaining headspace in the cooler, if any, will then be filled with ice followed by sorbent pads. Precautions will be taken to assure that the sample labels remain intact and legible.

The sample technologist will then sign the bottom of each chain-of-custody record form after Transfer No. 1. Under the heading "Transfers Relinquished By," he will fill in the courier's company name (such as Federal Express or UPS) and bill-of-lading number (or airbill number), as well as the date and time of sample custody relinquishment. The now-completed chain-of-custody record forms will be enclosed in plastic Ziplock bags and taped to the underside of the lid of the cooler.

Prior to the sealing of the cooler, an OHM Shipment Checklist will be reviewed for completion. The checklist is a tool utilized by OHM to standardize sample packaging procedures during field operations.

A minimum of three seals or evidence tape will be fixed to the cooler lid(s). The cooler(s) will then be shipped via common courier. The cooler will be sealed, addressed, identified, and placarded as environmental samples.

4.8 SAMPLE CONTROL

OHM field personnel are responsible for the identification, preservation, packaging, handling, shipping, and storage of samples obtained from this site. All samples will be readily identifiable and retain to the extent possible the in-situ characteristics to be determined through testing. All samples collected to be analyzed by a laboratory will be validated through the following procedures and preparation of a chain-of-custody record form.

4.8.1 Sample Number

All samples obtained during the course of this project will be consecutively numbered. Each sample identification number includes a five digit project code (OHM

project number 13407) and a two-digit (or more as required) sequence number assigned by the sampler(s) at the time of collection. The sample numbers will be recorded in consecutive order in a sample logbook.

Excavation samples for landfill disposal analysis will be consecutively numbered beginning with 20,001. Soil samples submitted to selected vendors for disposal acceptance will be consecutively numbered beginning with 30,001.

Liquid samples for wastewater treatment disposal analysis will be consecutively numbered beginning with 40,001. Liquid samples submitted to selected vendors for disposal acceptance will be consecutively numbered beginning with 50,001.

4.8.2 Sample Label

Correct sample labeling and the corresponding notation of the sample identification numbers in the field logbook are necessary to prevent misidentification of samples and their eventual results. All sample labels will be completed legibly with indelible ink. The completed label will be affixed to the sample bottle and covered with clear tape. All sample labels will include at a minimum the following information:

- Name/initials of collector
- Name/initials of witness
- Date and time (in military time) of sample collection
- OHM project number (13407)
- Place of collection
- Sample identification number (will uniquely identify each sample, i.e., project, station location, depth interval, etc.)
- Matrix and appearance of sample
- Analysis required
- Preservatives added (if any)
- Designation between "grab" or "composite" sample

4.8.3 Field Log

OHM will record information from the sample collection activities in the sampler's field logbook. The log will be a diary of the sampler's activities and will contain sample point locations, appearance, date and time of sample, sampler's identity, and any other pertinent observations.

4.8.4 Chain-of-Custody Procedures

All samples taken on this site will be verified with chain-of-custody procedures. The procedures followed will be in accordance with USACE Sampling Handling Protocols and USACE procedures. It is very important that the information on the chain-of-custody record form match the information on the sample bottles. The chain-of-custody record forms will be completed, enclosed in a plastic Ziplock bag, and taped to the underside of the lid of the shipping containers utilized.

4.8.5 Sample Preservation

The excavated soil samples submitted for disposal analysis will be placed on ice to maintain each sample's temperature at 4 degrees Celsius. No preservation will be required of the soil/liquid samples submitted for disposal acceptance purposes.

4.9 ANALYSIS

Eight soil samples for disposal parameters may be analyzed according to the parameters specified in Table 4.1, Analytical Requirements of Landfill Disposal for Solids and Sludges.

One liquid sample for disposal parameters will be analyzed according to the parameters specified in Table 4.2, Analytical Requirements of Wastewater Treatment Disposal for Liquids.

The soil samples submitted for disposal parameter analysis will be analyzed according to USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd Edition, September 1986. A 21-day turnaround time (from laboratory receipt) will be requested for disposal analysis.

OHM understands that the analytical requirements for disposal purposes vary greatly among disposal firms. This is due to the individual disposal firm's state requirements as well as their operating permits. The listed analytical requirements within Tables 4.1 and 4.2 will vary accordingly, but OHM feels that the analytical requirements proposed are suitable for a wide variety of disposal firms and state requirements.

TABLE 4.2

ANALYTICAL REQUIREMENTS
WASTEWATER TREATMENT DISPOSAL FOR LIQUIDS

Physical Tests:

Phasing
Solids, Total, % by Wt.

Characteristics Tests

Reactivity	Method	LOD (mg/kg)
Reactive Cyanide	9012	10
Reactive Sulfide	9030	10

Corrosivity, Standard Units

pH Test	9041

Ignitability, Degrees Fahrenheit or Celsius

Flash Point, SF, CC
Flame Test

Toxicity Leachate Characteristics Procedure (TCLP)

Metals	Method LOD (ppm)	Reference
Arsenic	0.1	7061
Barium	10.0	7081/6010
Cadmium	0.1	7130/7131/6010
Chromium	0.1	7190/7191/6010
Lead	0.1	7420/7421/6010
Mercury	0.01	7470
Selenium	0.1	7741
Silver	0.1	7760/7761/6010

5.0 BACKFILL SAMPLING

Environmental soil samples will be collected to assess the residual contamination within the backfill used at the locations to be excavated.

5.1 OBJECTIVES

This sampling effort is intended to assess the residual contamination remaining at the backfill used at the residential locations. OHM understands that samples of the backfill should be taken any time the soil composition and/or appearance changes noticeably.

5.2 TECHNICAL APPROACH

A systematic, equidistant grid will be used to locate sample points. OHM will submit a sample for volatile analysis, semivolatile organic analysis, and RCRA metal analysis. A grab sample will be acquired at each grid point and combined with the other sample points from the same area (except for the aliquot selected for volatile organic analysis) for a single composite sample.

5.3 METHODOLOGY

The OHM sample technologist will create a field sketch of the surface of the backfill excavation area in one plane. This sketch will be to approximate scale using the actual dimensions of the anticipated excavation. The center point will be located at the intersection of diagonal lines drawn from opposite corners of each of the four estimated sidewall planes.

The sample technologist will thoroughly clean a stainless-steel tulip bulb planter (or equivalent) according to the protocols in Section 5.4, Decontamination Procedures, using a soap/water/nitric acid water rinse. The sample points will be located horizontally on the surface to the nearest foot using a tape measure. Wooden tongue depressors will be used to locate the sample points at the surface.

The sample technologist will don clean sample gloves, remove a disposable stainless-steel spatula from its' factory packaging, and scrape away the surface layer of soil at the randomly selected point. Then the sample technologist will again don clean sample gloves, remove the clean tulip bulb planter from its' wrapping, and insert the clean tulip bulb planter into the soil to its' full depth (approximately 6 inches) and retrieve it. The soil obtained will be placed into a precleaned, 4-ounce, wide-mouth, clear glass sample jar (Eagle Picher No. 130-04C, or equivalent). This sample will be submitted for volatile organic analysis.

The sample technologist, using the hand auger, will repeat the process of inserting and retrieving the sampler and placing the soil obtained into precleaned, 8-ounce, wide-mouth, clear glass sample jars (Eagle Picher No. 131-08C, or equivalent).

The sample technologist will once again don clean sample gloves and thoroughly mix the samples in the stainless-steel mixing bowl (Cole-Parmer Catalogue No. L-07300-50, or equivalent) to homogenize the contents. Large clods will be broken up, if needed, using a gloved hand until no piece is larger than 0.25 square inches. The stainless-steel spatula (VWR Catalogue No. 58575, or equivalent) will be used to thoroughly mix the contents of the bowl for no less than 3 minutes. The mixture will then be spread into a thin layer and quartered. Opposite quarters will be discarded and the mixing, quartering, and splitting process continued until no less than 2 quarts by volume remains in the stainless-steel bowl. This material will be transferred to each of two precleaned, 32-ounce, wide-mouth, clear glass sample jars with Teflon-lined lids (Eagle-Picher Catalogue No. 133-32C, or equivalent). All the jars will be sealed and labeled. Clear tape will be placed over the label and custody seals applied to each container for shipment. Each container will be placed into two Ziplock bags, wrapped in sorbent padding, and placed into a sample cooler. A chain-of-custody record form will be completed and the sample documented in the field sampling notes. One sample will be sent for analysis and the other held on site for contingency purposes. The stainless-steel utensils will be decontaminated again using the protocols detailed in Section 5.4, Decontamination Procedures. The sample will be shipped to EHRT Laboratory as detailed in Section 5.3.1, Sample Packaging, for volatile and semivolatile organics, pesticides, and RCRA metals. A 21-day turnaround time from time of sample receipt at the laboratory will be requested in order to determine the residual contaminants remaining in the material in a timely manner.

The sampling trash (used gloves, paper towels, disposable sampling gear, etc.) will then be picked up. The samples will be labeled, packaged on ice, and their location documented on site sketches.

5.3.1 Sample Packaging

The samples will be wrapped with sorbent padding to reduce the chance of breakage in shipment and enclosed within a single plastic Ziplock bag. The bottom of the metal or equivalent strength plastic shipping cooler will be lined with absorbent material such as sorbent pads. The drain of the shipping container will be securely taped to prevent leakage in shipment. The wrapped containers will then be placed in the cooler allowing at least 1 inch of spacing between each container. Once the samples are secured, sorbent pads and ice will be placed on top of and among the sample containers. The remaining headspace in the cooler, if any, will then be filled with ice followed by sorbent pads. Precautions will be taken to assure that the sample labels remain intact and legible.

The sample technologist will then sign the bottom of each chain-of-custody record form after Transfer Number 1. Under the heading "Transfers Relinquished By," he will fill in the courier's company name (such as Federal Express or UPS) and bill-of-lading number (or airbill number) as well as the date and time of sample custody relinquishment. The now-completed chain-of-custody record forms will be enclosed in plastic Ziplock bags and taped to the underside of the lid of the cooler.

Prior to the sealing of the cooler, an OHM Shipment Checklist will be reviewed for completion. The checklist is a tool utilized by OHM to standardize sample packaging procedures during field operations.

A minimum of three custody seals or evidence tape will be fixed to the cooler lid(s). The cooler(s) will then be shipped to the subcontract laboratory via common courier. The cooler will be sealed, addressed, identified, and placarded as environmental samples. A 21-day turnaround time from time of sample receipt at the laboratory will be requested.

5.4 DECONTAMINATION PROCEDURES

Decontamination is accomplished to ensure the potential for cross contamination is minimized.

5.4.1 Sampling Equipment

The field sampling equipment cleaning and decontamination procedures are as follows:

- Non-phosphate detergent plus tap water wash
- Tap water rinse
- Sample glove change
- Ten percent nitric acid rinse (trace metal or higher grade HNO_3 diluted with distilled/deionized H_2O)
- Sample glove change
- Pesticide grade isopropanol rinse
- Sample glove change
- Double distilled/deionized water rinse
- Total air dry

5.4.2 Sample Containers

Sample containers will be precleaned by the manufacturer to USEPA cleaning protocols prior to arrival at the project site as follows:

- All bottles, caps, and liners will be washed in laboratory grade, non-phosphate detergent.
- These will be rinsed three times with distilled water.
- They will then be rinsed with a 1:1 solution of nitric acid.
- They will then be rinsed three times with ASTM Type 1 organic-free water.
- They will be oven-dried for 1 hour.
- They will be rinsed with hexane.
- They will be oven-dried again for 1 hour.

5.5 SAMPLE CONTROL

Field personnel are responsible for the identification, preservation, packaging, handling, shipping, and storage of samples obtained from this site. All samples must be readily identifiable and retain to the extent possible the in-situ characteristics to be determined through testing. All samples collected to be analyzed for the anticipated parameters will be validated through the following procedures and preparation of a chain-of-custody record form.

5.5.1 Sample Containers

Soil samples taken for volatile organic analysis will be packaged in precleaned, 4-ounce, wide-mouth clear glass jars secured with a Teflon-lined lid, (Eagle Picher No. 130-04C, or equivalent) precleaned to USEPA Protocol A. Soil samples taken for semivolatile organic analysis and RCRA metal analysis will be packaged in precleaned, 32-ounce, wide-mouth, clear glass jars secured with a Teflon-lined lid, (Eagle Picher No. 133-32C, or equivalent) precleaned to USEPA Protocol A.

5.5.2 Sample Number

All samples obtained during the course of this project will be consecutively numbered. Each sample identification number includes a five-digit project code (OHM project number 13407) and a two-digit (or more as required) sequence number assigned by the sampler(s) at the time of collection. The backfill samples will be consecutively

numbered beginning with 60,001. The sample numbers will be recorded in consecutive order in a sample logbook. Field sketches will include the sample points and dimensions to trace the sample locations to the nearest foot within the excavations.

5.5.3 Sample Label

Correct sample labeling and the corresponding notation of the sample numbers in the field logbook are necessary to prevent misidentification of samples and their eventual results. All sample labels will be completed legibly with indelible ink. The completed label will be affixed to the sample bottle and covered with clear tape. All sample labels will include at a minimum the following information:

- Name/initials of collector
- Name/initials of witness
- Date and time (in military time) of sample collection
- OHM project number (13407)
- Place of collection
- Sample number (will uniquely identify each sample, i.e., project, station location, depth interval, etc.)
- Matrix and appearance of sample
- Analysis required
- Preservatives added (if any)
- Designation between "grab" or "composite" sample

5.5.4 Field Log

OHM will record information from the sample collection activities in the sampler's field logbook. The log will be a diary of the sampler's activities and will contain sample point locations, appearance, date and time of sample, sampler's identity, and any other pertinent observations.

5.5.5 Chain-of-Custody Procedures

All samples taken on this site will be verified with chain-of-custody procedures. The procedures followed will be in accordance with USACE Sampling Handling Protocols and USACE procedures. It is very important that the information on the

chain-of-custody record form match the information on the sample bottles. The chain-of-custody record forms will be completed, enclosed in a plastic Ziplock bag, and taped to the underside of the lid of the shipping containers utilized.

5.5.6 Sample Preservation

The backfill sample submitted for analysis will be placed on ice to maintain each sample's temperature at 4 degrees Celsius.

5.6 ANALYSIS

The backfill soil sample submitted for analysis will be analyzed according to USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd Edition, September 1986, Methods 8240, 8270, and 6010.

The sample for volatile organic analysis will be extracted and analyzed within 14 days, the maximum allowable holding time. The sample for semivolatile organic analysis will be extracted within 7 days and analyzed within 40 days, the maximum allowable holding time. The sample for metals analysis will be analyzed within 28 days, the maximum allowable holding time. Soil and sediment sample results will be calculated and reported on a dry weight basis.

5.7 EQUIPMENT REQUIREMENTS

- Stainless-steel tulip bulb planter (1)
- Stainless-steel hand auger (1)
- Stainless-steel mixing bowl (Cole-Parmer Catalogue No. L-07300-50, or equivalent) (1)
- Stainless-steel spatulas (VWR Catalogue No. 58575, or equivalent) (20)
- Vinyl sample gloves (100)
- Non-phosphate detergent (14 ounces)
- Eight-ounce, wide-mouth, clear glass sample jars with Teflon-lined lids (Eagle-Picher No. 131-08C, or equivalent) precleaned to USEPA Protocol A (15)
- Four-ounce, wide-mouth, clear glass sample jars with Teflon-lined lids (Eagle-Picher No. 130-04C, or equivalent) precleaned to USEPA Protocol A (5)

- Thirty-two-ounce, wide-mouth, clear glass sample jars with Teflon-lined lids (Eagle-Picher No. 133-32C, or equivalent) precleaned to USEPA Protocol A (5)
- Fifty-four-quart coolers (5)
- Bale sorbent pad (1)
- Ice
- Tongue depressors (100)
- Paper towels
- Field logbook (1)
- Chain-of-custody record forms (15)
- Five-gallon buckets (2)
- Pesticide grade isopropanol (0.5 liters)
- 1:10 nitric acid (0.5 liters)
- Deionized water (2 liters)
- Scrub brush (1)
- Sample labels (30)

6.0 ANALYTICAL REQUIREMENTS

OHM will be obtaining soil samples and submitting them for fixed-base laboratory analysis to EHRT Laboratory. The following paragraphs outline the scope of the work effort for the laboratory. The parameters and number of samples required are delineated in Table 6.1.

The name, address, and telephone number of EHRT Laboratory is:

EHRT Laboratory
3532 Omni Drive
Cincinnati, OH 45245
513-752-2950
Contact: Dr. Mona Risk

6.1 METHODOLOGY

The following matrix specific analytical methods are anticipated for the soil samples. These methods will be followed explicitly including all QC procedures detailed in the respective methods.

OHM understands that the analytical requirements for disposal purposes vary greatly among disposal firms. This is due to the individual disposal firm's state requirements as well as their operating permits. The listed analytical requirements within Tables 4.1 and 4.2 will vary accordingly, but OHM feels that the analytical requirements proposed are suitable for a wide variety of disposal firms and state requirements.

One hundred seventy-six soil samples will be analyzed for total lead by the Digestion Method 3050, followed by the Analytical Method 7420. These samples will also be analyzed for percent moisture according to ASTM Method D-2216-80 "Moisture Content of Soil" outlined in Exhibit II.

Two hundred five soil samples will be analyzed for TCLP lead according to USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd Edition, November 1986 or SW-846 Update No. 1, Method 1311, "Toxicity Characteristic Leachate Procedure."

The TCLP leachates of solid samples will be prepared in accordance with USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 2nd Edition, November 1986 or SW-846 Update No. 1, Method 3050, "Acid Digestion of Sediments, Sludges, and Soils."

TABLE 6.1

SAMPLE TYPES AND NUMBERS

Parameter	TYPES: Estimated Environmental Samples	Estimated Duplicates/ Splits	Estimated Matrix Spike/MS Duplicates	Estimated Total Samples
Confirmation Soil Samples				
Total lead (Methods 3050/7420) and percent moisture	157	16	3	176
Disposal Determination (soil for TCLP lead)	205	0	0	205
Disposal Analysis (soil)				
Table 4.1 Parameters	8	0	0	8
Disposal Analysis (liquid)				
Table 4.2 Parameters	0*	0	0	0*
Backfill Soil Sample				
VOA, SVOA, RCRA metals (Methods 8240, 8270, 6010/7471)	1	0	0	1

*If decontamination water requires disposal, one sample will be collected and analyzed

Two soil samples for disposal parameters will be analyzed according to the parameters specified in Table 4.1, Analytical Requirements of Landfill Disposal for Solids and Sludges.

One liquid sample for disposal parameters will be analyzed, if needed, according to the parameters specified in Table 4.2, Analytical Requirements of Wastewater Treatment Disposal for Liquids. The decontamination water will be used for dust control.

Soil samples from the backfill source(s) will be analyzed for volatile and semivolatile organics and RCRA metals. Volatile organic analysis will be performed according to Method 8240, Semivolatile Organics, according to Method 8270, and RCRA metals according to Method 6010.

6.2 METHOD SPECIFIC DATA QUALITY OBJECTIVES

The following subsections provide OHM's objectives for precision, accuracy, detection limits, and completeness.

6.2.1 Method Detection Limits

Detection limits for the analyses requested will be according to the requested USEPA methodologies. Data reports will also list specific detection limits for constituents analyzed.

6.2.2 Calibration Requirements

Calibration requirements and the frequency associated with them will be in accordance with the individual methods specified.

6.2.3 Laboratory Quality Control

The selected laboratory will perform the QC procedures as described in the referenced methods. This includes reagent blanks, laboratory replicates, matrix spikes and duplicates, and surrogate standards, where applicable.

If acceptable windows (as outlined in SW-846) for matrix spike/surrogate recoveries are not met in the first analytical run, the laboratory will be responsible for rerunning the sample to prove matrix effects at no expense.

6.2.4 Laboratory Turnaround Time

OHM will require no longer than a 30-day turnaround time (from receipt of samples) for the analytical results from the selected laboratory. Twenty-four-hour turnaround time is required for the 176 soil samples to be analyzed for total lead and percent moisture, as well as the disposal analysis of the hazardous soils.

The selected laboratory's data for the soil samples will be submitted to OHM for data evaluation and QA/QC comparison within 30 days of receipt of the samples. USEPA SW-846 data report forms are acceptable. This report package will include all sample and internal QC results such as method blanks, spike and surrogate recoveries, and replicate analyses.

6.2.5 General Organic and Inorganic Reporting

For each analytical method run, the selected laboratory will report all analytes for each sample as a detected concentration or as less than the specific limits of quantitation. Each analytical method run will be clearly identified as belonging to a specific analytical batch. Generally, all samples with out-of-control spike recoveries being flagged for matrix interferences will be designated as such. Appropriate data flags such as contract laboratory procedures (CLP) will be used. All soil samples will be reported on a dry-weight basis with percent moisture also reported. The selected laboratory will also report dilution factors for each sample as well as the date of extraction (if applicable) and date of analysis.

The selected laboratory will be expected to submit to OHM detailed reports which contain the following:

- Sample descriptions and results with reference to USACE numbers
- Laboratory and matrix-dependent method detection limits
- Dilution records, if performed on OHM samples
- Laboratory QC results
- Matrix and matrix-duplicate results on OHM samples
- Calibration summaries for both the initial (ICV) and continuing (CCV) instrumental calibrations

OHM will expect these reports within 1 week of receipt of verbal or faxed results. OHM will require a 24-hour turnaround time for analytical results from the confirmation samples. All other results will be requested with a 21-day turnaround time.

6.2.6 Internal Quality Control Reporting

A complete set of QC results will be reported for each analytical batch even if some of the QC was not performed on samples. The QC results will include but not be limited to laboratory blanks, surrogate and matrix spike recoveries, laboratory duplicates

and/or matrix spike duplicate pairs. At a minimum, internal QC samples will be analyzed at rates specified in the specific methods or higher. The laboratory will also provide initial and confirmatory calibration summaries for each instrument batch.

All QA/QC problems in the laboratory will be reported immediately to OHM within 24 hours.

Data, including all QC information, will be reported on forms as presented in SW-846 (2nd edition). OHM understands that raw data are not required in the report package. Results for soil samples will be reported on a dry weight basis.

6.3 DELIVERABLES

6.3.1 Cooler Receipt Form

A cooler receipt form will accompany the chain-of-custody record form. The cooler receipt form will be filled out by the selected laboratory upon sample receipt. The form will be returned to OHM along with the requested analytical data.

The following deliverables will also be included in the reports generated:

- Sample results
- QA/QC summaries
- Date extracted/analyzed summaries
- Sample dilution summaries
- Initial calibration and continuing calibration summaries
- Table of normal detection limits
- GC/MS tuning summaries
- Batch summaries

EXHIBIT I

OPERATING MANUAL FOR THE SPECTRACE 9000 PORTABLE XRF ANALYZER

Spectrace 9000

Portable XRF Analyzer

Part No. 717715
Rev. 0.3
Preliminary
January 1992

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Contents

Chapter 1: Introduction 1-1

Components 1-1
Analytical Capabilities 1-2
Software 1-2
Operational Modes 1-2

Chapter 2: Basic Operation 2-1

Assembly 2-1
Start Up 2-2

Chapter 3: Sample Presentation and Preparation 3-1

Sample Cups 3-2
In-situ Analysis 3-3
Sample Preparation 3-3
Solids 3-3
Soils and Other Heterogenous Materials 3-4

Chapter 4: Software 4-1

The Keyboard 4-1
Start-Up 4-1
The Main Menu 4-2
1 Measure (Ready Screen) 4-2
2 Choose an application 4-3
3 Review stored results 4-3
4 Review stored spectra 4-4
5 More (Other Functions Menu) 4-5
Ready Screen (Measurement) 4-6
Measure 4-6
Modify 4-8
Options 4-9
Spectrum Display 4-11
Flow Charts 4-13
Main Menu 4-13
Ready Screen 4-14
Other Functions 4-15
Examine a Spectrum 4-16
Ready Screen Options 4-17

Chapter 5: Maintenance 5-1

Main Power Battery 5-1
Probe Detector Bias Battery 5-1
Probe Window Replacement 5-3

Chapter 6: Radiation Safety 6-1

Routine Precautions 6-1
In Case of Malfunction 6-2
Software Failure 6-2
Hardware Failure 6-2
Problem Prevention 6-3
Safety Provisions in the Instrument Design 6-3
The Radiation Sources 6-4
Source Capsule Design 6-4
Radiation Levels 6-5

Chapter 7: Regulatory Requirements 7-1

Licensing 7-1
Leak Testing 7-1
Transportation 7-1
Additional Safety Items 7-2

Glossary G-1

Appendix: General Licenses A-1

Environmental and Technical Services A-17

Index i

Specifications

Main Components

Probe	High-resolution mercuric iodide detector and radioisotope excitation sources
Electronics Unit	Data acquisition, processing, and display unit
Cable	Interconnecting cable (2 meter length)
Application Generator	IBM™ compatible PC/AT™ software package
Carrying/Shipping case	Heavy duty industrial grade with foam inserts

Analytical Capabilities

Element Range	77 elements, sulfur through uranium (Z=16 through 92)
Minimum Detection Limit (MDL)	50-100 ppm for most of the elements in the range of analysis
Measurement Time	Typically 30-200 seconds
Number of Elements	Up to 25 in each Application
Number of Applications	Up to 50 Applications can be stored in the analyzer and selected by user-defined name as needed

Electronics Unit

Operating Temperature	Standard: 0°C to 55°C (32°F to 130°F) Extended (optional): -10°C to 70°C (14°F to 158°F)
Storage Temperature	Standard: -20°C to 60°C (-4°F to 140°F) Extended (optional): -40°C to 80°C (-40°F to 175°F)
Dimensions	32 cm x 30 cm x 10 cm (13 in x 12 in x 4 in)
Weight	6.7 kg (14.75 lbs) with batteries
Connectors	25-pin D connector for RS-232C serial I/O Receptacle for AC adaptor/battery charger Probe cable connector

Electrical	Operation from battery or AC line (110/220 VAC, 50-60 Hz)
Display	High contrast, wide-angle view LCD 240x64 graphics resolution 30 column x 8 row alphanumeric characters Size: 13 cm width x 3.6 cm height (5.1 in x 1.4 in) Adjustable screen contrast
Controls	Sealed 21-key keypad

Probe

3 x-ray excitation sources

^{241}Am	Measures elements Cu to Tm (K x-rays); W to U (L x-rays)
^{109}Cd	Measures elements Ca to Rh (K x-rays); Ba to U (L x-rays) Ta to Pb (K x-rays)
^{55}Fe	Measures elements S to Cr (K x-rays); Mo to Ba (L x-rays)
	The analyzer software automatically selects which sources to use and the measurement time for each source based on the stored information for each application
X-ray detector	High resolution HgI_2 (mercuric iodide)
Operating Temperature	-10°C to 49°C (14°F to 120°F)
Storage Temperature	-40°C to 43°C (-40°F to 110°F)
Housing	Splash proof, soap and water washable
Dimensions	12.7 cm x 7.6 cm x 21.6 cm (5 in x 3 in x 8.5 in)
Weight	1.9 kg (4.2 lbs)
Controls	Start button

Index

"<—" key 4-1

A

accessories 1-1
acquire background data 4-9
adapter ring (30mm) 3-2
adjust calibration 4-10
agreement state 7-1
Am-241 1-2
Application
  library 1-2, 4-3
  maintenance 4-5
  selection 4-3
auto scaling 4-11
autocycle 4-7, 4-10
auxiliary batteries 5-1

B

background data 4-9
Batteries
  auxiliary 5-1
  battery charger 2-1
  discharged battery 5-1
  disconnected (when shipped) 2-1
  lithium cell 5-2
  low battery 5-1
  main power 5-1
    charging 5-1
  probe detector bias 5-1
    sensing circuit 5-1
  replacement 5-1
bias supply 5-1

C

Calibration
  adjust 4-10
  restore original 4-10
Cd-109 1-2
CHAN/DOT 4-11
channel number 4-12
choose application 4-3
COM port setup
  default 4-5
computer link 4-5
"CONT/PAUSE" 4-1
contrast knob 2-2
count time 4-2, 4-8
cyclic operation 4-7, 4-10

D

Default
  calibration 4-10
  COM port setup 4-5
Delete
  stored results 4-3
  stored spectra 4-4
detection limit 1-2
detector bias battery 5-1
disable/enable element lines 4-12
discharged battery 5-1
display contrast 2-2
display thresholds 4-8, 4-10
disposal 7-2, A-17

E

edit key 4-1
electronics unit 1-1
element lines 4-12
element range 1-2
emergencies. *See Radiation Safety*
end autocycling 4-7
energy calibration 4-9, 4-12
environmental and technical services division A-17
examine spectrum 4-5, 4-7, 4-10

F

fail safe provisions 6-4
Fe-55 1-2
FINE/COARS 4-12
first screen 4-1
flashing light red/yellow 4-6, 5-1
flow charts 4-13
fundamental parameter XRF 1-2

G

general license 7-1, A-4, A-4–A-5

H

half-life 6-4
hardware failure 6-2
heterogenous materials 3-4
Hmag (horizontal magnification) 4-11

I

in-situ analysis 3-1, 3-3
initialization routines 4-1
inspections A-9
instrument design 6-3

K

keyboard 4-1

L

lab stand 3-1
last results (show) 4-9
leak test records A-5
leak tests 7-1, A-2, A-4, A-10, A-17
Licensing
  leak test records A-5
  leak tests A-4
  license obligations A-4
  sale or transfer or unit A-5
  theft or loss of unit A-11
licensing 7-1, A-13–A-16
licensing agencies A-13
licensing and regulatory affairs A-17
light flashing red/yellow 4-6, 5-1
lithium cell 5-2
live/real time 4-8
log display 4-11
lost radioactive material A-3
low battery condition 5-1

M

Main Menu 2-2, 4-1, 4-2
  flow chart 4-13
  Other Functions flow chart 4-15
malfunctions 6-2
Measure (Ready Screen) 4-2, 4-6
measuring 4-6
mercuric iodide detector 1-1
Modify screen 4-8
moisture content (of soil sample) 3-3

N

negative offset 4-10
negative results 4-8, 4-10
NRC 7-1

O

O-ring (in probe) 5-4
offset, negative 4-10

P

packing list 2-1
particle size 3-3
parts (included) 2-1
PgUP, PgDN 4-3
power, main battery 5-1
precautions, radiation safety 6-1
preparation, samples 3-3
printer link 4-5
probe 1-1
probe button 4-6
probe detector bias battery 5-1
probe window replacement 5-3
problems
  hardware failure 6-2
  software failure 6-2
  "source did not close" message 6-2

R

radiation
  field 6-3
  records A-2
Radiation Safety 4-6, 6-1
  accidents 7-2
  disposal 7-2
  exposure risk 6-1
  fail safe 6-4
  instrument design 6-3
  malfunction 6-2
  radiation levels 6-5
  radiation sources 6-4
  radiation warning 4-6
  routine precautions 6-1
  shipping radioactive material A-17
  source capsule design 6-4
  training A-17
  transporting unit 7-1
radioactive material A-6
  emergency shipments A-7
  theft or loss A-11
  transfer of A-6
radioisotope sources 1-2
RAM memory 4-1
ranges of elements 1-2
raw data 4-7
Ready Screen 4-2
  flow chart 4-14
  options flow chart 4-17
real/live time 4-8
Recall
  spectra and recalc 4-9
  stored results 4-3
  stored spectra 4-4

regulatory requirements 7-1
repetitive measurement 4-7
restore original calibration 4-10
Results
  delete 4-3
  storage capacity 1-1
  store/send automatically 4-5
  stored 4-3
  thresholds 4-8, 4-10
  to send 4-6
  to store 4-7
Results Screen 4-6
  options 4-7

S

sale or transfer of unit A-5
sample cups 3-2
sample ID 4-6
Samples
  heterogenous materials 3-4
  ID (labelling for storage) 4-6
  large solids 3-1
  moisture content 3-3
  particle size 3-3
  preparation 3-3
  presentation 3-1
  small amount 3-3
  soil 3-3
  surface preparation 3-3
  unprepared 3-4
sampling errors 3-4
scroll 4-3
send/store mode 4-5
sensing circuit 5-1
set clock/calendar 4-5
sets of spectra 4-4
shield 6-1, 6-3
shield cup 3-1
shipping radioactive material A-2
small sample 3-3
Software 4-1
  version number 2-2, 4-1
software failure 6-2
soil samples 3-3
Source 6-4
  accidental exposure 6-3
  activity and half life 6-3
  capsule design 6-4
  capsules 6-3
  "did not close" message 6-2
  holders 6-4
  source decay 2-2
  SOURCE ON indicators 6-1
  when exposed 6-3
source-decay compensation 4-1
sources 1-2
specific license 7-1
Spectra
  flow chart 4-16
  review 4-4
  storage capacity 1-1
  store/send automatically 4-5
  stored 4-4
  to examine 4-7
  to send 4-7
  to store 4-7
Spectrum Display 4-11
standard deviation/units 4-7
start-up 4-1
store/send mode 4-5

T

theft or loss A-11
time and date 2-2, 4-1
Total Measurement Time 4-8
transmit reports or spectra 4-6
transporting unit 7-1

U

units/standard deviation 4-7
unpack (upon delivery) 2-1
unprepared samples 3-4

V

version number 4-1
Vmag (vertical magnification) 4-11

W

window plate 5-3
window, probe 5-3
window replacement 5-3

Z

Zeroing
  current result 4-8
  examine and modify zeros 4-9
  on a blank 4-9

Chapter 1: Introduction

X-radiation of sufficient energy will cause all atoms to *fluoresce*, emitting x-rays of characteristic energy (wavelength). By analyzing the fluorescent radiation emitted by a sample under excitation, both the identity and the quantity of the elements present in the sample can be determined.

The Spectrace 9000 is an x-ray fluorescence analyzer containing radioisotope sources to provide the necessary excitation and a high-resolution x-ray detector for the resulting fluorescence. It consists of two main components: a probe and an electronics unit.

Caution: ***The probe contains radioactive material. Before using this instrument it is essential that you review the radiation safety procedures and information in*** **Chapter 6: Radiation Safety.**

Components

Probe

The probe consists of a sealed aluminum enclosure containing a high resolution mercuric iodide detector and three radioisotope x-ray excitation sources. The probe aperture, through which the analysis is performed, is sealed with a thin, replaceable plastic film. The probe also contains a pre-amplifier and bias supply for the detector and a mechanism to move the radioisotope sources from their shielded location during an analysis.

Electronics Unit

The electronics unit provides data acquisition, processing, and display capabilities. Its computer includes a math coprocessor for fast calculation of results. Sufficient memory is available to store up to 300 sets of analysis results and up to 120 spectra. An RS-232 port allows stored data to be transferred to another computer. The graphics display allows direct viewing and qualitative analysis of the x-ray spectra. The replaceable and rechargeable internal battery provides for field-portable operation.

Accessories

The system is supplied with an industrial grade carrying case, a lab stand for bench-top use of the probe, and a sample cup kit for presentation of powdered and liquid samples.

Analytical Capabilities

The Spectrace 9000 uses three radioisotope sources. Each source emits a different energy (wavelength) of radiation which provides efficient analysis of specific ranges of elements:

Source	*Element Range*
Fe-55	S to Cr (K x-rays) and Mo to Ba (L x-rays)
Cd-109	Ca to Rh (K x-rays) Ta to Pb (K x-rays) and Ba to U (L x-rays)
Am-241	Cu to Tm (K x-rays) and W to U (L x-rays)

With these three sources, the Spectrace 9000 can effectively analyze any element above sulfur in the periodic table. The detection limit is typically 50-100 ppm for most analytes.

Software

The Spectrace 9000 utilizes a fundamental parameter XRF calibration derived from theoretical considerations (as opposed to empirical data). The menu driven software in the Spectrace 9000 supports multiple XRF calibrations called "Applications." Each Application is a complete analysis configuration including elements to be measured, interfering elements in the sample, and a set of fundamental parameter calibration coefficients.

Operational Modes

In-situ analysis of a wide variety of solid materials is possible by placing the Spectrace 9000 probe directly in contact with the sample.

Other materials such as liquids, powders, and pastes can be analyzed with little or no preparation using the sample cups. See *Chapter 3: Sample Presentation and Preparation* for a complete discussion.

Chapter 2: Basic Operation

Unpack everything from the case. Check to make sure that you have all the necessary parts:

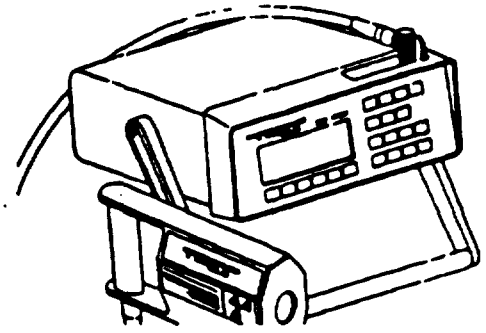
- Electronics unit
- Hand held probe with safety cover and one (1) spare window assembly
- Interconnecting cable (2 meters)
- Two (2) blank check samples
- Probe laboratory stand for table top use, safety shield, and sample adapter ring for standard 30 mm x-ray sample cups
- Battery charger
- Instruction manual
- RS-232C interface cable (2.3 meters)
- Two (2) screwdrivers for changing battery and probe window
- Shoulder strap
- Carrying/shipping case
- Spare probe battery (AA size)

Assembly

Note: The unit is shipped with the battery disconnected.

To connect the battery, set the electronics unit on its face and use the flat blade screwdriver provided to loosen the two 1/4-turn fasteners on the back. Remove the battery pack. Inside, find the cord with the red cap (it covers a three-pronged plug). Remove the cap and plug it into the battery pack. Put the pack back into the unit—it can only fit one way. Tighten the fasteners.

Set the electronics up with the handle latched in the bench-top position. Carefully plug the right angle end of the probe cable into the electronics unit and the other end into the probe handle.



If desired, place the probe in the lab stand at this time. If the unit is to be used on the bench for an extended period, use the battery charger provided. (It plugs in right next to the probe cable on the electronics unit.)

Start Up

Press the ON key. In two or three seconds, the display announces the version number of the software. If necessary, adjust the contrast knob located on the underside of the front bezel. This knob can be turned so far that the display appears blank.

The initial screen will display for about ten seconds and then the unit will ask if the time and date are set correctly.

Note: The date must be set correctly otherwise large errors in source-decay compensation can result. Furthermore, reports include time and date of analysis; incorrect settings may cause administrative confusion.

After the time and date screens, the Main Menu will appear:

```
            MAIN MENU
 1 Measure
 2 Choose an application
 3 Review stored results
 4 Review stored spectra
 5 More_

 1    2    3    4    5    6
```

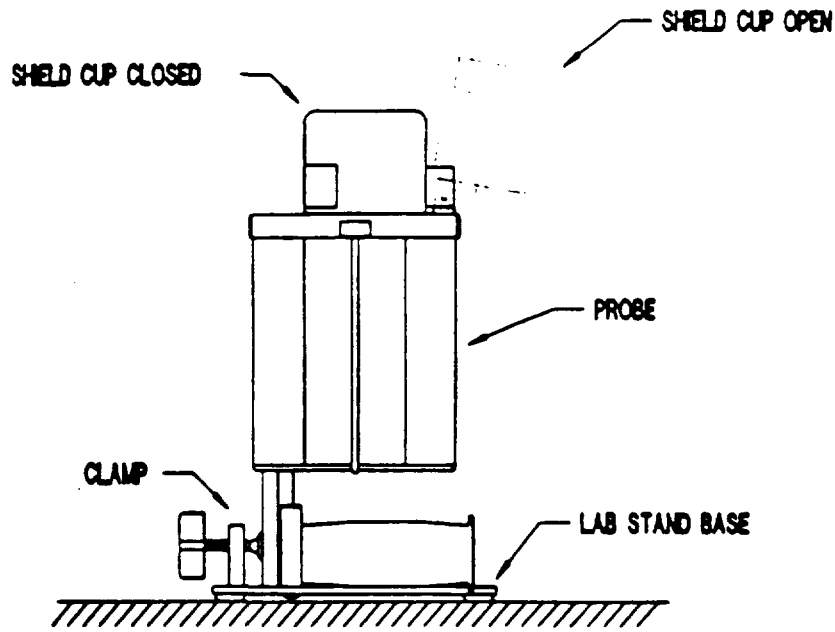
The Main Menu offers several selections. Each of these is discussed in detail in *Chapter 4: Software*. Before attempting any serious analytical work, be sure to read *Chapter 3: Sample Presentation and Preparation*.

Chapter 3: Sample Presentation and Preparation

Sample *presentation* is the positioning of the sample with respect to the probe aperture. Proper and consistent presentation is essential for accurate analytical results.

Ideally, the sample should be flat, larger than 1" in diameter, and should be placed in contact with the face of the probe. For flat metal plates, sheets of plastic and paper this is easily achieved. Other sample forms such as liquids or powders must be contained for presentation to the probe.

Large solid samples are most easily analyzed by placing the probe directly on the sample (in-situ analysis). For small samples it is usually more convenient to set up the unit on a table with the probe in the lab stand. The lab stand holds the probe with the aperture facing directly upwards so samples can be placed in position. Samples must cover the probe window. A shield cup that will stop any radiation transmitted through thin samples is provided for use with this configuration.



Sample Cups

Liquids and powders should be presented using sample cups. These cups are made up of three pieces: a cup, a ring and a piece of Mylar film.

To load a sample cup:

1. Fill the cup nearly full with your sample. If the sample is powdered, tap the cup a little to settle the contents and, if necessary, add more sample until the cup is at least 3/4 full.

2. Tear off a square (more or less) piece of the film. Lay it over the open cup approximately centered.

3. Examine the sample cup ring. One inside edge is rather sharp and the other inside edge is definitely smooth and rounded. Place the ring over the cup with the rounded edge down.

4. Using your thumbs and forefingers (or three fingers of one hand), press the ring down slowly and evenly until it is flush with the end of the cup. If properly done, the ring will slide down and snap into position leaving the film taut and wrinkle-free. If you do get wrinkles, sometimes they can be removed by pulling on the excess film in the appropriate places. Occasionally the window comes out so wrinkled you just have to take the ring off and start over with a new piece of film.

   Note: Wrinkles cause part of the sample to be held away from the face of the probe and can interfere with analysis. For maximum accuracy the film must be taut and free of wrinkles.

5. Turn the filled and sealed sample cup upside down and, if the sample is powdered, tap the cup on the bench to thoroughly settle and compact the contents.

The sample is now ready to be placed film side down on the probe for analysis. The 30mm adapter ring should be placed in the large hole in the shield cup base. This adapter ring locates the sample cup reproducibly over the probe aperture.

Note: Make certain the sample cup rests in contact with the probe face, otherwise significant analysis errors may result.

In-situ Analysis

In-situ analysis is appropriate for soils, manufactured items, and large objects. In other words, anytime it's easier to take the analyzer to the sample than it is to bring the sample to the analyzer.

Note: **The probe face must be kept in contact with the sample throughout the analysis. Whenever possible, arrange the sample so the probe can be set down on top of it.**

In the case of in-situ soil analysis, best results are obtained on reasonably dry, flat, compacted surfaces of fine-grained soils. Whenever possible, flatten and compact the area to be measured with your foot or an appropriate tool Good results can be obtained at moisture contents up to about 25% (beyond this point the soil is wet mud and must be contained in a sample cup). In-situ analysis of wet mud will grossly contaminate the probe window, invalidating all subsequent measurements until the window is cleaned.

Caution: ***The aperture window can be punctured. Clear test areas of sharp, hard or protruding objects (for example, twigs or rocks). Failure to clear the test area can result in damage to the instrument.***

Coarse-grained soil conditions may not permit a truly representative sample and may adversely affect the analysis results. Such samples should be prepared before analysis.

Sample Preparation

Sample *preparation* is the treatment given to the "as received" sample to make it suitable for XRF analysis. Most samples require little or no sample preparation. Homogeneous solids, clear solutions and finely ground powders (<200 mesh) can be accurately analyzed with no preparation (other than filling the sample cup).

Solids

Solid samples (sheets of metal, plastic or paper, for examples) can usually be analyzed without preparation. The size of the sample will determine whether you use the lab stand or in-situ analysis. The analyzed surface of the sample should be relatively clean, since many element's x-rays will not penetrate a thick layer of dirt. (Of course, if the sample *is* a thick layer of dirt it should remain, well, dirty.)

Note: **The sample should cover the aperture completely. If you have a very small sample which does not cover the aperture completely, please call us for assistance.**

Soils and Other Heterogenous Materials

The highly variable nature of soils increases the possibility of XRF analysis errors. It is difficult to predict whether these errors will make the results too high or too low. We recommend that whenever possible a comparison be made between the XRF results on prepared and unprepared material. For field screening work, this can be accomplished by collecting samples from a representative number of the locations analyzed. These samples should be dried and ground, and presented in sample cups. If desired, they can also be split *after* drying and grinding for chemical analysis.

Note: Do not split a small sample of coarse material. The splits will not be representative.

This comparison will show either:

- the unprepared sample results agree satisfactorily with both the chemistry and the XRF results on the prepared samples; or
- an appropriate correction factor should be applied to unprepared sample results; or
- the errors introduced by the variables in the unprepared material are too large to tolerate. Sample preparation will be required.

Chapter 4: Software

This chapter is a reference guide to the screens and options presented by the analyzer software. Each screen, and each option on each screen, is discussed in logical order. At the end of this chapter are flow charts which outline the menu structure of the Spectrace 9000 software.

The menus for routine operations are designed to be easy to use and understand. However, it is easy to become confused when dealing with such a powerful system. Please call us for assistance with any problem you may encounter.

The Keyboard

The row of keys under the LCD screen perform functions defined by labels that the software writes to the bottom line of the display. As you move through the various menus, these keys are redefined to provide an efficient user interface.

The keypad to the right of the screen is used for numeric entry.

The "CONT/PAUSE" key (referred to as CONT) is used

- as an ENTER key
- to begin an analysis
- to pause an analysis in progress.

The "<–" key is used to edit entries before pressing CONT.

Start-Up

The first screen to appear when you turn the instrument on shows the version number of the software. This screen displays for about 10 seconds while a number of initialization routines are executed. Next the RAM memory size is announced (usually 512K) and then the time and date screens appear. Time and date screens are in theflow chart on page 4-13.

Caution: ***The first time you turn on the unit after connecting the battery, the time and date MUST be set. It is critical that the date be accurate, since source-decay compensation is based on it.***

The Main Menu is the next screen to appear after the time and date screens.

The Main Menu

```
            MAIN MENU
 1 Measure
 2 Choose an application
 3 Review stored results
 4 Review stored spectra
 5 More_

 1    2    3    4    5    6
```

A flow chart of the Main Menu is on page 4-13.

1 Measure (Ready Screen)

This Main Menu selection takes you to the screen shown below. This screen is referred to as the Ready Screen.

```
 SOIL ANALYSIS
 updated 18NOV91
-----------------------------
Analysis Time L |TO MEASURE:
 Cd   Fe   Am   |Press CONT or
 200  200  200  |probe button.
                |-------------
Modify_         | Options|Quit
 1    2    3    4    5    6
```

The Ready Screen shows the Application name (with some description), the count times for each of the three sources, and accesses other options. (See *Ready Screen (Measurement)* on page 4-6 for detailed discussion.)

A flow chart of the Ready Screen begins on page 4-14.

2 Choose an application

This Main Menu selection lists the Applications currently loaded in the unit.

```
Application library index.


> SOIL ANALYSIS
  THIN SAMPLE ANALYSIS

UP   DOWN   OK   EXPND      QUIT
1    2      3    4    5     6
```

UP and DOWN scroll the Application list past the "> " pointer (on the left side of the screen).

OK selects the Application at the ">" pointer.

EXPND shows the entire description of the Application.

QUIT returns you to the Main Menu.

3 Review stored results

This Main Menu selection lists the stored results.

Note: UP and DOWN scroll is used on many screens. Where UP and DOWN are displayed, pressing the "0" key will toggle to PgUP and PgDN for rapid movement through long lists (press 0 again to return to UP and DOWN).

```
Results are stored for:


>25NOV91 11:36:26 TEST

 UP DOWN  DEL   VIEW ALL  QUIT
 1    2    3     4    5    6
```

DEL deletes the "> " (selected) result from memory. A confirmation message, "Are you sure?" will display.

VIEW shows you the Results Screen for that set of results.

ALL brings up a new screen, which enables you to either send all stored results out the COM port or delete all stored results.

QUIT returns you to the Main Menu.

4 Review stored spectra

This Main Menu selection functions similarly to the previous one, except it operates on stored sets of spectra. Each measurement usually has a set of three spectra.

```
Spectra are stored for:


>21NOV91 14:37:25 B


 UP DOWN  DEL   SEND ALL  QUIT
 1    2    3     4    5    6
```

DEL deletes the "> " (selected) result from memory.

SEND sends the selected set of spectra out the COM port.

ALL brings up a new screen, which enables you to either send all stored spectra out the COM port or delete all stored spectra.

QUIT returns you to the Main Menu.

5 More (Other Functions Menu)

The last Main Menu lists other functions.

1	**Set Clock/Calendar**	Lets you examine or reset the system time and date.
2	**Comm. port setup**	Shows you the current COM port configuration and allows MODification of baud rate, word length, parity, and XON-XOFF status. There are two configurations: the "printer link" is for sending stored results and spectra to either a printer or another computer. The "computer link" is exclusively for loading new Applications using the special Application Generator PC software. The default COM setup for both is 9600,8,N,1.
3	**Set store/send modes**	Allows you to specify automatic sending for any combination of results, intensities, and spectra to a printer or computer. The store mode enables automatic on-board storing of results and/or spectra.
4	**Application maintenance**	Lists functions pertaining to selecting, deleting, and examining Applications. Also provides a way to transfer new Applications from a PC (an operation that is guided and supervised by the PC software).
5	**Examine spectrum**	Allows you to select a single stored spectrum or collect a new spectrum and display it. See *Spectrum Display*, page 4-11, for more information.

A flow chart of the Other Functions Menu is on page 4-15.

Ready Screen (Measurement)

(This details the *1 Measure (Ready Screen)* of the Main Menu, as referenced on page 4-2.) A flow chart of the Ready Screen is on page 4-14.

There are four actions you can select from the Ready Screen:

- Measure
- Modify
- Options
- Quit

Measure

Warning: During analysis, there is a minimal risk of minor radiation exposure. While an analysis is in progress:
Do not remove a sample from the probe aperture,
Do not look into the aperture,
Do not touch the aperture.

Press either CONT or the probe button to start an analysis. A distinct warbling signals the beginning of the analysis. The display shows which source is exposed and how much count time remains. On the back of the probe under the handle, an LED flashes to indicate that a source is exposed. Usually this LED flashes red. If it ever flashes yellow, replace the lithium battery in the probe (see *Chapter 5: Maintenance* for instructions). At the end of the analysis the Results Screen is displayed. If the automatic "store results" mode is enabled you will be prompted for a sample ID before the Results Screen is displayed.

Results Screen

```
RESULTS:                  std. dev.



Cr22              4286        242
   K             18498        266
  Ca            108035        290
 UP DOWN SEND STORE OPTS MEASR
_1    2    3     4    5    6
```

UP or DOWN scrolls the screen to see more of the results. There are several actions you can select from the Results Screen (remember to press 0 to switch to PgUP and PgDN when you have lots of stored results).

SEND transmits the *result* report out the COM port. To send *spectra* out the COM port, select OPTS on the Results Screen. Then select Send Spectra.

STORE prompts you to enter an ID and then stores the results in memory. Memory is sufficient to store about 300 sets of results.

MEASR will immediately begin another analysis cycle. (CONT or the probe button will also start a new analysis at this point.)

OPTS There are two screens of special options under the Results Screen.

first screen

1	Send spectra	Transmits all the spectra associated with the latest analysis out the COM port.
2	Store spectra	Prompts you for an ID and stores the spectra in memory. The unit can store approximately 40 three-spectrum sets (120 individual spectra).
3	Show std devs/units	Toggles the right column display between units of concentration and calculated standard deviation.
4	Show Application name	Displays the entire Application description while in the Application.
5	See raw data	Brings up a series of screens which allow you to inspect the x-ray data from several intermediate stages in the processing. This is mainly a diagnostic tool.
6	Autocycle	Initiates endless repetitive measurements. Primarily used for stability studies. (Press CONT to end autocycling.)
7	See results	Returns you to the Results Screen.
8	Rdy screen	Returns you to the Ready Screen.
9	More opts	Continues Results OPTS ...
0	Exit	Returns to Main Menu

second screen

1	Examine spectrum	Provides a variety of operations involving the display and manipulation of x-ray spectra on the screen. See *Spectrum Display* beginning on page 4-11 and/or flow chart on page 4-16 for details.

2 Zero the current result

Zeros out the results of the last analysis and stores the corrections for use on all subsequent analyses within the current application. (Also, see Ready Screen—Options—3 Examine zero values.)

If zeroing has been performed, the message "zero" will appear on the Results Screen.

3 Enable/disable display thresholds

Normally very low analysis results are suppressed (not displayed) according to their values relative to the display thresholds. Disabling display thresholds shows all analysis results regardless of value (even negatives).

Modify

The Modify screen shows the count times currently set for each of the three sources and allows you to modify them. It also shows the x-ray energy range used for each of the three sources; this cannot be changed by the keypad.

```
SOURCE    RANGE(keV)  LIVE SECS


>Cd109        33          200
  Fe55         8          200
 Am241        88          200
 UP  DOWN  MOD REAL       EXIT
 1    2    3    4    5    6
```

UP and DOWN let you select the time you want to change. You also can change the Total Measurement Time. Existing time ratios are preserved (the Total Measurement Time you enter may be rounded off to keep the source times in whole seconds).

MOD allows you to enter a new count time value for a selected source. (CONT loads the new count time.)

REAL/LIVE toggles between real time (true clock time) and live time which adds time to the analysis to make up for the time the system is busy processing pulses.

EXIT tells the processor you are satisfied with the changes. The changes are saved and the Ready Screen is displayed.

Options

There are two screens of Ready Screen options.

first screen

1	Energy Calibration	This is only occasionally necessary. Most Applications automatically perform an energy calibration with each analysis. A warning screen will inform you when an energy calibration is required. You will be prompted to place the safety cover on the probe. A 600 second analysis will start, at the end of which the software will automatically update the x-ray energy calibration.
2	Acquire background data	Prompts you to present blank samples so the background subtraction coefficients can be updated. This procedure is only necessary when the unit exhibits a persistent zero drift on all blank samples.
3	Examine zero values	Allows you to inspect (and modify) the current zero correction values. This procedure is only necessary when the unit exhibits a persistent zero drift on all blank samples. If zeroing has been performed, "zero" will appear on the Results Screen.
4	Show last results	Returns you to the Results Screen after performing other operations such as changing COM port parameters.
5	Recall spectra and recalc	Lists the stored spectra-sets and allows you to select one for recalculation. Recalculation processes the stored spectra exactly as if they were just acquired from the probe.
6	More options	Continues Options ...

second screen

1 Adjust calibration — Lists all the elements in the application, with a slope and offset for each one. The default values of these coefficients are 1 and 0, respectively (in other words, no adjustment). If you want to adjust any element's calibration, enter the desired slope and offset here. The adjusted result (Ra) will be related to the original result (Ro) as follows:

Ra = (Ro * slope) + offset

Note: The sign of the offset is selected after its absolute value has been entered.

If a calibration adjustment has been made, "adj" will appear on the Results Screen.

2 Restore original calibration — Restores all slope and offset calibration adjustments to 1 and 0.

3 Autocycle — Causes the system to perform repeat analyses indefinitely. This feature is primarily used for studying the stability of the system. (Press CONT to end autocycling.)

4 Examine a spectrum — Prompts you to select a spectrum, then displays it. See *Spectrum Display* (next page) for more information.

5 Enable/disable display thresholds — Normally very low analysis results are suppressed (not displayed) according to their values relative to the display thresholds. Disabling display thresholds shows all of the analysis results regardless of value (even negatives).

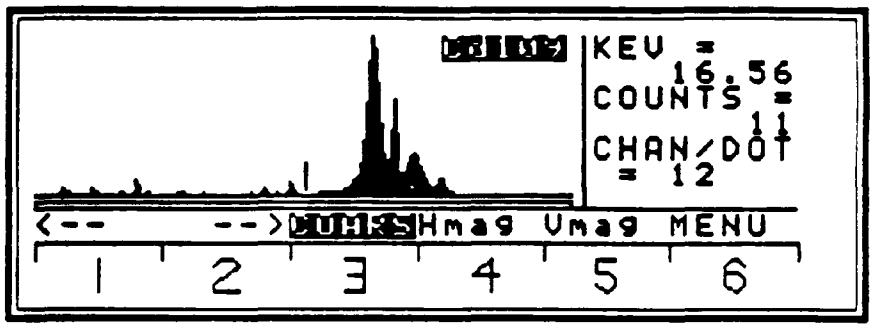
7 Return to Ready Screen

A flow chart of the Ready Screen Options is on page 4-17.

Spectrum Display

Several menu paths lead to Spectrum Display as illustrated in the flowcharts beginning on page 4-13. The most direct path (following a measurement) is through Results Screen—OPTS/second screen (as on page 4-7). A flow chart of this path begins on page 4-14.

When Spectrum Display is selected, you are asked to select one of three spectra (they are identified by source). With the spectrum displayed on the screen, there are a number of operations you can perform.



<--
--> Move the cursor along the energy axis. The x-ray energy and the channel count corresponding to the cursor location are displayed on the right side of the screen.

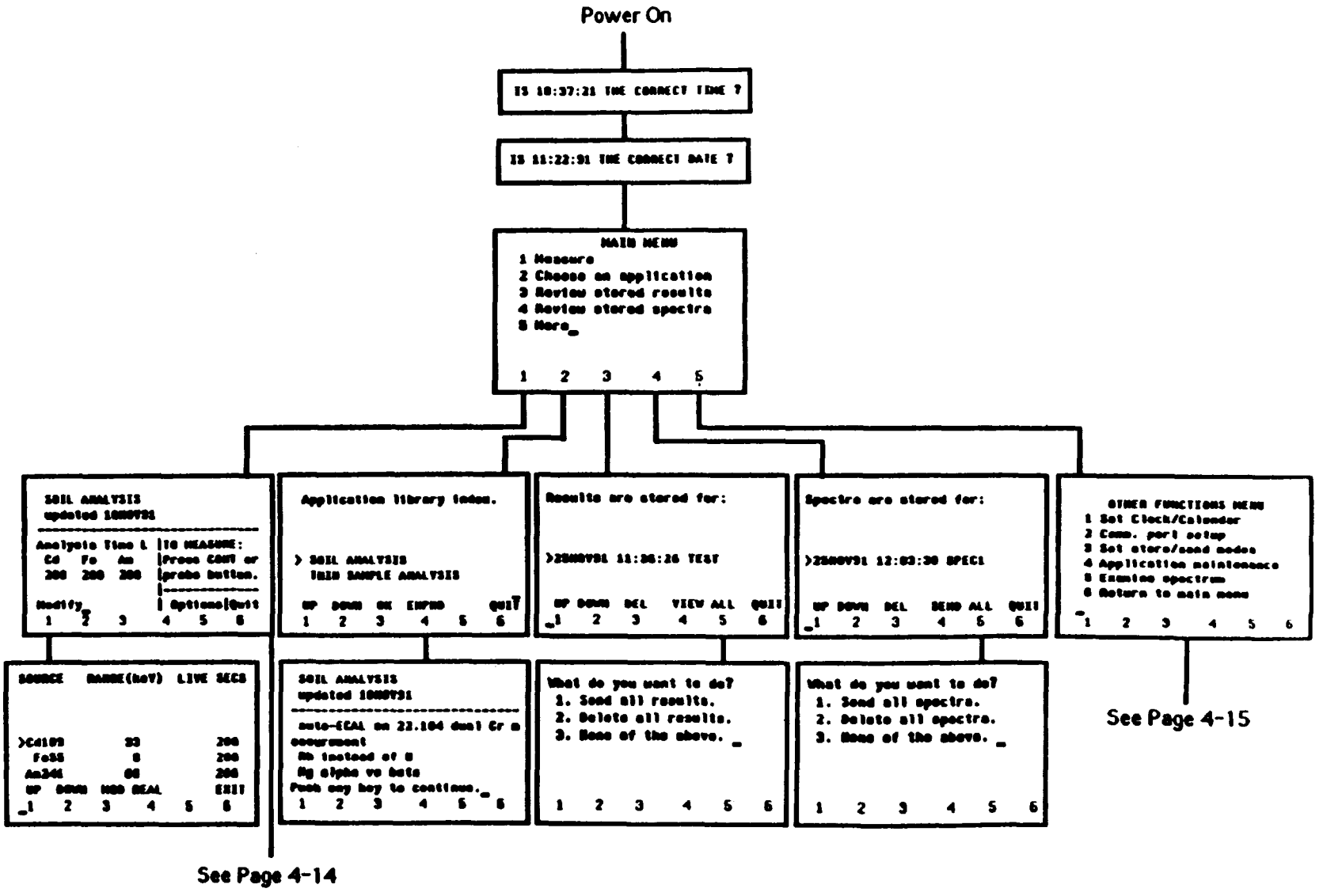
COARS/FINE Toggle. Controls how fast the cursor moves.

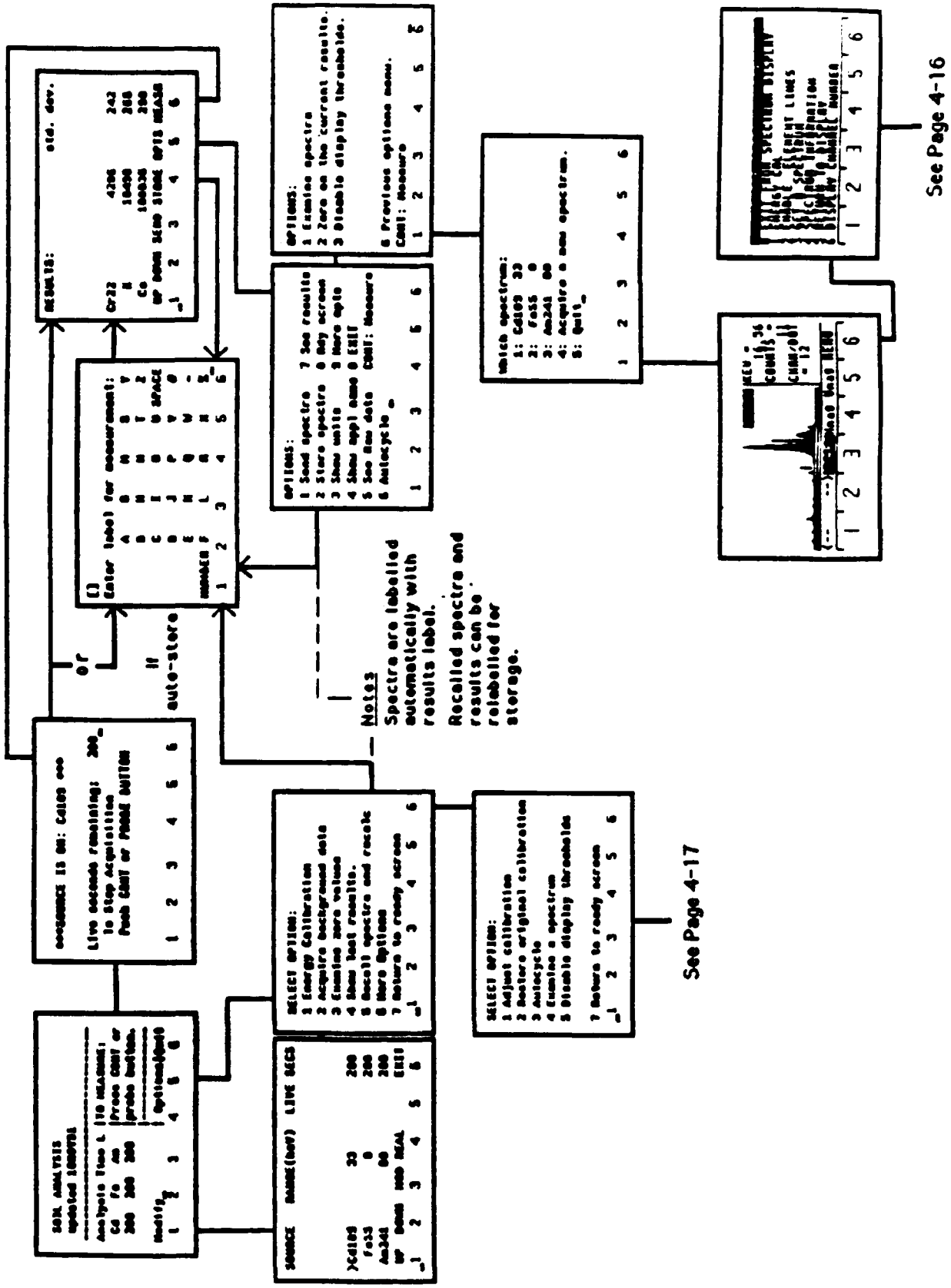
Hmag Horizontal Magnification: Expands the display by a selectable factor centered at the cursor. The CHAN/DOT value will change according to the selected magnification.

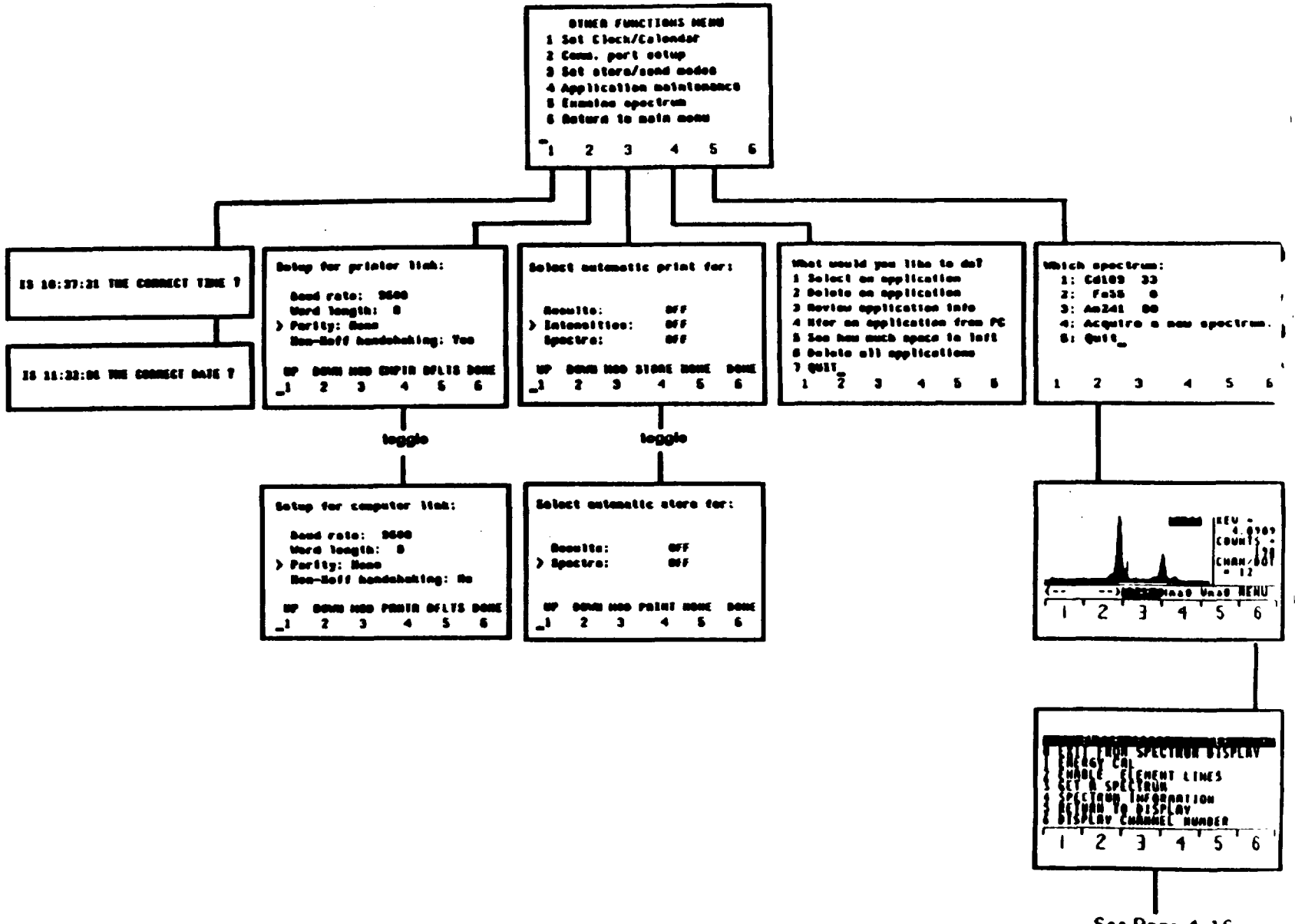
Vmag Vertical Magnification: Provides
- manual adjustment of the vertical scale
- auto scaling so the highest peak is full scale
- logarithmic vertical scaling.

MENU Lists additional spectrum processing commands.

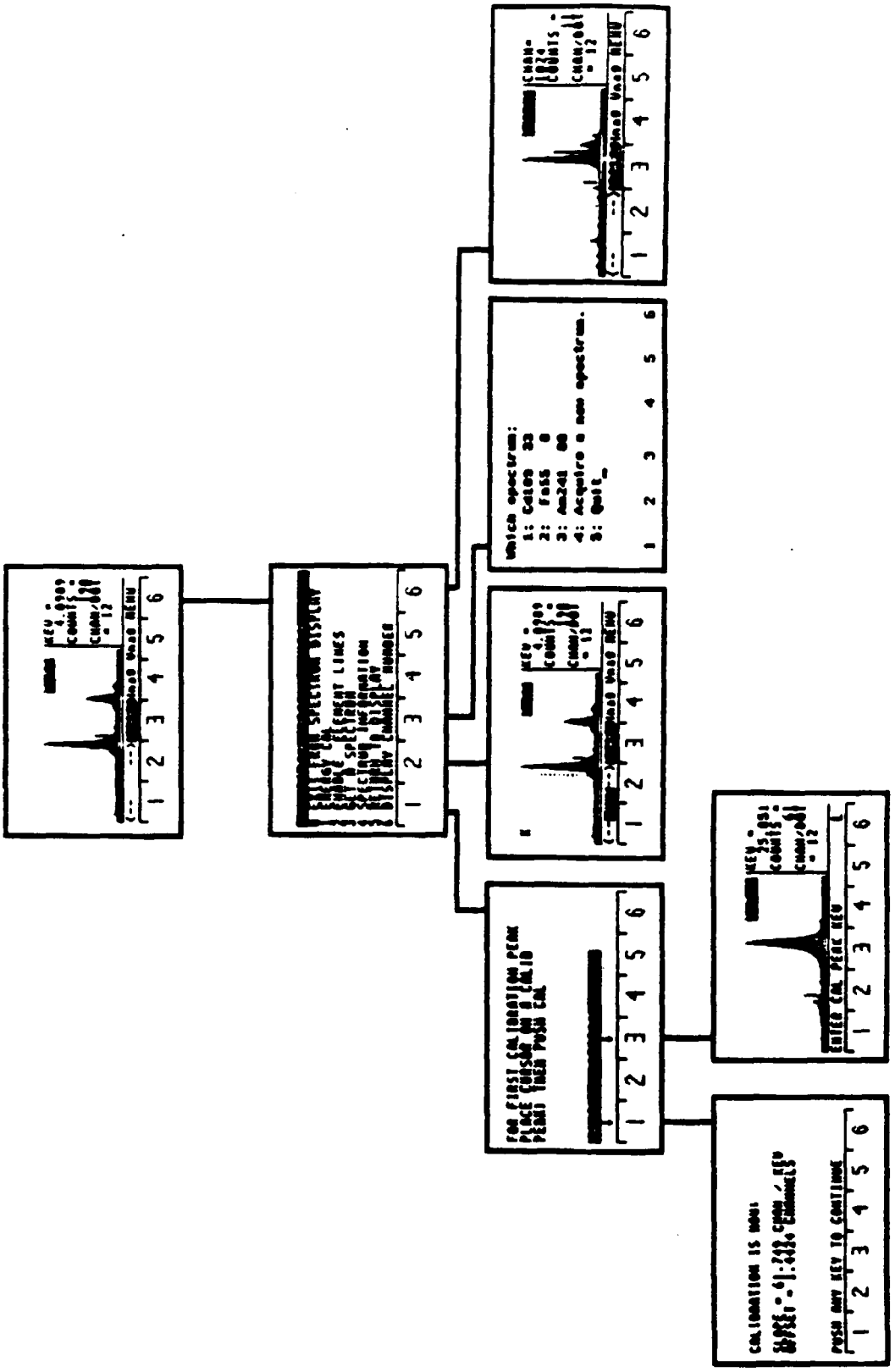
1 Energy cal	An advanced feature which allows you to perform an energy calibration by selecting known x-ray peaks and entering the energies for those peaks. **Note: This calibration will apply only to the current display. It is lost upon exiting the Spectrum Display mode.**
2 Enable/Disable element lines	Toggles the spectrum cursor function to display dotted vertical lines which indicate the expected location of the x-rays of a given element. The name of the element is displayed in the upper left corner. The <-- and --> keys move the lines either one element at a time or ten at a time, depending on the FINE/COARS selection. These lines are very useful for identifying unknown peaks in the spectrum.
3 Get a spectrum	Lets you display another spectrum or acquire a new one. This feature is useful for rapid investigation of a series of unknown samples. **Note: Such acquired spectra carry the Energy Cal prescribed by the resident Application. If known peaks do not line up with the element lines, perform the above mentioned Energy Cal procedure.**
4 Spectrum Information	Not yet implemented.
5 Return to Display	Returns you to Spectrum Display.
6 Display Channel Number/keV	Toggles the cursor readout between energy units and channel number values. Used for diagnostic purposes.

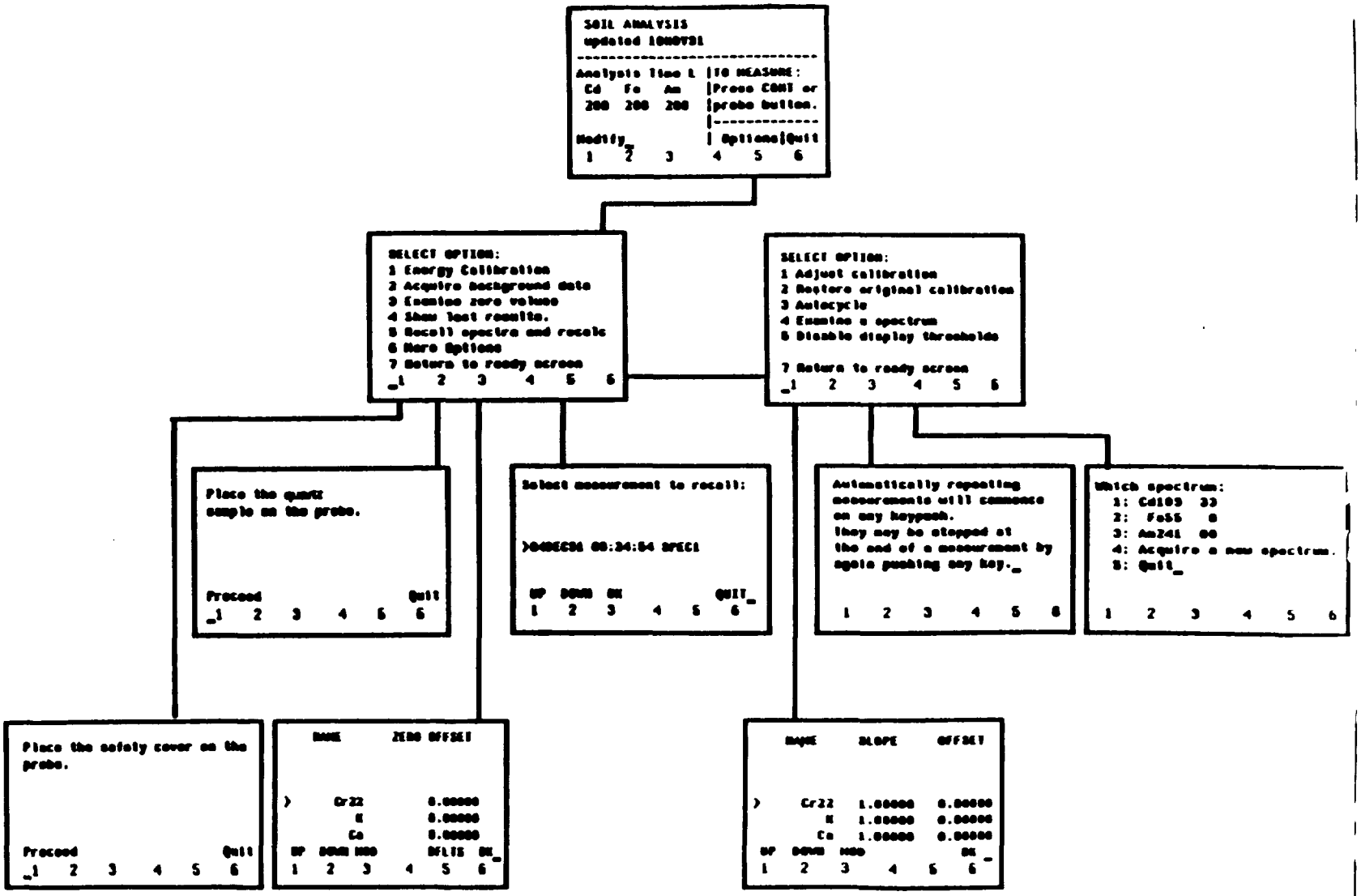

Power On
IS 10:37:21 THE CORRECT TIME ?
IS 11:22:91 THE CORRECT DATE ?
MAIN MENU
1 Measure
2 Choose an application
3 Review stored results
4 Review stored spectra
5 More_
1 2 3 4 5
SOIL ANALYSIS
updated 10NOV91
Analysis Time L
Cd Fe Am
200 200 200
Modify_
TO MEASURE:
Press CONT or
probe button.
Options Quit
1 2 3 4 5 6
Application library index.
> SOIL ANALYSIS
THIN SAMPLE ANALYSIS
UP DOWN OK EXPND QUIT
1 2 3 4 5 6
Results are stored for:
>25NOV91 11:36:26 TEST
UP DOWN DEL VIEW ALL QUIT
1 2 3 4 5 6
Spectra are stored for:
>25NOV91 12:03:30 SPEC1
UP DOWN DEL SEND ALL QUIT
1 2 3 4 5 6
OTHER FUNCTIONS MENU
1 Set Clock/Calendar
2 Comm. port setup
3 Set store/send modes
4 Application maintenance
5 Examine spectrum
6 Return to main menu
1 2 3 4 5 6
SOURCE RANGE(keV) LIVE SECS
>Cd109 33 200
Fe55 8 200
Am241 60 200
UP DOWN MOD REAL EXIT
1 2 3 4 5 6
SOIL ANALYSIS
updated 10NOV91
auto-ECAL on 22.104 dual Cr m
easurement
Rh instead of U
Hg alpha vs beta
Push any key to continue._
1 2 3 4 5 6
What do you want to do?
1. Send all results.
2. Delete all results.
3. None of the above. _
1 2 3 4 5 6
What do you want to do?
1. Send all spectra.
2. Delete all spectra.
3. None of the above. _
1 2 3 4 5 6
See Page 4-14
See Page 4-15


or
auto-store
Notes
Spectra are labelled automatically with results label.
Recalled spectra and results can be relabelled for storage.
See Page 4-16
See Page 4-17


OTHER FUNCTIONS MENU
1 Set Clock/Calendar
2 Comm. port setup
3 Set store/send modes
4 Application maintenance
5 Examine spectrum
6 Return to main menu
1 2 3 4 5 6
IS 16:37:21 THE CORRECT TIME ?
IS 11:22:06 THE CORRECT DATE ?
Setup for printer link:
Baud rate: 9600
Word length: 8
> Parity: None
Non-Xoff handshaking: Yes
UP DOWN MOD CHPTR DFLTS DONE
1 2 3 4 5 6
toggle
Setup for computer link:
Baud rate: 9600
Word length: 8
> Parity: None
Non-Xoff handshaking: No
UP DOWN MOD PRNTR DFLTS DONE
1 2 3 4 5 6
Select automatic print for:
Results: OFF
> Intensities: OFF
Spectra: OFF
UP DOWN MOD STORE NONE DONE
1 2 3 4 5 6
toggle
Select automatic store for:
Results: OFF
> Spectra: OFF
UP DOWN MOD PRINT NONE DONE
1 2 3 4 5 6
What would you like to do?
1 Select an application
2 Delete an application
3 Review application info
4 Xfer an application from PC
5 See how much space is left
6 Delete all applications
7 QUIT
1 2 3 4 5 6
Which spectrum:
1: Cd109 33
2: Fe55 0
3: Am241 00
4: Acquire a new spectrum.
5: Quit
1 2 3 4 5 6
MENU
1 2 3 4 5 6
EXIT FROM SPECTRUM DISPLAY
ENERGY CAL
ENABLE ELEMENT LINES
SET A SPECTRUM
SPECTRUM INFORMATION
RETURN TO DISPLAY
DISPLAY CHANNEL NUMBER
1 2 3 4 5 6

See Page 4-16


Which spectrum:
1: Cd109 33
2: Fe55 0
3: Am241 00
4: Acquire a new spectrum.
5: Quit
FOR FIRST CALIBRATION PEAK
PLACE CURSOR ON A CALIB
PEAK1 THEN PUSH CAL
ENTER CAL PEAK KEV
CALIBRATION IS NOW:
PUSH ANY KEY TO CONTINUE


SOIL ANALYSIS
updated 10NOV91
Analysis time L
Cd Fe Am
200 200 200
Modify_
1 2 3 4 5 6
TO MEASURE:
Press CONT or
probe button.
Options Quit
SELECT OPTION:
1 Energy Calibration
2 Acquire background data
3 Examine zero values
4 Show last results.
5 Recall spectra and recalc
6 More Options
7 Return to ready screen
_1 2 3 4 5 6
SELECT OPTION:
1 Adjust calibration
2 Restore original calibration
3 Autocycle
4 Examine a spectrum
5 Disable display thresholds
7 Return to ready screen
_1 2 3 4 5 6
Place the quartz
sample on the probe.
Proceed Quit
_1 2 3 4 5 6
Select measurement to recall:
>04DEC91 08:24:54 SPECI
UP DOWN OK QUIT_
1 2 3 4 5 6
Automatically repeating
measurements will commence
on any keypush.
They may be stopped at
the end of a measurement by
again pushing any key._
1 2 3 4 5 6
Which spectrum:
1: Cd109 33
2: Fe55 8
3: Am241 80
4: Acquire a new spectrum.
5: Quit_
1 2 3 4 5 6
Place the safety cover on the
probe.
Proceed Quit
_1 2 3 4 5 6
NAME ZERO OFFSET
> Cr22 0.00000
K 0.00000
Ca 0.00000
UP DOWN MOD DELETE OK_
1 2 3 4 5 6
NAME SLOPE OFFSET
> Cr22 1.00000 0.00000
K 1.00000 0.00000
Ca 1.00000 0.00000
UP DOWN MOD OK _
1 2 3 4 5 6

Chapter 5: Maintenance

Main Power Battery

The main power battery is a string of high-capacity rechargeable Ni-Cd cells. It will power the unit four to five hours at normal room temperatures (less time under very hot conditions). To charge the battery in the unit, the unit should be off so maximum power will be delivered to the battery. Once every two weeks the unit should be run without the charger connected until a Low Battery condition shuts the instrument down. Then, with the unit off, recharge the battery with a full 16-hour charge. This will restore the battery capacity. Auxiliary batteries *should not* be charged continuously. They should be given a 16-hour charge with the adapter and then set aside until needed.

Note: **A nearly discharged battery may fail to turn the unit on even with the charger connected. If this happens you will need to allow up to 30 minutes for a sufficient charge or install a freshly charged battery. If your instrument is heavily used, you may want to purchase additional batteries and charging units.**

Battery Replacement

When the battery will no longer hold a charge, it should be replaced. Only use TN part no. 885717; other Ni-Cds can reduce the performance of the instrument.

Probe Detector Bias Battery

The detector bias battery in the probe should be replaced every six months. In hot climates, or when the unit is often stored under conditions where the temperature exceeds 100°F (38°C), the battery may need to be replaced more often. Only use TN part no. 690352.

To ensure uninterrupted operation, your unit has been equipped with a sensing circuit on the bias battery. When the battery is near the end of its life, the red flashing SOURCE ON indicator (visible below the probe handle) will change to flashing yellow. Replace the battery immediately if this should happen.

Battery Replacement

1. Before starting, read these battery change instructions completely and make certain that the spare battery is at hand. Follow the order of the instructions *exactly* so that power to the bias supply is interrupted for as short a time as possible.

2. Set the probe face-down on the table in front of you. Orient it so the broad side is towards you and the handle is pointing off to the right.

3. Using a #1 Phillips screwdriver, remove the four screws holding the rear plate of the probe.

4. Carefully lift the near edge of the rear plate (by lifting the handle) and tilt the plate back as if you were opening a box. It is necessary to tilt the plate as if it were on hinges because the wires at the back edge are fairly short. Tilt the plate past 90° and let it hang on the wires in the open position.

5. Look inside and, on the right, you will see the bias battery. It's a AA size lithium cell held in two spring clamps. It should be equipped with a pull-tab made of a wrap of fiberglass filament tape. If so, simply grasp the tab and pull straight up to remove the battery. If the tab breaks or is missing, insert and twist a large flat-blade screwdriver under the battery to pry it up out of the spring clamps.

6. Lift the battery up to the extent of its connecting wiring. This will expose the in-line connector. Pull the connector apart.

7. Immediately connect the new battery, being careful not to bend the connector pins. Perform this step quickly to minimize the interruption in the detector bias.

8. Lower the new battery into place making sure that its wires lie comfortably in the space provided and are not caught in the spring clamps. Orient the new battery so the wire that runs along the battery (under the battery wrapping) is upwards. Press the new battery into the spring clamps.

9. Raise the rear plate to 90° and hold it up so there is no tension on the wires. Press on the red wire connectors to make sure they are fully seated. They often are pulled away by this operation and must be reseated for proper operation.

10. Slowly lower the rear plate towards the closed position, tucking in any wires that try to escape. Press the rear plate firmly into position. It should move relatively easily down to a point where the gasket is actually touching the enclosure. If modest hand pressure cannot close this gap, lift the rear plate again and check for wires in the way. Never force the rear plate down into place.

11. Once the rear plate is properly reseated, replace the four screws and tighten securely.

Probe Window Replacement

If the probe window is punctured it must be replaced immediately. If not replaced, the probe and internal mechanisms of the unit can be contaminated. This can lead to costly repairs. Replacement windows are supplied in the accessory case and additional supplies can be ordered as TN part No. 885868.

Caution: ***The detector window is extremely fragile. During the window replacement operation take care to keep pointed tools and loose objects well away from the open area of the probe.***

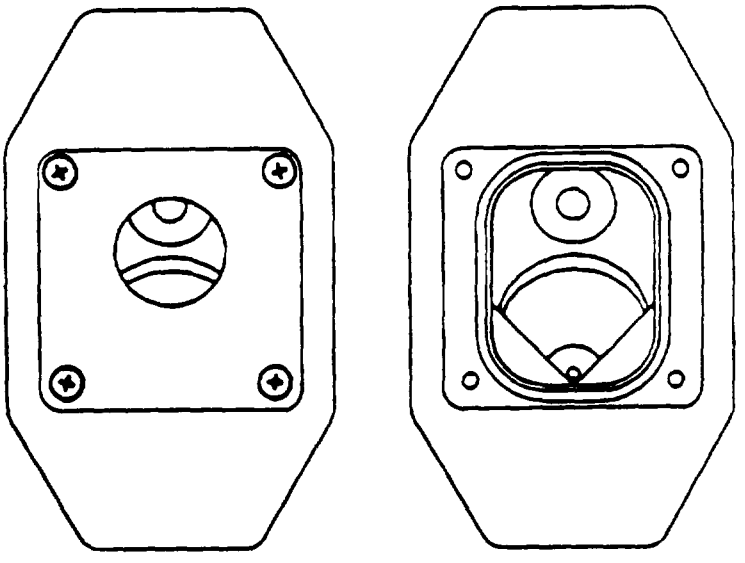
1. Place the probe in the lab stand.

2. Note the location of the window aperture; it is closer to one end of the window plate.

3. Remove the four screws from the window plate. Do not remove any other screws. Be careful to not drop the screws inside the probe (this could happen if the probe window is badly punctured).

Probe Window Aperture

With Window Plate **Without Window Plate**



4. Press any corner of the window plate. The opposite corner will pop up so that you can easily lift out the window. Rock the window plate gently if it does not immediately pop up.

5. The O-ring may pop out of place. To put it back, stretch it for 10 seconds and lay it back in the groove. The O-ring must lie flat in the groove in order to install the new window plate.

6. Put in the new window assembly in the same orientation as the old. Check that the screw holes line up exactly. If the surface of the window plate is not flush with the face of the probe, the O-ring has probably come out of the groove. Remove the window assembly and try again.

7. Carefully replace the four screws.

Chapter 6: Radiation Safety

Warning: All operators should read, understand, and observe the following instructions to minimize any radiation exposure risk.

The Spectrace 9000 is designed to be portable and easy to use, even for operators with no prior experience of x-ray analysis. It is important to realize that x-rays are used in measurement and that radioisotope sources of x-rays are contained in the probe. We have designed into the instrument many special features to minimize the risk of accidental radiation exposure, but there are still precautions which you must take to ensure safe operation.

Routine Precautions

- Familiarize yourself with basic instrument operation before attempting analysis.
- Do not initiate an analysis unless the probe is connected to the electronics and a sample is in place.
- Do not remove a sample or move the probe about while the indicators show SOURCE ON.

  SOURCE ON indicators are:

  - the message on the screen
    ••••SOURCE ON••••
  - the flashing light at the base of the probe.
- Avoid contact with the top of the probe.
- When using sample cups, use the lab stand shield.
- Never aim the probe at yourself or another person.
- Always replace a damaged probe window as soon as possible (see *Chapter 5: Maintenance* for replacement instructions).
- Never attempt to loosen any of the screws on the probe, except those associated with the replacement of the probe window or the battery unit in the base.
- In case of serious mechanical damage to the probe, return the complete instrument to TN Technologies for inspection.

In Case of Malfunction

As long as the analysis sequence is properly carried out and a sample is in contact with the probe window, there is no radiation hazard.

Warning: With a malfunction, a source may be exposed. Follow the instructions below to avoid any radiation exposure risk.

With any malfunction, your first priority must be to keep the probe aperture covered.

Software Failure

If the processor ever locks up during a measurement (the keyboard will be inoperative and the screen may go blank):

1. Disconnect the probe from the data processor unit. This will automatically close the shutter.

2. To restore proper operation of the processor, press the OFF key, wait a few moments and press the ON key. This should bring up a display.

   If it does not, remove the main battery for a moment, then reconnect it. By doing so, you may lose data.

3. Turn the data processor OFF again before reconnecting the probe.

Hardware Failure

The opening and closing of a source is sensed by the electronics through a switch contact. When the program terminates the exposure, it looks to the switch contact to verify the closing of the source. If the switch contact does not detect that the source has closed, the following message will appear:

•••• WARNING ••••
Source did not close

Should you ever see this message, follow these steps:

1. Cover the probe end with the safety shield. Place the probe in the carrying case or other secure place.

2. Call TN Technologies immediately at (512) 388-~~9200~~ 9100. *The instrument must not be used in this condition.*

3. Do not leave the instrument unattended.

Problem Prevention

Always take appropriate steps to keep the instrument operating reliably. This will reduce the chance of malfunction or of any situation which might become hazardous. Make sure the probe is placed securely on the sample or in the lab stand before beginning an analysis. If the instrument is used routinely on the bench with the probe in the lab stand, use the shield provided with the lab stand. Avoid immersing the probe.

Report any instrument malfunction to TN Technologies, no matter how infrequent or trivial it may seem.

Safety Provisions in the Instrument Design

We have designed the Spectrace 9000 with many special features to minimize the risk of accidental radiation exposure. These design features are outlined below:

- All radioactive materials are permanently sealed within high strength capsules which have undergone tests to be certified as satisfactory for industrial use.
- The source capsules are firmly mounted within the instrument, and are further protected against physical damage by the probe design.
- When sources are not exposed (any time other than during a measurement) all radiation emitted by the sources is stopped by the shielding structure.
- Only one source at a time can be exposed, and the operator is alerted to an exposed source by visible and audible signals.
- Source exposure is only possible under electrical input from the electronic unit, and then only at certain points in the application procedure.
- Accidental source exposure is *not* possible. The correct key sequence must be entered before a measurement can be started.
- The radiation field from each source is spatially restricted, and in normal use is totally confined by the sample to the immediate vicinity of the probe.

Chapter 7: Regulatory Requirements

Licensing

Instruments containing quantities of radioactive material, except those specifically exempted, are subject to regulations by the U. S. Nuclear Regulatory Commission (NRC) or an Agreement State. An "Agreement State" is one which has entered into an agreement with the NRC, in which regulatory authority over the use of certain materials within the state has been transferred to the respective state. These agreements provide for a high degree of compatibility between the regulatory programs of the state and the NRC. Because of the similarities between the programs of the Agreement States and the NRC, we can discuss some general characteristics of all programs as they pertain to instrument control.

The approach utilized in assuring the safety of a manufactured device containing radioactive material is to regulate the manufacturer. The inherent safety of the device is studied, and conditions of assuring its safety are contained in the specific license under which the device is manufactured and distributed. The user must also be licensed either by a Specific License or General License prior to receiving the device. Most users accept the 9290 Analyzer (Spectrace 9000) under General License which is issued in all regulations. General License conditions are summarized on the label affixed to the probe unit. This label must not be removed. Complete General License conditions are included in this manual.

Leak Testing

The sources contained in the 9290 Analyzer are required to be leak tested at intervals not to exceed six (6) months. TN Technologies will automatically notify you when leak tests are due, and can provide a mailable leak test kit. The analyzer must be within current leak test prior to any shipment.

Transportation

Under U. S. Department of Transportation regulations (49 CFR, 173.422) and International Air Transport Association (IATA), the 9290 Analyzer is classified as "Radioactive material, excepted package, instruments, UN2910." As such, the device can be transported by any mode - air, land, or sea. It is eligible to be transported in the baggage compartment of a passenger-carrying aircraft. The device is excepted from all specification packaging, marking, and labeling (i.e. no marking or labeling is required on the carrying case). The bill of lading or airway bill should, however, contain the words: "Radioactive material, excepted package, instruments, UN2910." These words should be inserted with the description of the goods. Since regulations are constantly changing, call TN Technologies (512/388-9291) for current information prior to making a shipment.

Additional Safety Items

In the event of an accident which is thought to have damaged the source encapsulations, TN Technologies should be notified immediately for further instructions.

Until appropriate measurements have been made, the device should be handled as little as possible to avoid the spread of contamination. TN Technologies will provide advice and help in the evaluation of further steps to be taken.

Should use of the analyzer be discontinued, or disposal of the sources become necessary, TN Technologies should be contacted for aid in disposition. Disposal of radioactive material must be handled by someone specifically licensed to do so.

Appendix: General Licenses

IMPORTANT

PLEASE READ

EXCERPTS FROM TEXAS REGULATIONS FOR CONTROL OF RADIATION AS THEY APPLY TO ANY PERSON WHO RECEIVES, ACQUIRES, POSSESSES OR USES RADIOACTIVE MATERIAL RECEIVED UNDER GENERAL LICENSE

TN Technologies, Inc.
Post Office Box 800
Round Rock, Texas 78680

January, 1992

To our Valued Customers:

You recently received device(s) containing radioactive material distributed under General License as set out in the regulations. TN Technologies, Inc. (formerly Texas Nuclear Corporation), as the manufacturer and distributor, is required to furnish parts of the Texas regulations pertaining to General Licensees. Identical wording is contained in all Agreement State and Nuclear Regulatory Commission regulations.

The attached excerpts outline your responsibilities as a licensee and the conditions under which you must possess, use and transfer these devices. Regulations can be confusing to read and interpret; therefore, following is a brief summary of those items of which you should be most aware.

41.22; 41.31; 41.40; 11.4

(1) Only certain devices are eligible for distribution to General Licensees. This approval is granted to the manufacturer under a special license.

(2) Fixed gauges must be commissioned by the manufacturer or someone holding a specific license authorizing them to perform these functions. Gauges can be physically installed (mounted) without a specific license authorization. Also, wipe test samples can be taken for return to an approved laboratory, and periodic shutter checks can be performed by operating personnel.

(3) Ensure leak testing is performed at specified intervals. For Texas Nuclear products, this is:

Gauges	Every 3 years
Portable Analyzers	Every 6 months

(4) Maintain records as follows:

Receipt records
Leak test certificates
Copy of General License Regulations
Records of transfer or disposal
Records of periodic shutter (on-off mechanism) tests

(5) Devices can only be transferred to someone authorized to receive them.

41.50

(1) The General License can be amended in the regulations.

(2) Willful violation of license conditions can result in termination of license by the regulatory agency.

41.100

(1) If you need to ship radioactive material, contact TN for instructions.

11.5

(1) The agency may inspect any time and the licensee must make records available.

11.6; 11.7

(1) Devices must be leak tested at specified intervals and records maintained.

(2) Test results must not exceed 0.005 µCi.

21.402; 21.403

(1) You must report to the regulatory agency any lost radioactive material and certain incidents involving radioactive material.

(2) Reportable incidents are stated in 21.403.

Please feel free to call if you have any questions.

Doris C. Bryan, Manager
Licensing & Regulatory Affairs
(512) 388-9287

41.22 General Licenses - Radioactive Material other than Source Material

(d) Certain Measuring, Gauging and Controlling Devices

(1) A general license is hereby issued to commercial and industrial firms and to research, educational, and medical institutions, individuals in the conduct of their business, and State or local government agencies to receive, acquire, possess, use, or transfer in accordance with the provisions of 41.22(d)(2), (3), (4), radioactive material, excluding special nuclear material, contained in devices designed and manufactured for the purpose of detecting, measuring, gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.

(2) The general license in 41.22(d)(1) applies only to radioactive material contained in devices which have been manufactured and labeled in accordance with the specifications contained in a specific license issued by the U. S. Nuclear Regulatory Commission or an Agreement State which authorizes distribution of devices to persons generally licensed by the U.S. Nuclear Regulatory Commission or an Agreement State.

(3) Any person who receives, acquires, possesses, uses, or transfers radioactive material in a device pursuant to the general license in 41.22(d)(1):

(i) Shall assure that all labels affixed to the device at the time of receipt, and bearing a statement that removal of the label is prohibited, are maintained thereon and shall comply with all instructions and precautions provided by such labels;

(ii) Shall ensure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals or at such other intervals as specified in the label; however,

(a) Devices containing only krypton need not be tested for leakage of radioactive material, and

(b) Devices containing only tritium or not more than 100 microcuries of other beta and/or gamma emitting material or 10 microcuries of alpha emitting material and devices held in storage in the original shipping container prior to initial installation need not be tested for any purpose;

(iii) Shall assure that the tests required by 41.22(d)(3)(ii) and other testing, installation, servicing, and removal from installation involving the radioactive materials, shielding or containment, are performed by a person holding a specific license from the Agency, the U.S. Nuclear Regulatory Commission, or an Agreement State to perform such activities;

(iv) Shall maintain records showing compliance with the requirements of 41.22(d)(3)(ii) and (3)(iii). The records shall show the results of tests. The records also shall show the dates of performance of, and the names of persons performing, testing, installation servicing, and removal from installation concerning the radioactive material, its shielding or containment;

(v) Upon occurrence of a failure of or damage to, or any indication of a possible failure of or damage to, the shielding of the radioactive material, shall immediately suspend the operation of the device until it has been repaired by the manufacturer or other person holding a specific license from the Agency, the U.S. Nuclear Regulatory Commission, or Agreement State to repair such devices, or disposed of by transfer to a person authorized by a specific license to receive the radioactive material contained in the device and, within thirty (30) days, furnish to the Agency a report containing a brief description of the event and the remedial action taken;

(vi) Shall not abandon the device containing radioactive material;

(vii) Except as provided in 41.22(d)(3)(viii), shall transfer or dispose of the device containing radioactive material only by transfer to a specific licensee of the Agency, the U.S. Nuclear Regulatory Commission, or an Agreement State whose specific license authorizes him to receive the device and within thirty (30) days after transfer of a device to a specific licensee shall furnish to the Agency a report containing identification of the device by manufacturer's name and address of the person receiving the device. No report is required if the device is transferred to the specific licensee in order to obtain a replacement device;

(viii) Shall transfer the device to another general licensee only:

(a) Where the device remains in use at a particular location. In such case the transferor shall give the transferee a copy of this regulation and any safety documents identified in the label on the device and within thirty (30) days of the transfer, report to the Agency the manufacture's name and model number of device transferred, the name and address of the transferee, and the name and/or position of an individual who may constitute a point of contact between the Agency and the transferee; or

(b) Where the device is held in storage in the original shipping container at its intended location of use prior to initial use by a general licensee.

(ix) Shall comply with the provisions of 21.402 and 21.403 for reporting radiation incidents, theft, or loss of licensed material, but shall be exempt from the other requirements of Parts 21 and 22.

(4) The general license in 41.22(d)(1) does not authorize the manufacture of devices containing radioactive material.

(5) The general license provided in 41.22(d)(1) is subject to the provisions of Parts 11, 41.31, 41.40, 41.50 and 41.100.

41.31 Specific Terms and Conditions of Licenses

(a) Each license issued pursuant to this part shall be subject to all the provisions of the Act, now or hereafter in effect, and to all rules, regulations, and orders of the Agency.

(b) No license issued or granted under this part and no right to possess or utilize radioactive material granted by any license issued pursuant to this part shall be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person unless the Agency shall, after securing full information, find that the transfer is in accordance with the provisions of the Act, and shall give its consent in writing.

(c) Each person licensed by the Agency pursuant to this part shall confine his use and possession of the material licensed to the locations and purposes authorized in the license.

(d) (1) Each licensee shall notify the Agency, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapters of Title 11 (Bankruptcy) of the United States Code (11 U.S.C.) by or against:

(i) A licensee;

(ii) An entity [as that term is defined in 11 U.S.C. 101(14)] controlling a licensee or listing the license or licensee as property of the estate; or

(iii) An affiliate [as the term is defined in 11 U.S.C. 101(2)] of the licensee.

(2) This notification must indicate:

(i) The bankruptcy court in which the petition for bankruptcy was filed; and

(ii) The date of the filing of the petition.

41.40 Transfer of Material

(a) No licensee shall transfer radioactive material except as authorized pursuant to this part.

(b) Except as otherwise provided in his license and subject to the provisions of 41.40(c) and (d), any licensee may transfer radioactive material:

(1) To the Agency; 11/

(2) To the U.S. Energy Research and Development Administration;

(3) To any person exempt from the regulations in this part to the extent permitted under such exemption;

11/ A licensee may transfer material to the Agency only after receiving prior approval from the Agency.

(4) To any person authorized to receive such material under terms of a general license or its equivalent, or a specific license or equivalent licensing document, issued by the Agency, the U.S. Nuclear Regulatory Commission, or any Agreement State, or to any person otherwise authorized to receive such material by the Federal Government or any agency thereof, the Agency, or any Agreement State; or

(5) As otherwise authorized by the Agency in writing.

(c) Before transferring radioactive material to a specific licensee of the Agency, the U.S. Nuclear Regulatory Commission, or an Agreement State, or to a general licensee who is required to register with the Agency, the U.S. Nuclear Regulatory Commission, or an Agreement State prior to receipt of the radioactive material, the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred.

(d) The following methods for the verification required by 41.40(c) are acceptable:

(1) The transferor may have in his possession, and read, a current copy of the transferee's specific license or registration certificate;

(2) The transferor may have in his possession a written certification by the transferee that he is authorized by the license or registration certificate to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or registration certificate number, issuing agency, and expiration date;

(3) For emergency shipments the transferor may accept oral certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or registration certificate number, issuing agency, and expiration date; provided, that the oral certification is confirmed in writing within ten (10) days.

(4) The transferor may obtain other sources of information compiled by reporting service from official records of the Agency, the U.S. Nuclear Regulatory Commission, or the licensing agency of an Agreement State as to the identity of licensees and the scope and expiration dates of licenses and registration; or

(5) When none of the methods of verification described in 41.40(d)(1) to (4) are readily available or when a transferor desires to verify that information received by one of such methods is correct or up-to-date, the transferor may obtain and record information from the Agency, the U.S. Nuclear Regulatory Commission, or the licensing agency of the Agreement State that the transferee is licensed to receive the radioactive material.

(e) Preparation for shipment and transport of radioactive material shall be in accordance with the provisions of 41.100.

41.50 Modification, Revocation, and Termination of Licenses

(a) The terms and conditions of all licenses shall be subject to amendment, revision, or modification, or the license may be suspended or revoked by reason of amendments of the Act, or by reason of rules, regulations, and orders issued by the Agency.

(b) Any license may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application or any statement of fact required under provisions of the Act, or because of conditions revealed by such application or statement of fact or any report, record, or inspection, or other means which would warrant the Agency to refuse to grant a license on an original application, or for violations of, or failure to observe any of the terms and conditions of the Act, or of the license, or of any rule, regulation, or order of the Agency.

(c) Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended, or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

41.100 Preparation of Radioactive Material for Transport

No licensee shall deliver any radioactive material to a carrier 12/ for transport unless:

(a) The licensee complies with the applicable requirements of the regulations, appropriate to the mode of transport, of the U.S. Department of Transportation insofar as such regulations relate to the packing of radioactive material, and to the monitoring, marking, and labeling of those packages;

(b) The licensee has established procedures for opening and closing packages in which radioactive material is transported to provide safety and to assure that, prior to the delivery to a carrier for transport, each package is properly closed for transport; and

(c) Prior to delivery of a package to a carrier for transport, the licensee shall assure that any special instructions needed to safely open the package are sent to, or have been made available to the consignee.

11.4 Records

Each licensee and registrant shall maintain records showing the receipt, transfer, and disposal of all licensed or registered sources of radiation. These records shall be maintained by the licensee or registrant until disposal is authorized by the Agency. Additional record requirements are specified elsewhere in these rules. All records required by these rules shall be accurate and factual.

12/ For the purpose of the regulation, a licensee who transports his own licensed material as a private carrier is considered to have delivered such material to a carrier for transport.

11.5 Inspections

(a) Each licensee and registrant shall afford the Agency at all reasonable times opportunity to inspect sources of radiation and the premises and facilities wherein such sources of radiation are used or stored.

(b) Each licensee and registrant shall make available to the Agency for inspection, upon reasonable notice, records maintained pursuant to these rules.

(c) Routine Inspection of Radiation Machines and Services

(1) Routine inspections by Agency personnel will be made no more frequently than the intervals specified in Appendix 11-C.

(2) Notwithstanding the provisions of 11.5(c)(1) above, for those radiation machines determined by the Agency to constitute a minimal threat to human health and safety, the routine inspection interval will be five years. The applicable categories are listed in Appendix 11-D.

(3) Notwithstanding the inspection intervals specified in these rules, the Agency may inspect registrants more frequently due to:

(i) The persistence or severity of violations found during an inspection.

(ii) Investigation of an incident or complaint concerning the facility;

(iii) A request for an inspection by a worker(s) in accordance with 22.16;

(iv) Any change in a facility or equipment which might cause a significant increase in radiation output or hazard; or

(v) A mutual agreement between the Agency and registrant.

11.6 Tests

Each licensee and registrant shall perform, upon instructions from the Agency, or shall permit the Agency to perform such reasonable tests as the Agency deems appropriate or necessary including, but not limited to, tests of:

(a) Sources of radiation;

(b) Facilities wherein sources of radiation are used or stored;

(c) Radiation detection and monitoring instruments; and

(d) Other equipment and devices used in connection with utilization or storage of licensed or registered sources of radiation.

11.7 Tests for Leakage and/or Contamination of Sealed Sources

(a) Requirements. Each licensee using sealed sources of radioactive material, Nickel 63 foil sources, or plated alpha sources shall have such sources periodically tested for leakage and/or contamination as prescribed in this Section. Records of these tests shall be maintained and made available for inspection by the Agency.

(b) Method of Testing. Tests for leakage and contamination shall be performed only by persons specifically authorized to perform such tests by the Agency, another Agreement State or the U.S. Nuclear Regulatory Commission. The test sample shall be taken from the surface of the source or from the surface of the device in which the source is stored or mounted and on which one might expect contamination to accumulate. The test sample shall be analyzed for radioactive contamination and the analysis shall be capable of detecting the presence of 0.005 microcuries of radioactivity on the test sample. The results of the test shall be kept in units of microcuries and maintained for inspection by the Agency.

(c) Interval of Testing. Each sealed source of radioactive material and each Nickel 63 foil source shall be tested at intervals not to exceed six (6) months except that each source designed for the purpose of emitting alpha particles shall be tested at intervals not to exceed three (3) months. In the absence of a certificate from a transferor indicating that a test has been made prior to the transfer, the sealed source shall not be put into use until tested. Notwithstanding the leak test intervals specified herein, the Agency may authorize extended leak test intervals for specified sources used in certain specific applications.

(d) Leaking or Contaminated Sources. If the test reveals the presence of 0.05 microcuries or more of leakage or contamination obtained from a teletherapy or a gamma irradiator source, or 0.005 microcuries or more of leakage or contamination obtained from any other type source, the licensee shall immediately withdraw the source from use and shall cause it to be decontaminated, repaired, or disposed of in accordance with the Texas Regulations for Control of Radiation. A report, describing the equipment involved, the test results and the corrective action taken shall be filed with:

Director, Division of Compliance and Inspection
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, TX 78756

(e) Exemptions. Notwithstanding the requirements of 11.7(a) through (d), the following sources are exempted from periodic leak testing:

(1) Hydrogen 3 sources;

(2) Sources of radioactive material with a half-life of 30 days or less;

(3) Sealed sources of radioactive material in gaseous form;

(4) Sources of beta and/or gamma emitting radioactive material with an activity of 100 microcuries or less;

(5) Sources of alpha emitting radioactive material with an activity of 10 microcuries or less;

(6) Nickel 63 foil sources of 100 microcuries or less; and

(7) Plated alpha sources, other than Californium 252 sources, with an activity of 0.1 microcuries or less.

21.402 Reports of Theft or Loss of Sources of Radiation

(a) Each licensee or registrant shall report by telephone and telegraph, mailgram, or facsimile, to the Agency the theft or loss of any licensed or registered source of radiation immediately after such occurrence becomes known.

(b) Each licensee or registrant who is required to make a report pursuant to 21.402(a) shall, within thirty (30) days after he learns of the loss or theft, make a report in writing to the Agency, setting forth the following information:

(1) A description of the source of radiation involved, including the kind, quantity, chemical, physical form, and/or model and serial numbers;

(2) A description of the circumstances under which the loss or theft occurred;

(3) A statement of disposition or probable disposition of the source of radiation involved;

(4) Radiation exposures to individuals, circumstances under which the exposures occurred, and the extent of possible hazard to persons in unrestricted areas;

(5) Actions which have ben taken, or will be taken, to recover the source of radiation, and

(6) Procedures or measures which have been or will be adopted to prevent a recurrence of the loss or theft of sources of radiation.

(c) Subsequent to filing the written report, the licensee or registrant shall also report any substantive additional information on the loss or theft which becomes available to the licensee, within thirty (30) days after he learns of such information.

21.403 Notification of Incidents

(a) Immediate Notification. Each licensee or registrant shall immediately notify the Agency by telephone and telegraph, mailgram, or facsimile of any incident involving any source of radiation possessed by him and which may have caused or threatens to cause:

(1) A dose to the whole body of any individual of 25 rems or more of radiation; a dose to the skin of the whole body of any individual of 150 rems or more of radiation, or a dose to the feet, ankles, hands, or forearms of any individual of 375 rems or more of radiation; or

(2) The release of radioactive material in the concentrations which, if averaged over a period of twenty-four (24) hours, would exceed 5,000 times the limits specified for such materials in Appendix A, Table II; or

(3) A loss of one working week or more of the operation of any facilities affected; or

(4) Damage to property in excess of $200,000.

(b) Twenty-Four Hour Notification. Each licensee or registrant shall within twenty-four (24) hours notify the Agency by telephone and telegraph, mailgram, or facsimile, of any incident involving any source of radiation possessed by him and which may have caused or threatens to cause:

(1) A dose to the whole body of any individual of five (5) rems or more of radiation; a dose to the skin of the whole body of any individual of thirty (30) rems or more of radiation; or a dose to the feet, ankles, hands, or forearms of seventy-five (75) rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of twenty-four (24) hours, would exceed 500 times the limits specified for such materials in Appendix A, Table II; or

(3) A loss of one day or more of the operation of any facilities affected; or

(4) Damage to property in excess of $2,000.

LICENSING AGENCIES IN AGREEMENT STATES AS OF JANUARY, 1992

ALABAMA

Alabama Dept. of Public Health
Div. of Radiological Health
State Office Building
Montgomery, AL 36130
Phone: 205/242-5315

ARIZONA

Arizona Radiation Regulatory Agency
814 South 40th Street
Phoenix, AZ 85040
Phone: 602/255-4845

ARKANSAS

Arkansas Dept. of Health
Radiation Control & EMP
4815 West Markham Street
Little Rock, AR 72205-3867
Phone: 501/661-2301

CALIFORNIA

California Department of Health
Radiologic Health Section
744 P Street
Sacramento, CA 95814
Phone: 916/445-0931

COLORADO

Colorado Department of Health
Radiation Control Division
4210 East 11th Avenue
Denver, CO 80220
Phone: 303/331-8480

FLORIDA

Florida Department of HRS
Radiological Health Services
1317 Winewood Boulevard
Building 1, Room 108
Tallahassee, FL 32301
Phone: 904/487-2437

GEORGIA

Georgia Department of
Natural Resources
Radioactive Materials Program
4244 International Parkway, Suite 114
Atlanta, GA 30354
Phone: 404/362-2675

ILLINOIS

Illinois Department of Nuclear Safety
1035 Outer Park Drive
Springfield, IL 62704
Phone: 217/785-9948

IOWA

Iowa Department of Public Health
Bureau of Radiological Health
Lucas State Office Building
Des Moines, IA 50319
Phone: 515/281-4942

KANSAS

Kansas Department of Health
and Environment
Bureau of Radiation Control
Topeka, KS 66620
Phone: 913/296-1562

KENTUCKY

Radiation Control Branch
Cabinet for Human Resources
275 East Main Street
Frankfort, KY 40621
Phone: 502/564-3700

LOUISIANA

Louisiana Department of
Environmental Quality
Radiation Protection Division
P. O. Box 82135
Baton Rouge, LA 70884-2135
Phone: 504/765-0160

LICENSING AGENCIES IN AGREEMENT STATES AS OF JANUARY, 1992

MARYLAND

Department of the Environment
2500 Broening Highway
Baltimore, MD 21224
Phone: 301/631-3000

MISSISSIPPI

Mississippi State Board of Health
Div. of Radiological Health
P. O. Box 1700
Jackson, MS 39215-1700
Phone: 601/960-7400

NEBRASKA

Nebraska Department of Health
Div. of Radiological Health
P. O. Box 95007
Lincoln, NE 68509
Phone: 402/471-2168

NEVADA

Nevada Department of Human Resources
Bureau of Regulatory Health
Consumer Health Protection
505 East King Street
Carson City, NV 89710
Phone: 702/687-5394

NEW HAMPSHIRE

New Hampshire Division of
Public Health Services
Bureau of Radiological Health
Health & Welfare Building
6 Hazen Drive
Concord, NH 03301-6527
Phone: 603/271-4588

NEW MEXICO

New Mexico Environmental
Improvement Division
Community Services Bureau
1190 St. Francis Drive
Santa Fe, NM 87503
Phone: 505/827-2948

NEW YORK

New York Department of Labor
Div. of Safety and Health
1 Main Street, 8th Floor
Brooklyn, NY 11201
Phone: 718/797-7636

NORTH CAROLINA

North Carolina Department of
Environment, Health and Natural
Resources
Division of Radiation Protection
Radioactive Materials Section
P. O. Box 27687
Raleigh, NC 27611-7687
Phone: 919/571-4141

NORTH DAKOTA

North Dakota Department of Health
Environmental Health Section,
Environmental Engineering
1200 Missouri Avenue, Room 304
Bismarck, ND 58502
Phone: 701/221/5183

OREGON

Oregon Department of Human Resources
Health Division
Radiation Control Section
1400 SW 5th Avenue
P. O. Box 231
Portland, OR 97201
Phone: 503/229-5797

LICENSING AGENCIES IN AGREEMENT STATES AS OF JANUARY, 1992

RHODE ISLAND

Rhode Island Radiation
Control Agency
206 Cannon Building
75 Davis Street
Providence, RI 02908
Phone: 401/277-2438

SOUTH CAROLINA

South Carolina Dept. of Health
and Environmental Control
Div. of Radioactive Material
Licensing and Compliance
2600 Bull Street
Columbia, SC 29201
Phone: 803/734-4626

TENNESSEE

Tennessee Department of Public Health
Division of Radiological Health
TERRA Building
150 9th Avenue North
Nashville, TN 37203
Phone: 615/741-7812

TEXAS

Texas Department of Health
Bureau of Radiation Control
Division of Licensing,
Registration, and Standards
1100 West 49th Street
Austin, TX 78756
Phone: 512/835-7000

UTAH

Utah Department of Health
Division of Environmental Health
Bureau of Radiation Control
P. O. Box 1660
1460 West 288 North
Salt Lake City, UT 84116-0690
Phone: 801/538-6734

WASHINGTON

Radioactive Materials Section
DOH - Division of Radiation
Protection LE-13
Airdustrial Center Building #5
P. O. Box 47827
Olympia, WA 98504-7827
Phone: 206/753-3468

LICENSING AGENCIES IN AGREEMENT STATES AS OF JANUARY, 1992

HEADQUARTERS OFFICE

Division of Fuel Cycle
and Material Safety
Office of Nuclear Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555
Phone: 301/492-7000

CONNECTICUT, DELAWARE, MAINE
MASSACHUSETTS, NEW JERSEY
PENNSYLVANIA, VERMONT, WASHINGTON, DC

U.S. Nuclear Regulatory Commission
Region I
Nuclear Material Section B
475 Allendale Road
King of Prussia, PA 19406
Phone: 215/337-5000

VIRGINIA, WEST VIRGINIA,
PUERTO RICO, VIRGIN ISLANDS

U.S. Nuclear Regulatory Commission
Region II
Material Radiation Protection Section
101 Marietta Street, Suite 2900
Atlanta, GA 30303
Phone: 404/331-4503

INDIANA, MICHIGAN, MINNESOTA,
MISSOURI, OHIO, WISCONSIN

U.S. Nuclear Regulatory Commission
Region III
Material Licensing Section
799 Roosevelt Road
Glen Ellyn, IL 60137
Phone: 708/790-5500

IDAHO, MONTANA, OKLAHOMA,
SOUTH DAKOTA, WYOMING

U.S. Nuclear Regulatory Commission
Region IV
Material Radiation Protection Section
611 Ryan Plaza Drive
Suite 1000
Arlington, TX 76011
Phone: 817/860-8100

ALASKA, HAWAII, GUAM

U.S. Nuclear Regulatory Commission
Region V
Material Radiation Protection Section
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596
Phone: 510/975-0200

ENVIRONMENTAL AND TECHNICAL SERVICES

James B. (Jim) Whitworth
Director
(512) 388-9285

Doris C. Bryan
Manager
(512) 388-9287

Contacts:

Consulting - Safety Programs	Doris Bryan	(512) 388-9287
Emergencies/Accidents	Mark McCray Doris Bryan	(512) 388-9301 (512) 388-9287
Leak Test Service	Sharon Alexander	(512) 388-9303
Disposals	Mark McCray	(512) 388-9301
Licensing and Regulatory Affairs	Doris Bryan Kathleen Nelson	(512) 388-9287 (512) 388-9288
Training	Pam Zelewski	(512) 388-9286
Shipping Radioactive Material	Doris Bryan	(512) 388-9287
Survey Meter Calibration & Repair	Jon George	(512) 388-9308

Glossary

Accuracy A measure of how close an analysis result is to the correct value or to a value assumed to be the correct value.

Application A complete analysis configuration which defines the elements to be measured, the sources to be used, the interfering elements in the sample, and a set of fundamental parameter calibration coefficients.

Backscatter The source radiation that "scatters" off the sample, losing little or no energy in the process.

Blank A sample that contains *none* of the elements of interest. Used to zero the unit.

Channels One of 2048 memory locations the x-ray spectral data are stored in after being processed by a multi-channel analyzer.

Fundamental Parameters Theoretical XRF calibration coefficients based on known mass absorption coefficients, fluorescent yields, etc. for all elements.

keV Kilo-electron-volt. Unit of energy associated with x-ray emission.

Precision A measure of the repeatability of an analysis result on the same sample under identical measurement conditions.

Source Decay The gradual reduction in source activity over time. The "half-life" of the source is the time it takes for the source to decay to 1/2 its original activity. The Spectrace 9000's sources and their half-lives are:

isotope	half-life	%decay/week
Fe-55	2.7 years	.5
Cd-109	1.3 years	1
Am-241	456 years	.003

Spectrum The distribution of x-ray energies emitted by a sample when excited by a source.

Standard Deviation A quantitative measure of the typical error observed (or expected) in an analysis result. Specifically, in a group of results obtained by repeat analyses of the same sample, 67% of the results will fall within one standard deviation of the mean result. Ninety five percent of the results will fall within two standard deviations of the mean. The term "sigma" is synonymous with "standard deviation."

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

APPENDIX B

SITE-SPECIFIC SAFETY AND HEALTH PLAN

EXHIBIT II

STANDARD METHOD D-2216-80, MOISTURE CONTENT OF SOIL

Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[1]

This standard is issued under the fixed designation D 2216; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This method covers the laboratory determination of the water (moisture) content of soil, rock, and soil-aggregate mixtures by weight. For simplicity, the word "material" hereinafter refers to either soil, rock, or soil-aggregate mixtures, whichever is most applicable.

1.2 The water content of a material is defined as the ratio, expressed as a percentage, of the mass of "pore" or "free" water in a given mass of material to the mass of the solid material particles.

1.3 This method does not give true representative results for materials containing significant amounts of halloysite, montmorillonite, or gypsum minerals; highly organic soils; or materials in which the pore water contains dissolved solids (such as salt in the case of marine deposits). For a material of the previously mentioned types, a modified method of testing or data calculation may be established to give results consistent with the purpose of the test.

2. Summary of Method

2.1 The practical application in determining the water content of a material is to determine the mass of water removed by drying the moist material (test specimen) to a constant mass in a drying oven controlled at 110 ± 5°C and to use this value as the mass of water in the test specimen. The mass of material remaining after oven-drying is used as the mass of the solid particles.

3. Significance and Use

3.1 For many soil types, the water content is one of the most significant index properties used in establishing a correlation between soil behavior and an index property.

3.2 The water content of a soil is used in almost every equation expressing the phase relationships of air, water, and solids in a given volume of material.

3.3 In fine-grained (cohesive) soils, the consistency of a given soil type depends on its water content. The water content of a soil, along with its liquid and plastic limit, is used to express its relative consistency or liquidity index.

3.4 The term "water" as used in geotechnical engineering, is typically assumed to be "pore" or "free" water and not that which is hydrated to the mineral surfaces. Therefore, the water content of materials containing significant amounts of hydrated water at in-situ temperatures or less than 110°C can be misleading.

3.5 The term "solid particles" as used in geotechnical engineering, is typically assumed to mean naturally occurring mineral particles that are not readily soluble in water. Therefore, the water content of materials containing extraneous matter (such as cement, etc), water-soluble matter (such as salt) and highly organic matter typically require special treatment or a qualified definition of water content.

4. Apparatus

4.1 *Drying Oven*, thermostatically-controlled, preferably of the forced-draft type, and maintaining a uniform temperature of 110 ± 5°C throughout the drying chamber.

4.2 *Balances*, having a precision (repeatability) of ±0.01 g for specimens having a mass of 200 g or less, ±0.1 g for specimens having a mass of between 200 and 1000 g, or ± 1 g for specimens having a mass greater than 1000 g.

4.3 *Specimen Containers*—Suitable containers made of material resistant to corrosion and a change in mass upon repeated heating, cooling, and cleaning. Containers with close-fitting lids shall be used for testing specimens having a mass of less than about 200 g; while for specimens having a mass greater than about 200 g, containers without lids may be used (Note 1). One container is needed for each water content determination.

NOTE 1—The purpose of close-fitting lids is to prevent loss of moisture from specimens before initial weighing and to prevent absorption of moisture from the atmosphere following drying and before final weighing.

4.4 *Desiccator*—A desiccator of suitable size (a convenient size is 200 to 250-mm diameter) containing a hydrous silica gel. This equipment is only recommended for use when containers having close-fitting lids are not used. See 7.4.1.

5. Samples

5.1 Keep the samples that are stored prior to testing in noncorrodible airtight containers at a temperature between approximately 3 and 30°C and in an area that prevents direct contact with sunlight.

5.2 The water content determination should be done as soon as practicable after sampling, especially if potentially corrodible containers (such as steel thin-walled tubes, paint cans, etc.) or sample bags are used.

6. Test Specimen

6.1 For water contents being determined in conjunction with another ASTM method, the method of specimen selection specified in that method controls.

[1] This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.03 on Texture, Plasticity and Density Characteristics of Soils.

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5 The manner in which the test specimen is selected and d mass is basically dependent on the purpose (pu n) of the test, type of material being tested, and the e of sample (specimen from another test, bag, tube, it-barrel, etc.). In all cases, however, a representative rtion of the total sample shall be selected. If a layered soil more than one soil type is encountered, select an average rtion or individual portions or both, and note which rtion(s) was tested in the report of the results.

6.2.1 For bulk samples, select the test specimen from the aterial after it has been thoroughly mixed. The mass of oist material selected shall be in accordance with the llowing table:

Sieve Retaining More Than About 10 % of Sample	Recommended Minimum Mass of Moist Specimen, g
2.0 mm (No. 10) sieve	100 to 200
4.75 mm (No. 4) sieve	300 to 500
19 mm	500 to 1000
38 mm	1500 to 3000
76 mm	5000 to 10 000

7 For small (jar) samples, select a representative por- cordance with the following procedure:

6.2.2.1 For cohesionless soils, thoroughly mix the mate- al, then select a test specimen having a mass of moist aterial in accordance with the table in 6.2.1. See Note 2.

6.2.2.2 For cohesive soils, remove about 3 mm of material om the exposed periphery of the sample and slice it in half o check if the material is layered) prior to selecting the test pecimen. If the soil is layered see 6.2. The mass of moist selected should not be less than 25 g or should be in ce with the table in 6.2.1 if coarse-grained particles re noted. (Note 2).

6.3 Using a test specimen smaller than the minimum nass indicated previously requires discretion, though it may e adequate for the purpose of the test. A specimen having a nass less than the previously indicated value shall be noted n the report of the results.

Note 2—In many cases, when working with a small sample con- g a relatively large coarse-grained particle, it is appropriate not to de this particle in the test specimen. If this occurs, it should be noted he report of the results.

7. Procedure

7.1 Select representative test specimens in accordance with Section 6.

7.2 Place the moist specimen in a clean, dry container of known mass (Note 3), set the lid securely in position, and determine the mass of the container and moist material using an appropriate balance (4.2). Record these values.

7.3 Remove the lid and place the container with moist material in a drying oven maintained at 110 ± 5°C and dry to a constant mass (Notes 4, 5, and 6).

Note 3—To assist in the oven-drying of large test specimens, they should be placed in containers having a large surface area (such as pans) and the material broken up into smaller aggregations.

Note 4—The time required to obtain constant mass will vary ing on the type of material, size of specimen, oven type and and other factors. The influence of these factors generally can ablished by good judgment, and experience with the materials being tested and the apparatus being used. In most cases, drying a test specimen over night (about 16 h) is sufficient. In cases where there is doubt concerning the adequacy of drying, drying should be continued until the mass after two successive periods (greater than ½ h) of drying indicate an insignificant change (less than about 0.1 %). Specimens of sand may often be dried to constant mass in a period of about 4 h, when a forced-draft oven is used.

Note 5—Oven-drying at 110 ± 5°C does not always result in water content values related to the intended use or the basic definition especially for materials containing gypsum or other minerals having significant amounts of hydrated water or for soil containing a significant amount of organic material. In many cases, and depending on the intended use for these types of materials, it might be more applicable to maintain the drying oven at 60 ± 5°C or use a vacuum desiccator at a vacuum of approximately 133 Pa (10 mm Hg) and at a temperature ranging between 23 and 60°C for drying. If either of these drying methods are used, it should be noted in the report of the results.

Note 6—Since some dry materials may absorb moisture from moist specimens, dried specimens should be removed before placing moist specimens in the oven. However, this requirement is not applicable if the previously dried specimens will remain in the drying oven for an additional time period of about 16 h.

7.4 After the material has dried to constant mass remove the container from the oven and replace the lid. Allow the material and container to cool to room temperature or until the container can be handled comfortably with bare hands and the operation of the balance will not be affected by convection currents. Determine the mass of the container and oven-dried material using the same balance as used in 7.2. Record this value.

7.4.1 If the container does not have a lid, weigh the container and material right after their temperatures are such that the operation of the balance will not be affected by convection currents or after cooling in a desiccator.

Note 7—Cooling in a desiccator is recommended since it prevents absorption of moisture from the atmosphere during cooling.

8. Calculation

8.1 Calculate the water content of the material as follows:

$$w = [(W_1 - W_2)/(W_2 - W_c)] \times 100 = \frac{W_w}{W_s} \times 100$$

where:

w = water content, %,
W_1 = mass of container and moist specimen, g,
W_2 = mass of container and oven-dried specimen, g,
W_c = mass of container, g,
W_w = mass of water, g, and
W_s = mass of solid particles, g.

9. Report

9.1 The report (data sheet) shall include the following:

9.1.1 Identification of the sample (material) being tested by boring number, sample number, test number, etc.

9.1.2 Water content of the specimen to the nearest 0.1 % or 1 %, depending on the purpose of the test.

9.1.3 Indication of test specimen having a mass less than the minimum indicated in Section 6.

9.1.4 Indication of test specimen containing more than one soil type (layered, etc).

9.1.5 Indication of the method of drying if different from oven-drying at 110 ± 5°C.

9.1.6 Indication of any material (size and amount) excluded from the test specimen.

10. Precision and Accuracy

10.1 Requirements for the precision and accuracy of this test method have not yet been developed.

LOCATION-SPECIFIC SAFETY AND HEALTH PLAN FOR RAPID RESPONSE LEAD CONTAMINATION REMEDIATION FOR NL INDUSTRIES/TARACORP SUPERFUND SITE IN GRANITE CITY, MADISON, AND VENICE, ILLINOIS DACW45-89-D-0516; DELIVERY ORDER NO. 58

Submitted to:

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Corps of Engineers
Omaha, Nebraska

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TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

1.1 LOCATION HISTORY 1-1
1.2 REGULATORY REQUIREMENTS 1-2
1.3 APPLICABILITY OF THE LOCATION-SPECIFIC SAFETY AND HEALTH PLAN 1-3
1.4 VISITORS 1-3
1.5 WORK AREA LOCATIONS 1-4
1.6 AREA SOIL TYPE/TOPOGRAPHY 1-4
1.7 SCOPE OF WORK 1-8
1.8 MANAGEMENT ORGANIZATION 1-8

2.0 RESPONSIBLE AUTHORITIES 2-1

3.0 PROJECT HAZARDS 3-1

3.1 CHEMICAL HEALTH HAZARDS 3-1
3.2 PHYSICAL HEALTH HAZARDS 3-5
3.3 ENVIRONMENTAL HEALTH HAZARDS 3-8

4.0 WORK AREA CONTROL 4-1

4.1 DESIGNATION OF WORK ZONES 4-1
4.2 EXCLUSION ZONE 4-2
4.3 CONTAMINATION REDUCTION ZONE 4-2
4.4 SUPPORT ZONE 4-2
4.5 LOCATION MAP 4-2
4.6 LOCATION SECURITY 4-2
4.7 THE BUDDY SYSTEM 4-3
4.8 WORK AREA COMMUNICATIONS 4-3
4.9 COMMUNICATION PROCEDURES 4-4

5.0 ACCIDENT PREVENTION PROGRAM 5-1

5.1 MOBILIZATION 5-2
5.2 INSTALL PERIMETER FENCE 5-5
5.3 BAG AND STOCKPILE NON-HAZARDOUS MATERIAL 5-7
5.4 SOIL SAMPLING 5-8
5.5 EXCAVATION OF CONTAMINATED SOIL AND/OR BATTERY CASE MATERIAL 5-9
5.6 BACKFILL OF EXCAVATIONS 5-11
5.7 SOIL LOAD-OUT ACTIVITIES 5-13

TABLE OF CONTENTS (CONTINUED)

5.8 RESTORATION OF DISTURBED AREAS 5-14
5.9 DECONTAMINATION AND DEMOBILIZATION 5-16

6.0 PERSONAL PROTECTIVE EQUIPMENT 6-1

6.1 LEVEL D - NO RESPIRATORY PROTECTION 6-1
6.2 LEVEL C - FULL-FACE AIR PURIFYING RESPIRATORS 6-1
6.3 TASK-SPECIFIC PROTECTION LEVEL 6-2

7.0 DECONTAMINATION PROCEDURES 7-1

7.1 PERSONNEL DECONTAMINATION PROCEDURES--LEVEL C 7-1
7.2 SUSPECTED CONTAMINATION 7-2
7.3 PERSONAL HYGIENE 7-2
7.4 EQUIPMENT DECONTAMINATION 7-2
7.5 OTHER DECONTAMINATION PROCEDURES 7-2
7.6 SAMPLING EQUIPMENT 7-4
7.7 DECONTAMINATION WASTES GENERATED 7-5
7.8 EMERGENCY DECONTAMINATION 7-6

8.0 RESPIRATORY PROTECTION 8-1

8.1 AIR-PURIFYING RESPIRATORS 8-1
8.2 CARTRIDGE CHANGES 8-1
8.3 INSPECTION AND CLEANING 8-1
8.4 FACIAL HAIR 8-1
8.5 FIT TESTING 8-1
8.6 CORRECTIVE LENSES 8-2

9.0 AIR MONITORING 9-1

9.1 AIR MONITORING METHODOLOGIES 9-1
9.2 EQUIPMENT REQUIREMENTS 9-2
9.3 DURATION OF ENTIRE SAMPLING PROGRAM 9-3
9.4 POSTING OF AIR MONITORING RESULTS 9-3
9.5 FUGITIVE DUST 9-3
9.6 X-RAY FLUORESCENT MONITORING 9-3
9.7 AIR MONITORING ACTION LEVELS 9-4
9.8 AIR MONITORING FREQUENCY 9-5
9.9 FIELD CALIBRATION OF AIR SAMPLING PUMPS 9-6

TABLE OF CONTENTS (CONTINUED)

TABLE 9.1, AIR MONITORING ACTION LEVELS 9-4
TABLE 9.2, AIR MONITORING FREQUENCY 9-5

10.0 GENERAL SAFETY 10-1

10.1 SAFETY INSPECTION CHECK-OFF SHEET 10-1
10.2 SAFETY RE-EVALUATION 10-1
10.3 PARKING 10-1
10.4 ACCIDENT INVESTIGATION 10-1
10.5 ILLUMINATION 10-1
10.6 SANITATION 10-1
10.7 SAFETY AND HEALTH POSTER 10-2
10.8 SAFETY EQUIPMENT 10-2
10.9 COMPLIANCE WITH 29 CFR 1910.120 10-2

11.0 TRAINING PROGRAM 11-1

11.1 OHM EMPLOYEES 11-1
11.2 EMPLOYEE TRAINING 11-1
11.3 JOB LOCATION TRAINING 11-2
11.4 DAILY SAFETY MEETINGS 11-3
11.5 RECORDS 11-3
11.6 PRE-PHASE TRAINING 11-3

12.0 MEDICAL SURVEILLANCE 12-1

12.1 GENERAL 12-1
12.2 PROJECT-SPECIFIC MEDICAL SURVEILLANCE 12-1
12.3 ANNUAL MEDICAL EXAMINATION 12-2
12.4 EXIT MEDICAL EXAMINATION 12-2
12.5 SUBCONTRACTORS 12-2
12.6 ACCESS TO MEDICAL RECORDS 12-2

13.0 EMERGENCY PROCEDURES 13-1

13.1 EMERGENCY TELEPHONE NUMBERS 13-1
13.2 EMERGENCY MAP 13-2
13.3 EMERGENCY EQUIPMENT 13-2
13.4 EMERGENCY SIGNALS/EMERGENCY ALARMS 13-2
13.5 EMERGENCY RESPONSE CONTINGENCY PLAN 13-2

TABLE OF CONTENTS (CONTINUED)

13.6 BUDDY SYSTEM 13-2
13.7 EMERGENCY COORDINATOR 13-3
13.8 MEDICAL EMERGENCY AND PERSONAL INJURY 13-3
13.9 FIRE EMERGENCY 13-4
13.10 SPILL CONTAINMENT PROGRAM 13-5
13.11 EVACUATION/RE-ENTRY 13-6

APPENDIX A - WORKER/VISITOR ACKNOWLEDGEMENT TO HEALTH AND SAFETY PLAN

APPENDIX B - LOCATION MAPS

APPENDIX C - MATERIAL SAFETY DATA SHEETS

APPENDIX D - LOCKOUT/TAGOUT PROCEDURES

APPENDIX E - HIGH PRESSURE WASHER SAFETY PROCEDURES

APPENDIX F - HEAT STRESS/COLD STRESS INFORMATION

APPENDIX G - EXCAVATION SAFETY PROCEDURES

APPENDIX H - HOT WORK PROCEDURES PERMIT

APPENDIX I - OHM ACCIDENT/INJURY/ILLNESS REPORTING PROCEDURES

APPENDIX J - OHM SAFETY INSPECTION PROJECT SITE FORM

APPENDIX K - SUMMARY OF SAMPLE RESULTS

APPENDIX L - SAFETY EQUIPMENT AVAILABLE ON-LOCATION

1.0 INTRODUCTION

OHM Remediation Services Corp. (OHM), a wholly owned subsidiary of OHM Corporation, has been contracted to excavate and to dispose of lead contaminated fill material placed in alleys, parking lots, driveways, and yards in residential communities located in Granite City, Madison, and Venice, Illinois.

1.1 LOCATION HISTORY

The NL site includes the NL Industries/Taracorp Plant, a former secondary lead smelting operation facility, located at 16th Street and Cleveland Blvd. in Granite City, Illinois. Metal refining, fabricating, and associated activities had been conducted at the plant since before the turn of the century. Prior to 1903, the plant included a shot tower, machine shop, factory for the manufacture of blackbird targets, sealing wax, manufacture of mixed metals, refining of drosses, and the rolling of sheet lead. From 1903 to 1983, secondary lead smelting occurred on-location. Secondary smelting facilities included a blast furnace, a rotary furnace, several lead melting kettles, a battery breaking operation, a natural gas-fired boiler, several baghouses, cyclones, and an afterburner. Secondary lead smelting operations were discontinued during 1983 and the equipment was dismantled.

In July of 1981, St. Louis Lead Recyclers, Inc. (SLLR) began using equipment on adjacent property owned by Trust 454 to separate components of the Taracorp waste pile. The objective was to recycle lead-bearing materials to the furnaces at Taracorp and send hard rubber and plastic off-location for recycling. SLLR continued operations until March 1983 when it shut down operation. Residuals from the operation remain on Trust 454 property as does some equipment.

A State Implementation Plan for Granite City was published in September 1983 by the Illinois Environmental Protection Agency (IEPA). The IEPA's report indicated that the lead nonattainment problem for air emissions in Granite City was in large part attributable to emissions associated with the operation of the secondary lead smelter operated by Taracorp and lead reclamation activities conducted by SLLR. The IEPA procedure administrative orders by consent with Taracorp, St. Louis Lead Recyclers Inc., Stackcorp, Inc., Tri-City Truck Plaza Inc., and Trust 454 during March 1984. The orders required the implementation of remedial activities relative to the air quality.

NL Industries (NL), as former owner of the site, voluntarily entered into an agreement and administrative order by consent with the U.S. Environmental Protection Agency (U.S. EPA), and IEPA in May 1985 to implement a remedial investigation and feasibility study (RI/FS) for that location and other potentially affected areas. Taracorp was not a party to the agreement due to bankruptcy. The U.S. EPA determined that the

site was a CERCLA facility and it was placed on the National Priorities List on June 10, 1986.

This rapid response action shall require the excavation and disposal of fill material placed in alleys, parking lots, driveways, and yards in residential communities (namely Eagle Park Acres and Venice Township Alleys). Determination and disposal of hazardous versus non-hazardous waste will be based on Woodward Clyde data. The communities include Granite City, Madison, and Venice, Illinois.

Based on the Record of Decision, the action levels for clean-up established for this action shall be 500 parts per million (ppm). Following the removal of the contaminated material, the impacted areas shall be restored. This restoration shall include sodding the yards, and paving the alleys, driveways, and parking lots.

1.2 REGULATORY REQUIREMENTS

All site investigation/removal activities shall comply with and reflect the following regulations and appropriate guidance publications, as a minimum:

- Federal Acquisition Regulation, F.A.R., Clause 52.236-13: Accident Prevention;

- United States Army Corps of Engineers (USACE), Safety and Health Requirements Manual, EM 385-1-1 (latest revision);

- Occupational Safety and Health Administration (OSHA) Construction Industry Standards, 29 CFR 1926; and General Industry Standards, 29 CFR 1910; especially 29 CFR 1910.120, "Hazardous Waste Site Operations and Emergency Response"; and Lead Standards, 29 CFR 1910.1025 Appendices A and B must be covered and made available to employees during initial safety meeting.

- NIOSH/OSHA/USCG/USEPA, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985;

- Title 40, Code of Federal Regulations, USEPA Standards;

Part 61 Subpart A	National Emission Standards for Hazardous Air Pollutants-General Provisions,

Subpart M — Air Pollutants-National Emission Standard for Asbestos; and

- Other applicable federal, state, and local safety and health requirements.

1.3 APPLICABILITY OF THE LOCATION-SPECIFIC SAFETY AND HEALTH PLAN

This Location-Specific Safety and Health Plan (LSSHP) is prepared in accordance with the standards established by OSHA for hazardous waste sites. Specifically, this SSHP complies with the appropriate sections of 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response."

Additionally, this SSHP details the health and safety measures that shall be implemented at the beginning of the project and effective for the duration of the project. This document is intended for field use by OHM personnel and subcontractors and these personnel are required to abide by it. Where not specifically mentioned, OHM will follow all pertinent regulations contained in 29 CFR 1910, and 1926, and USACE EM-385-1-1 in conducting this work.

This document may require revision as the project progresses. All revisions must be approved by the OHM Midwest Region Health and Safety Manager. Revisions must be made in writing and incorporated into the document or attached as an amendment to this document.

It is the goal of OHM to successfully complete this project with all due regard and respect for appropriate professional safety protocol. It is also OHM's objective to complete the entire project without logging any OSHA-recordable accidents.

1.4 VISITORS

Visitor access to regulated project areas such as the exclusion and contamination reduction zones shall be restricted. The following criteria must be met for visitors to gain access to these areas:

- Visitors must provide proof of participation in a medical surveillance program that complies with requirements stated in 29 CFR 1910.120 (f);

- Visitors must provide proof of training accomplishment equivalent to standards set forth in 29 CFR 1910.120 (e). This training must have been received within 1 year from the date of desired access. Some visitors may be required to show proof of the specified 8-hour refresher training within the same time frame;

- Visitors must read the SSHP and sign the form contained in Appendix A. By signing the form, visitors agree to comply with all specifications contained in the SSHP and agree to comply with all applicable OSHA requirements; and

- Visitors who do not adhere to these requirements shall not be allowed access and/or be requested to leave the regulated work areas.

1.5 WORK AREA LOCATIONS

Various residential properties located within Granite City, Madison, and Venice, Illinois will be the locations for removal of contaminated material. Refer to Appendix B for maps showing the location of each area.

1.6 AREA SOIL TYPE/TOPOGRAPHY

This project involves work in a number of different locations, which includes a potential for variation in soil type/topography. The following information describes areas that might be encountered in Granite City, Madison, and Venice, Illinois.

- Urban land, bottom land with 0 to 3 percent slopes--The locations consist of areas in which more than 85 percent of the surface is covered by asphalt, concrete, buildings, or other impervious materials. Parking lots, shopping and business centers, railroad yards, and industrial parks are examples. They occur throughout the area, except the western part. Most areas are small; the largest are in the city of St. Louis near the Mississippi River and along the Meramec River upstream from the city of Fenton. The areas originally were bottom land or terrace land. Many of them have been built up with fill material to elevate them above normal flood levels. However, they are subject to inundation for short periods by local flooding, and extremely large floods cover some areas of this unit for long periods. Individual areas generally range from 30 to 500 acres.

  Composition of the soil material capable of supporting vegetation is quite variable. The vegetation is primarily ornamental trees, shrubs, and lawn grasses.

The amount of fill in these areas ranges from none on some terrace positions at a higher elevation to more than 20 feet on former swampy areas near the Mississippi River in the northern part of the city of St. Louis. Identification of the soils and soil-like materials in this unit is impractical because of variability.

These areas are not assigned to a capability subclass.

- Urban land-Harvester areas with 0 to 2 percent slopes--Other areas consist of Urban land and the intermingles areas of nearly level, moderately well drained Harvester soils. It is on broad upland divides in the city of St. Louis and in the eastern and northern parts of St. Louis County. Individual areas are irregular in shape and range from about 30 to 900 acres. They are about 65 percent Urban land and 30 percent Harvester soils. The Urban land and Harvester soils are intermingled.

  The urban land part of this complex is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the series is not feasible.

  Typically, the surface layer of the Harvester soil is brown silt loam about 4 inches thick. The next layer, to a depth of about 37 inches, consists of multicolored silt loam and silty clay loam fill material that contains fragments of bricks, glass, cinders, and other manmade materials. Below the reworked fill material to a depth of about 60 inches is the lower part of a buried soil. It is dark yellowish brown, mottled, firm silty clay loam. In places, the fill material is more than 40 inches thick, or part of all of the original soil has been removed during land shaping, or the surface layer is silty clay loam, or one or more soil layers contain more than 20 percent coarse fragments.

  Included in these areas and making up about 5 percent are small areas of well drained Menfro soils, moderately well drained Winfield soils, and somewhat poorly drained Iva soils. These soils are in parks, playgrounds, and a few open spaces between buildings.

  The Urban land is impervious to water. Permeability is moderately slow in the Harvester soils. Surface runoff is slow in the areas. The natural fertility is medium, and organic matter content is very low. The surface layer of the Harvester soils is friable.

  The Harvester soil in the areas is in yards, open spaces between buildings, parks, playgrounds, gardens, and undeveloped random tracts. Recreation uses are suitable if they can be adapted to the limited size and shape of the

open spaces (and/or to the slope). Permeability is a moderate limitation for camp and picnic areas and playgrounds. Good surface drainage is needed, and areas of heavy foot traffic need resurfacing with suitable material.

The Harvester soils are suitable for building sites. Proper design of structures and extra reinforcement in footings, foundations, and basement walls are necessary to prevent damage caused by shrinking and swelling. Drain tile around footings and foundations helps overcome excessive wetness. Community sewers are the chief means for the disposal of waste. Adequate base material for local roads and streets and proper drainage with side ditches and culverts, or tile drains and storm sewers, are needed to prevent damage caused by low strength and frost action.

The areas are not assigned to a capability subclass.

- Urban land-Harvester area with 2 to 9 percent slopes--The area consists of Urban land and the intermingled areas of gently sloping and moderately sloping, moderately well drained Harvester soils. It is on ridgetops and side slopes on uplands. Individual areas are irregular in shape and range from about 20 to 400 acres. They are about 65 percent Urban land and 30 percent Harvester soils. The Urban land and Harvester soils are intermingled.

  The Urban land for these areas is similar to those described in the previous section (0 to 2 percent slopes).

  Typically, the surface layer of the Harvester soil is very dark grayish brown silt loam about 4 inches thick. The next layer, to a depth of about 25 inches, consists of multicolored silt loam and silty clay loam fill material the contains cinders. Below the reworked fill material to a depth of about 60 inches is buried soil. It is brown and pale brown silt loam in the upper part and yellowish brown and dark yellowish brown, firm silty clay loam in the lower part. In places, the fill material is more than 40 inches thick. Also in places, part or all of the original soil has been removed during land shaping, or the surface layer is silty clay loam, or the fill material contains more than 20 percent fragments of manmade materials.

  The characteristics/specifications for Urban land and Harvester soil are the same as those outlined for the previous classification (Urban land-Harvester areas with 0 to 2 percent slopes); however, these areas encounter rapid surface runoff due to their increased slopes.

- Urban land-Harvester areas with 9 to 20 percent slopes--The area consists of Urban land and the intermingled areas of strongly sloping and moderately

steep, moderately well drained Harvester soils. It is on uplands on the side slopes of valleys. Individual areas are irregular in shape and range from about 10 to 120 acres. They are about 50 to 60 percent Urban land and 20 to 30 percent Harvester soils. The Urban land and Harvester soils are intermingled.

The Urban land areas for this land classification are similar to those outlined in the previous two sections.

Typically, the surface layer of the Harvester soil is dark brown silt loam about 3 inches thick. The next layer, to a depth of about 33 inches, consists of multicolored silt loam, silty clay loam, and clay fill material that contains sandstone fragments in the lower part. Below the reworked fill material to a depth of about 60 inches is a buried soil. It is yellowish brown, firm silt loam in the upper part and brown and dark yellowish brown, firm silty clay loam in the lower part. In places, the fill material is more than 40 inches thick. Also in places, part or all of the original soil has been removed during land shaping, or the surface layer is silty clay loam, or the fill material contains more than 20 percent fragments of manmade materials.

Included with the areas and making up about 20 percent of the total areas are small areas of well drained Menfro soils and moderately well drained Winfield soils along drainageways, in parks, and in a few open spaces between buildings. Also included are a few small areas that have chert or bedrock exposed at the surface and a few areas along drainageways that have a slope of more than 20 percent.

The Urban land is impervious to water. Permeability is moderately slow in the Harvester soils. Surface runoff is rapid, to very rapid in these areas. The natural fertility is medium, and organic matter content is very low. The surface layer of the Harvester soils is friable.

The Harvester soils in this complex are in yards, open spaces between buildings, parks, gardens, and undeveloped tracts primarily adjacent to drainageways. Recreation uses are suitable if they can be adapted to the limited size and shape of the open spaces and to the slope. The slope is a severe limitation. On-site investigation is needed in areas being considered for recreation uses.

The characteristics/specifications for Harvester soils in these areas are the same as those outlined for the previous sections.

The communities of Granite City, Madison, and Venice, Illinois present a variety of residential and industrial areas. some areas include wooded parks and fields. Work in the different locations will involve an evaluation of the area and necessary precautions once crews are on-location. Area maps (Appendix B), help distinguish the different areas.

1.7 SCOPE OF WORK

The scope of work for all sites in this remediation project is included in the summary below:

- Mobilization;
- Installation of perimeter fence;
- Bag and stockpile non-hazardous material;
- Soil sampling;
- Excavation of contaminated soil and/or battery case material;
- Backfill of excavations;
- Soil load-out activities;
- Restoration of disturbed areas; and
- Decontamination and demobilization.

1.8 MANAGEMENT ORGANIZATION

The OHM management organization on this project will be as follows:

- Site Supervisor--All personnel working on the project ultimately report to this individual who has authority over all phases and is the senior OHM on-site representative. The site supervisor is the primary safety official for this project and is responsible for ensuring the SSHP is properly implemented and all activity is performed in a healthful and safe manner. It is the duty of the site-supervisor to perform weekly safety inspections of the project and to monitor the safety performance of all personnel on a daily bases. The site supervisor is the designated competent person should any excavation exceed 4 feet in depth.

- General Foreman--This individual's duty is to disseminate information, assign tasks, and coordinate efforts between the multiple OHM crews. This person reports directly to the site supervisor.

- Foreman--This individual's duty is to coordinate and monitor the activities of a specific work crew. This person reports to the general foreman.

- Recovery Technician--This individual safely completes the on-site tasks required to fulfill the work plan, complies with the SSHP, and notifies the HSO of unsafe conditions. This person reports to the foreman.

- Site Health and Safety Officer (HSO)--This individual is delegated the responsibility to assist the site supervisor in the implementation and enforcement of the safety and health program and site-specific plan elements on-location. The HSO is also responsible for monitoring the effectiveness of the SSHP, air monitoring, accident reporting, etc. He/she has the authority to temporarily cease any project phase or operation deemed either inherently dangerous to life and health or not in compliance with the SSHP. In addition, he/she can cause the removal of any person who is deemed inherently unsafe or a threat to the safety of other individuals at or in the vicinity of the project. The HSO reports to the site supervisor and the Regional Health and Safety Manager.

- Certified Industrial Hygienist (CIH)--The Regional Health and Safety Manager is the project CIH. This individual, being experienced in hazardous waste material operations, is responsible for the development, implementation, and oversight of the Safety and Health Program and SSHP.

2.0 RESPONSIBLE AUTHORITIES

The following people are responsible for safety and health on this project:

o Site Supervisor	George Hamra
o Site Health and Safety Officer (HSO)	_____
o Alternate HSO	_____
o Regional Health and Safety Manager	James Joice, CIH, CHMM 419-423-3526 (x4212)
o Project Manager	Dale Krageschmidt 612-531-0987 612-538-5768
o District Manager	Todd Kenning 708-759-9493
o Executive Vice President, Midwest Region	Daniel P. Buettin 419-424-4960
o Vice President of Health and Safety	Fred Halvorsen, Ph.D., P.E., CIH 419-424-4910

Additionally, as stated in the OHM Employee Safety Guide, each employee is responsible for his own personal safety and the safety of his co-workers.

3.0 PROJECT HAZARDS

The general categories of hazards that may be present at each designated project location in Eagle Park Acres and Venice alleys are described in this section. The main divisions of health hazards at these locations are chemical, physical, and environmental. The pathways for hazardous substance dispersion at this project are personnel and equipment tracking, and migration via dust/dirt in the air.

3.1 CHEMICAL HEALTH HAZARDS

Preventing exposure to toxic chemicals is a primary concern at this hazardous material remediation project. This project contains a variety of chemical substances; however, with the exception of fuels, these will be found mostly as solids in the soils. These substances can enter the unprotected body by inhalation, skin absorption, ingestion, or through a puncture wound (injection). A contaminant can cause damage at the point of contact or can act systemically, causing a toxic effect at a part of the body distant from the point of initial contact. A summary of the generalized chemical health hazards expected at this project is presented below.

3.1.1 Lead

Lead, at this project, will be in the soil and exposure could be from inhalation, oral ingestion, or contact exposure. It is to be noted that inhalation of lead contaminated particulates (dust) is a hazard for all work related tasks on this project. The symptoms and effects of exposures to lead are summarized as follows:

- Acute Exposure--Short-term, high concentration exposure to lead by unprotected personnel causes eye, nose, and throat irritation. A slight metallic taste and severe gastric disturbances have been noted by some people.

- Chronic Exposure--Workers in other industries, such as foundries or metal refining operations, who have long-term exposure without, or with limited benefit of protective equipment, have been found to have liver, kidney, and central nervous system impairment.

Since lead is a solid metal with a melting point of 621°F and a molecular weight of 207.2, the vapor pressure for lead is approximately 0 mm. Guidelines for ionization potential, odor threshold, and flammability ranges are not applicable.

The following exposure limits have been established for lead and must not be exceeded:

COMPOUND	OSHA-PEL	NIOSH-REL	ACGIH-TLV
Lead	0.05 mg/m³	<0.1 mg/m³	0.15 mg/m³

All workers should be aware of strange odors, irritation, and feelings of discomfort or extreme well being. Often these signs can indicate chemical exposure is occurring.

A Material Safety Data Sheet (MSDS) is attached in Appendix C, which describes in more detail, the chemical, physical, and health hazards posed by lead.

3.1.2 Metals

The metals listed below may exist on-location but should be at significantly lower concentrations than the lead. These can also affect unprotected personnel through ingestion, inhalation, and dermal contact. The metal constituents of concern and exposure limits are outlined below:

HEAVY METAL	OSHA-PEL	ACGIH-TLV
Arsenic	0.01 mg/m³	0.2 mg/m³
Barium	0.5 mg/m³	0.5 mg/m³
Cadmium	0.2 mg/m³	<0.05 mg/m³
Chromium	1.0 mg/m³	0.5 mg/m³
Manganese	5.0 mg/m³ (C)	5.0 mg/m³
Mercury	0.01 mg/m³	0.01 mg/m³
Nickel	1.0 mg/m³	1.0 mg/m³
Selenium	0.2 mg/m³	0.2 mg/m³
Silver	0.01 mg/m³	0.01 mg/m³
Zinc	5.0 mg/m³	5.0 mg/m³

NOTE: The OSHA (C) notation denotes a Ceiling Limit, which is the concentration that should not be exceeded at any time during the course of work.

Acute and chronic exposures to heavy metals above the exposure limits can be summarized as follows:

- o Acute Exposure--Eye, nose, and throat irritation, coughing, upset stomach, nausea, shortness of breath, weakness, chills and fever, headache, hoarseness, diarrhea, coughing up blood, skin rash.

- o Chronic Exposure--Poor coordination, difficulty in speaking, tremor (shakes), kidney damage, liver damage, unstable emotions, recurring chills and fever, and possible carcinogen.

The appropriate site-specific MSDSs are included in Appendix C.

3.1.3 Petroleum Distillates and Cleaning Compounds

Operational compounds such as fuels for heavy equipment will be used to complete this project. Aside from some petroleum distillates (fuels) being EXTREMELY FLAMMABLE and cleaning compounds being potentially corrosive, personnel must also recognize the health hazards associated with these compounds. The health hazards associated with these materials and acute and chronic exposure symptoms are summarized as follows:

- o Petroleum distillates that will be used as fuel (depending on product, odor of gasoline or kerosene may be noted)

  - Acute exposure--Dizziness, nausea, weakness, euphoria (feeling good), mild skin irritation, inhalation of concentrated vapors or aspirated liquids can cause death by chemical pneumonia

  - Chronic exposure--Skin irritation; damage to liver, kidneys, and blood compounds; leukemia (benzene)

- o Cleaning compounds which may be used by site personnel for equipment decontamination purposes (cleaning compounds can have a pungent, irritating, or scented odor)

  - Acute exposure--Skin, eye, nose, and throat irritation

  - Chronic exposure--Undetermined but continuing skin irritation is possible, damage to the respiratory tract

Primary exposure routes for these materials include inhalation, ingestion, and skin contact. Personnel must be alert for signs and symptoms of possible exposure and must immediately report them to the site supervisor and/or HSO.

MSDS's for materials brought on location are found in OHM's written Hazard Communication Program, found in the project office trailer.

3.1.4 Hazard Communication

The purpose of hazard communication (Employee Right-to- Know) as required by 29 CFR 1926.59, is to ensure that the hazards of all chemicals used to complete this field project are communicated to all OHM personnel and OHM subcontractors. Hazard communication includes the following:

- Container Labeling--OHM personnel must ensure that all drums and containers are labeled according to contents. These drums and containers will include those from manufacturers and those produced on-location by operations personnel. All incoming and outgoing labels must be checked for identity, hazard warning, and name and address of responsible party.

- MSDS--There must be a MSDS available on-location for each hazardous chemical used. MSDSs for all chemicals brought and used on-location are provided in the OHM's Written Hazard Communication Program, which can be found in the project office trailer. MSDS's for location-specific chemicals can be found in Appendix C of this plan.

- Employee Information and Training--Training employees on chemical hazards is accomplished through an ongoing corporate training program. Additionally, chemical hazards must be communicated to employees through daily safety meetings held at OHM field projects and/or by an initial project orientation program.

At a minimum, personnel must be instructed on the following:

- Chemicals and their hazards in the work area;

- How to prevent exposure to these hazardous chemicals;

- Mechanisms to prevent workers' exposure to these chemicals;

- Procedures to follow if they are exposed to these chemicals;

- How to read and interpret labels and MSDSs for hazardous substances found on OHM sites;

- Emergency spill procedures; and

- Proper storage and labeling.

Before any new hazardous chemical is introduced on-location, each employee must be given information in the same manner as during the safety class. The site supervisor will be responsible for seeing that the MSDS on the new chemical is available. The information pertinent to the chemical hazards will be communicated to project personnel.

Morning safety meetings are to be held and the hazardous materials used on-location will be discussed. Attendance is mandatory for all personnel.

- Subcontractor Information and Training--It shall be the responsibility of the site supervisor to ensure that all subcontractors coming onto project locations be informed of the hazardous chemicals present, effects of exposure, location of MSDS, location of emergency equipment (i.e., eye wash, fire extinguisher), and emergency spill and evacuation procedures. By signing the SSHP acknowledgment form, located in Appendix A of the SSHP, the subcontractor is acknowledging receipt of all of this information. The site supervisor shall also ensure that subcontractors submit information on chemicals that they are responsible for introducing to the project area. All chemicals introduced to these areas must be accompanied by the appropriate MSDS. This information can be exchanged at the daily morning safety meeting. These meetings must be attended by all subcontractors.

3.2 PHYSICAL HAZARDS

There are many physical hazards associated with this project. Hazard identification, training, adherence to work rules, and careful housekeeping can prevent many problems or accidents arising from physical hazards. The following text outlines the physical hazards associated with this project and suggested preventative measures:

- Mechanical/Electrical Energy--Lockout and tagout procedures may need to be applied for specific work at this job. In the event that some operation requires lockout and tagout procedures, review and apply the standard operating procedures presented in Appendix D.

- Bulky or Heavy Loads--Intelligent thought shall be exercised before heavy and bulky loads are lifted or handled manually by personnel. Mechanical equipment such as forklifts, wheel barrows, hand-trucks, loaders, and cranes shall be utilized when possible and needed. **Note: Back injuries are real, debilitating, unproductive, and costly to both employees and employers, and sometimes permanent. Back injury prevention must be given high priority on all project sites. If you think the load you are about to lift is too heavy or bulky, it probably is - get help or utilize mechanical equipment, or do not attempt to lift it.**

- Hoisting Accidents--Employees can have suspended loads dropped on them, or be caught or smashed between a load and a stationary object. All hoisting must be done by qualified personnel only after inspections are made and documented, of chokers, slings, and cables. In addition, no hoisting will take place without a designated signal man present. Chains are not appropriate for vertical lifts.

- Small Quantity Flammable/Combustible Liquids--Small quantities of flammable/combustible liquids must be properly stored in "safety" cans with appropriate flame arresters, and labeled according to contents.

- Bulk Fuel Storage--A bulk fuel storage area must be designated for storage of bulk fuels and other flammable materials. The bulk fuel vessels must be grounded and have bonding cables attached. The area must be prominently posted as "flammable" and no smoking signs erected. At least one 20-pound dry chemical, ABC-type fire extinguisher must be available in this area.

- Heavy Equipment--Each morning before startup, all heavy equipment must be inspected to ensure all safety equipment and devices, (e.g., backup alarms, brakes, control levers, and fire extinguishers) are operational or ready for immediate use. Only qualified personnel may operate this equipment. Before crossing either in front of or behind a piece of heavy equipment, the ground personnel will signal the equipment operator and receive confirmation before moving. During excavation activity, the swing-radius area of excavators should be marked and personnel should be prohibited in this area.

- Slip/Trip/Fall Hazards--All ground personnel should be constantly aware of the possibility of slip, trip, and fall hazards due to poor and possibly slippery footing in the work areas. Some areas may have wet surfaces, which will greatly increase the possibility of inadvertent slips. Caution must be exercised when using steps and stairs due to slippery surfaces in conjunction with the fall hazard. Since all stairs with 4 or more risers are equipped with handrails, one would be wise to use them. Good housekeeping practices are essential to minimize the trip hazards.

- Electrical Hazards--Electrical devices and equipment must be de-energized prior to working near them. All extension cords must be kept out of water, protected from crushing, and inspected regularly to ensure structural integrity. Temporary electrical circuits must be protected with ground fault circuit interrupters. Only qualified electricians are authorized to work on electrical circuits. Lockout and tagout procedures may be applicable (See Appendix D).

- High-Pressure Washing--Pressure washing of equipment may require the use of high-pressure washers. These devices can be hazardous if not used properly. Refer to Appendix E for specific standard operating procedures for high pressure washer.

- Pumping Equipment--Various pumps and hoses may be used for the removal of water from the excavation area. The handling of pressurized hoses that could rupture and violently release liquid materials onto the workers, can be controlled by inspecting all hose fittings for secure connections. (All OPW [cam lock] fittings must be secured with wire.) Employees must don splash gear including splash shields, when moving or disconnecting pumps and hoses.

- Noise--Some equipment often used may create excessive noise. The effects of noise can include:

  - Workers being startled, annoyed, or distracted,

  - Physical damage to the ear, which may cause pain, or temporary and/or permanent hearing loss,

  - Communication interference that may increase potential hazards due to the inability to warn of danger.

If employees are subjected to noise exceeding an 8-hour TWA sound level of 85 dBA (decibels on the A-weighted scale), feasible administrative or engineering controls must be utilized.

3.3 ENVIRONMENTAL HAZARDS

The primary environmental hazards to be considered during location-specific work are heat stress and cold stress.

3.3.1 Heat Stress

Heat stress may affect personnel wearing protective clothing in conjunction with high ambient temperatures and solar heat load. Plenty of fluids, rest breaks, and careful attention by supervisors are to be used as control measures. As a minimum, the following precautions must be taken:

- The general topic of heat stress should be the subject of the first training session if ambient temperatures are expected to exceed 70°F in the near future. This presentation should include recognition of heat stress, heat stress prevention, and specifically outline the requirements given in the following paragraphs.

- If ambient temperatures are expected to exceed 70°F during the day, all personnel shall drink 1 pint of water prior to commencing work. At each break, water and electrolyte fluids shall be made available. Each person should drink fluids at the break, consistent with his/her fluid loss, recognizing that his/her level of thirst is not a good indicator of fluid loss.

3.3.2 Heat Stress Monitoring

If ambient temperatures are expected to exceed 70°F all supervisors should ensure that their personnel are briefed on the hazards, symptoms, and treatment of heat related problems.

For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. Frequency of monitoring should increase as the ambient temperature increases or as slow recovery rates are indicated. When temperatures exceed 85 degrees Fahrenheit, workers should be monitored as follows, for heat stress after every work period:

- Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by ten minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

- Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the OT exceeds 99.7 degrees Fahrenheit at the beginning of the next period, the following work cycle should be further shortened by 33 percent. OT should be measured again at the end of the rest period to make sure that it has dropped below 99 degrees Fahrenheit.

- Body water loss (BWL) due to sweating should be measured by weighing the worker in the morning and in the evening. The clothing worn should be similar at both weighings. The scale should be accurate to plus or minus ¼ pound. BWL should not exceed 1.5 percent of the total body weight. If it does, the worker should be instructed to increase his daily intake of fluids. Ideally, body fluids should be maintained at a constant level during the workday. Proper nutrition and consumption of various electrolyte fluids usually provide for the replacement of salts lost in the sweat.

Good hygienic standards must be maintained by frequent changes of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel. Certain laundry detergents, especially if not completely rinsed out, may cause or aggravate heat related skin disorders.

3.3.3 Cold Stress

Working outside in conditions of low ambient temperature can subject workers to cold stress, which includes frostbite and hypothermia. As a minimum, the following precautions must be taken if ambient temperatures are expected to be below:

Source	Max. Activity	Half-Life
Iron 55 (Fe-55)	100 millicuries	2.7 years
Cadmium 109 (Cd-109)	10 millicuries	1.3 years
Americium 241 (Am-241)	10 millicuries	458 years
Curium 244 (Cm-244)	100 millicuries	17.6 years

The source capsules are located beneath and to one side of the measurement aperture, and are enclosed in source holders mounted on a rotatable hub. Radiation is emitted through the aperture when the hub is rotated to expose one source at a time to the sample. The activity level and radiation output of these sources require that the probe always be handled with care. In normal instrument operation there is no radiation hazard.

Two of the primary sources have comparatively short half-lives. As each source decays, the remaining activity decreases by 1%, approximately every week for Cd-109 and every two weeks for Fe-55. Measurement times are typically increased in proportion to source decay. In terms of potential radiation exposure, the need for caution remains the same.

Source Capsule Design

The radioactive material of each source (except Fe-55) is sealed inside a stainless steel capsule with a beryllium window. This capsule is of standard industrial design and tested integrity. The Fe-55 source is electroplated onto a metal substrate and then overplated with nickel to seal it.

The sources are further protected and additional shielding is provided by metal source holders. The source holders are attached to a hub which is rotated by an electric motor to expose one source at a time through the measurement aperture. The hub has a narrow clearance between its top surface and the lower surface of the probe cover, which is also shielded. The effect of the design is to absorb all of the source radiation inside the top region of the probe when the sources are in the closed position. A fail safe circuit in the probe monitors power levels from the electronics, and in the event of a power failure, uses energy stored in a capacitor to drive the sources to the safe position.

The integrity of the source capsules has been tested according to standards recommended for industrial radioisotope x-ray devices (ANSI Standard N542 "Classification of Sealed Radioactive Sources").

Radiation Levels

When the source shutters are closed, the external radiation level is very low. With three sources, Fe-55, Cd-109 and Am-241 at their maximum activity and the source mechanism in the "closed" position, the gamma and x-ray exposure rate is <0.1 mR/h. When a 100 mCi Cm-244 source is loaded, the neutrons emitted due to spontaneous fission create a 5 mrem/h exposure rate at a 5 cm (1.95") distance from the source. At 12", the rate drops to 0.14 mrem/h. When the source shutters are open, external radiation levels remain low, provided the window is covered by a full size sample in contact with the probe. If the window is only partially covered, exercise caution to prevent unnecessary exposure. When using the probe in the lab stand, use the shield to prevent unnecessary exposure.

Warning: With no sample in place, the radiation level is not negligible, especially in the measurement zone close to the window. The instrument should never be operated without a sample in place on the window.

- Training sessions are to be regularly held to emphasize warning symptoms such as reduced coordination, drowsiness, impaired judgment, fatigue, and numbing of toes and fingers,

- Workers must be outfitted with winter clothing as necessary,

- Clothing must be changed as soon as it becomes wet,

- Warm shelters and regular rest periods will be available for crew members,

- Warm beverages should be provided.

Additional information pertaining to and standard operating procedures for evaluating heat stress/cold stress are included in Appendix F.

4.0 WORK AREA CONTROL

The purpose of area control is to minimize potential contamination of workers, protect the public from the area activities, and prevent loss due to vandalism.

The excavation areas for this job vary with respect to characterization of work zones, area control and access. The range of locations includes residential areas, public access routes (alleys, etc.) and open fields. The access route to each location varies from alleyways and roads with ample access room to residential driveways with limited access. The exclusion zone and its respective work zones for each separate location will vary with respect to size and area, and should be based upon surveys conducted of each area once crews are on-location.

4.1 DESIGNATION OF WORK ZONES

To prevent both exposure to unprotected personnel and migration of contamination due to tracking by personnel or equipment, work zone areas must be clearly identified.

Work areas or zones should be designated as suggested in "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," NIOSH/OSHA/USCG/ USEPA, November 1985. Each of the work areas must be divided into three zones:

- Exclusion zone (dirty or contaminated),
- Contamination reduction zone (CRZ or transition);
- Support zone (clean).

In general, the exclusion zone includes all designated work areas and all areas where chemicals and physical hazards exist. These zones should be marked with caution tape or other suitable means. The exclusion zones for locations included in this project are depicted on maps in Appendix M of this plan. Areas designated as "trace" are considered "hot" areas and will therefore be designated as the exclusion zone.

Location access will occur from the support zone through the contamination reduction zone (CRZ) to the exclusion zone. The CRZ should be a corridor located where the support zone is upwind (for example, if wind is blowing from the north, the CRZ corridor will be north of the location). These zones will be determined once on-location, as wind direction and other environmental factors will be considered in the delineation of the CRZ.

4.2 EXCLUSION ZONE

The exclusion zone will consist of active work areas where chemical and physical hazards exist, or have the potential to exist, during operations. The exclusion zone shall be marked with caution tape. All personnel entering this area must wear the prescribed level of protective equipment. Unauthorized personnel shall not be allowed in this area. Work zones within the exclusion zone are to be designed once personnel are on-location and should be based upon the location survey. Typically, the work zone will span 15-20 feet when feasible. Due to the variation in excavation areas, smaller zones may be encountered.

4.3 CONTAMINATION REDUCTION ZONE

The contamination reduction zone (CRZ) will be a clearly marked corridor(s) between the exclusion and support zones; this is where personnel will begin the sequential decontamination process when exiting the exclusion zone. To prevent cross contamination and for accountability purposes, all personnel will enter and leave the exclusion zone through the contamination reduction zone. Appropriate equipment for hygienic activity such as soap, water, and towels, shall be made available in this area. Emergency equipment such as eye wash, fir aid kit, and emergency alarm shall be made available in this area. The location and delineation of the CRZ will be contingent on the location of the exclusion zone and conditions of the area, and will therefore be determined upon mobilization to the area(s).

4.4 SUPPORT ZONE

The support zone should be located upwind, if possible and shall be secured against active or passive contamination from the work location. The support zone will consist of those areas adjacent to the exclusion zone where support trailers and equipment are staged. Eating, drinking, and smoking will be allowed only in this area.

4.5 LOCATION MAP

Location maps must be developed showing the location of emergency equipment and work zones and egress routes. These maps must be posted. The maps must be updated as location conditions change. Refer to Appendix B for review of the location maps.

4.6 LOCATION SECURITY

Location security is necessary to:

- Prevent chemical and physical exposures to unauthorized and/or unprotected people by site hazards;

- Avoid the increased hazards and liabilities from vandals or persons seeking to abandon other wastes on location;
- Prevent theft; and
- Avoid interference with safe working procedures.

To maintain location security during working hours:

- Control points must be maintained to control personnel access to the exclusion and decontamination zone;
- An identification system of some fashion should be established to identify authorized persons; and
- Responsibility for enforcing exclusion zone entry and exit requirements should be assigned.

To maintain site security during off-duty hours:

- Barricade open excavations;
- Secure the equipment; and
- Notify the local police department of site activities.

4.7 THE BUDDY SYSTEM

Activities in contaminated or otherwise hazardous areas should be conducted with a buddy who is able to:

- Maintain sight of his other partner;
- Provide his or her partner with assistance;
- Observe his or her partner for signs of chemical or heat exposure;
- Periodically check the integrity of his or her partner's protective clothing; and
- Notify the site supervisor or others if emergency help is needed.

4.8 WORK AREA COMMUNICATIONS

Two sets of communication systems should be established: internal communication among on-location personnel and external communication between on-and off-location personnel.

Internal communication is used to:

- o Alert team members to emergencies;
- o Communicate changes in the work to be accomplished; and
- o Maintain work area control.

Verbal communication on-location can be impeded by area background noise and the use of PPE. All communication devices used in a potentially explosive or flammable atmosphere must be intrinsically safe and not capable of sparking. The internal communication systems used on this project may be hand-held radios and/or voice communication.

An external communication system between on- and off-location personnel is necessary to:

- o Coordinate emergency response;
- o Report to management; and
- o Maintain contact with essential off-location personnel.

The primary means of external communication is by telephone. All personnel must be informed as to the location of the telephone or nearest available telephone.

4.9 COMMUNICATION PROCEDURES

Personnel in the exclusion zone should remain in communication or within sight of other project personnel. Difficulties in maintaining communications requires an evaluation of whether personnel should leave the exclusion zone.

A 30-second blast on the air horn is the emergency signal to indicate that all personnel should leave the exclusion zone and assemble in the contamination reduction zone. Evacuation routes are to be established once personnel are on-location.

5.0 ACCIDENT PREVENTION PROGRAM

This section of the SSHP serves as the Accident Prevention Program (APP).

5.1 HEALTH HAZARD ANALYSIS

A health hazard analysis has been developed in the form of Phase Safety Plans to examine the health and safety hazards inherent within each separate project task. The goal of this exercise is to enable personnel to recognize, evaluate, and control hazards before they develop. This exercise is intended to identify hazards in a task-specific fashion, in addition to the broad identification outlined in Section 3.0. This hazard analysis must be further developed by project supervisory staff while on-location prior to beginning any specific activity and then incorporated into this SSHP on an ongoing basis. The Phase Safety Plans are intended to be used by all site personnel, who are encouraged to discuss and expand upon valuable information about task hazards. Controls are often determined by experienced personnel or by dialogue between thoughtful and interested crew members. Brainstorming sessions can sometimes identify serious hazards that may at other times be overlooked or forgotten about.

For the purposes of hazard analysis, this project can be divided into nine separate tasks as follows:

- Mobilization;
- Installation of perimeter fence;
- Bag and stockpile non-hazardous material;
- Soil sampling;
- Excavation of contaminated soil and/or battery case material;
- Backfill of excavations;
- Soil load-out activities;
- Restoration of disturbed areas; and
- Decontamination and demobilization.

5.1 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Mobilization	Potential atmospheric hazards	1) Implement air monitoring program for detection of lead. 2) Exclusion zone shall be delineated and PPE shall be utilized as necessary. 3) Safety orientation meetings must be held. 4) Implement wet method for dust control during all phases of activity. Unless the area is already wet, the excavation area should be pre-wetted to prevent visible emissions, if visible emissions are observed, work will stop immediately.
	Potential contact hazards from chemical agents	1) Visually inspect work area for presence of chemical contamination (lead battery casings.)

5.1 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Mobilization (continued)	Strains from manually moving materials and equipment	1) Personnel shall be directed to use proper lifting techniques such as keeping back straight, lifting with legs, limiting twisting, and getting help in moving bulky/heavy materials and equipment. 2) Hand truck use shall be encouraged. 3) Heavy equipment safety procedures shall be implemented. 4) All heavy equipment shall be inspected daily and documented prior to use.
	Slips, trips and falls from various agents	1) Work areas shall be visually inspected and pre-existing slip, trip, and fall hazards shall be marked, barricaded, or eliminated as is feasible. 2) Work areas shall be kept neat and in an orderly state of housekeeping. 3) Proper illumination shall be maintained in work areas.

5.1 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Mobilization (continued)	Electrocution	1) Only qualified electricians shall be allowed to hook-up electrical circuits. 2) All extension cords shall be inspected daily for structural integrity, ground continuity, and damaged areas. 3) Extension cord inspection should be documented, ground fault circuit interrupters (GFCI) should be used on all 110-120 v circuits. 4) Electric wire of flexible cord passing through work area shall be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching. 5) Plugs and receptacles shall be kept out of water unless of an approved submersible type. 6) All electrical circuits shall be grounded in accordance with the NEC and the NESC.

5.2 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Install Perimeter Fence	Muscle strains/back injuries	1) Get other personnel to help move the fencing. 2) Personnel should recognize that rolled sections of fencing can be very heavy and extremely awkward, and that the use of mechanical equipment to move or position rolls of fencing is recommended. 3) If personnel must lift or move fencing components, they should lift with their legs and avoid twisting while lifting.
	Slips, trips, and falls	1) Personnel shall look for and eliminate any pre-existing hazards. 2) Additionally, personnel shall be watching for and addressing any other hazards as they arise.

5.2 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Install Perimeter Fence (continued)	Cuts on hands	1) Wear gloves to prevent cutting hands on wire. 2) Be alert to tension build-up on coiled rolls of fence.

5.3 PHASE SAFETY PLAN

JOB/PHASE/TASK	HAZARDS TO BE CONTROLLED	ACTION TO BE TAKEN TO OVERCOME HAZARDS
Bag and Stockpile Non-hazardous Material	Strains from manually moving materials and equipment	1) Personnel shall use appropriate lifting techniques such as keeping back straight, lifting with legs, limiting twisting, getting help in moving bulky/heavy loads, and using mechanical assistance when feasible.
	Equipment hazards	1) Appropriate equipment inspections shall be conducted and documented prior to use. 2) All heavy equipment shall be equipped with Roll-Over Protection Systems (ROPS), back-up alarms, and seat belts. 3) Personnel shall remain outside of the stockpile area. 4) Only trained and qualified personnel shall operate heavy equipment. 5) Prevent operating equipment at excessive speeds or beyond the rated load capacity.
	Atmospheric or contact hazards	1) Ambient air monitoring will be conducted during operations. 2) Appropriate PPE levels will be used, based on a location specific evaluations.
	Hazards associated with tool use	1) Appropriate tools shall be used for work on this job. Damaged tools shall be taken out of service. Tools shall be inspected on a regular basis.

5.4 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Soil Sampling	Atmospheric and contact hazards from chemical and physical agents	1) PPE use shall be required. 2) Ambient air monitoring and visual monitoring for lead shall be used to verify selection of PPE. 3) Prevent potential ingestion by not eating, drinking, smoking, putting hands or other objects near mouth.
	Injury from use of excavation and sampling equipment	1) Boring equipment shall be inspected before each use. 2) Personnel shall have been trained in the use of excavation equipment. 3) Personnel shall maintain appropriate work/rest cycles to minimize fatigue. 4) Hydraulic equipment shall be used when possible for inserting and extracting split spoon to prevent back strains.

5.5 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Excavation of Contaminated Soil and/or Battery Case Material	Atmospheric and contact hazards from chemical agents	1) PPE use shall be required. 2) Ambient air monitoring for lead and visual monitoring for battery casings shall used to verify selection of PPE. 3) Dust control must be given high priority.
	Excavation hazards from soil and concrete removal	1) Personnel shall follow standard operating procedures for excavation safety (see Appendix G.) Confined space entry should not be required for this job as it stands; however, if conditions would require confined space entry at any of the excavation locations, appropriate guidelines should be acquired.
	Strains from use of tools	1) Personnel shall maintain rational pace when using tools and given adequate rest periods. 2) Tools shall be maintained in good condition. 3) Select appropriate tool for the job (size, type.)

5.5 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Excavation of Contaminated Soil and/or Battery Case Material (continued)	Heavy equipment hazards	1) All heavy equipment on this project shall be equipped with Roll-Over Protection Systems (ROPS) and back-up alarms. 2) Personnel shall be cognizant of the boom swing area and stay clear of its path. 3) Heavy equipment shall be inspected daily prior to use. 4) All inspections shall be documented. 5) Follow all specified capacities (speed, load.)

5.6 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Backfill of Excavations	Excavation hazards	1) All previously stated safety precautions and OHM standard operating procedures for excavation safety (Appendix G) shall apply.
	Heavy equipment hazards	1) All heavy equipment on this project shall be equipped with Roll-Over Protection Systems (ROPS), back-up alarms, and seat belts. 2) Personnel shall be cognizant of the boom swing area and stay clear of its path. The area should be marked and/or roped off if possible. 3) Personnel shall remain outside of backfilling area. 4) A warning device or signal person shall be provided where there is danger to persons from moving equipment, swinging loads, buckets, booms etc. 5) All heavy equipment shall be inspected and documented daily prior to use. 6) Operators shall be qualified to operate heavy equipment.

5.6 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Backfill of Excavation (continued)	Excavation hazards	7) Operators shall observe equipment capacities, including speed, lifting, range, etc. 8) Utilize appropriate PPE (including seatbelt, if required, while operating heavy machinery.)

5.7 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Soil Load-Out Activities	Truck traffic	1) Truck routes shall be designated. 2) Personnel shall stay clear of traffic. 3) Personnel shall be on guard when working in this area. 4) The use of spotters shall be provided in this area. 5) No vehicle will be loaded so as to obscure the driver's view ahead or to either side or to interfere with the safe operation of such a vehicle. 6) The load on every vehicle shall be distributed evenly, checked, and tied down or secured. 7) Trucks will obsesrve the designated speed limit(s) and will operate the vehicle in a non-wreckless fashion.
	Hazards from atmosphere and physical contact	1) PPE shall be required. 2) Ambient air monitoring for lead and other metals and visual monitoring for battery casings shall be used to verify selection of PPE. 3) Dust control shall be maintained.

5.8 PHASE SAFETY PLAN

JOB/PHASE/TASK	HAZARDS TO BE CONTROLLED	ACTION TO BE TAKEN TO OVERCOME HAZARDS
Restoration of Disturbed Areas (Asphalting and Sodding)	Slips, trips, and falls	1) Work areas shall continue to be visually inspected and slip, trip, and fall hazards shall be marked, barricaded or eliminated as is feasible. 2) Areas shall be kept neat and in an orderly state. 3) Proper illumination shall be maintained in work areas.
	Strains from moving equipment	1) Personnel shall be directed to use proper lifting techniques such as keeping back straight, lifting with legs, limiting twisting back, getting help in moving bulky/heavy loads, and using mechanical equipment to move materials and equipment. 2) Hand truck use shall be encouraged.
	Noise Protection	1) Proper hearing protection will be provided.

5.8 PHASE SAFETY PLAN

JOB/PHASE/TASK	HAZARDS TO BE CONTROLLED	ACTION TO BE TAKEN TO OVERCOME HAZARDS
Restoration of Disturbed Areas (Asphalting and Sodding continued)	Electrocution	1) Electricians shall inspect work area to identify electrical circuits. 2) Only qualified electricians shall be allowed to hook-up electrical circuits. 3) All extension cords shall be inspected daily for structural integrity, ground continuity, and damaged areas. 4) Prevent contact of electrical extension cords with standing water. 5) Utilize a ground fault circuit interruptor (GFCI) on all extension circuits.
	Heavy equipment	1) Heavy equipment shall be equipped with ROPS and back-up alarms. 2) Personnel shall be "on-guard" when working in the vicinity of heavy equipment.

5.9 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Decontamination and Demobilization	Potential atmospheric and contact hazards from chemical agents	1) All equipment will be decontaminated prior to being removed from the area. 2) PPE shall be used as required. 3) All general chemical hazards in the area and decontamination solution must be stored in the appropriate containers in the designated areas. 4) Ambient air monitoring for lead and other chemicals used on-location and visual monitoring shall be used to verify selection of PPE.
	High pressure washer hazards	1) Standard operating procedures for high pressure washer safety must be followed (see Appendix E.)
	Strains from use of tools such as shovels and scrapers	1) Personnel shall maintain a rational pace when using tools and given an adequate rest period. 2) Tools shall be appropriate for the task and maintained in good condition.

5.9 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Decontamination and Demobilization (continued)	Strains from manually moving materials and equipment	1) Personnel shall be directed to use proper lifting techniques such as keeping back straight, lifting with legs, limiting twisting, getting help in moving bulky/heavy loads, and using mechanical equipment to move material and equipment. 2) Hand truck use shall be encouraged. 3) Personnel shall work at a rational pace.
	Slips, trips, and falls	1) Work area shall continue to be visually inspected and slip, trip, and fall hazards shall be marked, barricaded, or eliminated as is feasible. 2) Work area shall be kept neat and in an orderly state. 3) Proper illumination shall be maintained in work areas.
	Electrocution	1) Only qualified electricians shall be allowed to disconnect electrical circuits. 2) All extension cords shall continue to be inspected daily for structural integrity, ground continuity, and damaged areas.

5.9 PHASE SAFETY PLAN

Job/Phase/Task	Hazards to be Controlled	Action to be Taken to Overcome Hazards
Decontamination and Demobilization (continued)	Electrocution	3) Ground fault circuits shall be used on all 110-120-v circuits. 4) The safety actions specified in Section 5.1 also apply.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Work on-location will be accomplished primarily using two levels of protection, USEPA Levels D and C. The following supplemental protective clothing/equipment should be utilized as necessary to help control for cold stress on-location:

- Cotton work gloves
- Insulated coveralls
- Hard hat liners
- Tyvek coveralls with hood

The following text summarized the levels of protection in detail.

6.1 LEVEL D - NO RESPIRATORY PROTECTION

Work in the support zone may be done in Level D PPE depending on results of initial and ongoing air monitoring.

Level D equipment consists at a minimum, of:

- Eye protection (safety glasses with sides shields or goggles)
- Hard hats
- Safety shoes or boots (Steel toe/shank)

6.2 LEVEL C - FULL-FACE AIR PURIFYING RESPIRATORS

Some work in the exclusion zone, and where there is the potential for exposure to airborne contaminants, (especially during debris removal and excavation work) will require the use of Level C PPE. Level C equipment consists of:

- MSA "Ultra-twin" full-face respirator with GMC-H cartridges (provides protection against organic vapors, chlorine, hydrogen chloride, sulfur dioxide, dusts, fumes, mists, radon daughters, asbestos-containing dusts and mists, pesticides, and radionuclides.) Survivair 4200 equipped with 1093 cartridge and American Optical full-face "Commander" or "Seven Star" equipped with R53HE cartridges are acceptable equivalents.

- Hard hat (face shield for high-pressure washing)

- Cotton coveralls (inner, hot work)

- Regular Tyvek coveralls with hood (dry materials work)

- Saranex-coated Tyvek coveralls with hood (wet material work)
- Leather, steel-toed and shank work shoes/boots
- Vinyl or latex booties over leather work shoes/boots
- PVC Robar or Neoprene Tingley outerboots over vinyl latex booties (for operations workers)
- Vinyl or latex inner gloves
- Cotton gloves (inner, as desired)
- PVC or Nitrile gloves (outer)
- Rain suits (required for high-pressure washing)
- Hearing protection (if necessary)

All joints between protective garments will be sealed with vinyl duct tape.

6.3 TASK-SPECIFIC PROTECTION LEVEL

Based on the evaluation of potential hazards, the following levels of PPE have been designated for the applicable work areas or tasks:

TASK	INITIAL LEVEL OF PROTECTION
Mobilization	Level D
Installation of perimeter fence	Level D
Bag and stockpile non-hazardous material	Level C or D
Soil sampling	Level D
Excavation of contaminated soil	Level C
Load-out of contaminated soil	Level C
Backfill of excavation	Level D
Restoration of disturbed areas	Level D
Decontamination and demobilization	Level C or D

NOTE: Levels of protection may be upgraded or downgraded depending on air monitoring results and actual field conditions. All changes in the protection level must be approved by the Regional Manager of Health and Safety and the USACE on-location representative.

7.0 DECONTAMINATION PROCEDURES

Decontamination is accomplished to ensure the materials that personnel and equipment may have contacted in the exclusion zone are removed in the contamination reduction zone before passing into the support zone.

Decontamination areas will be located in the contamination reduction zone, which will vary from each location as determinations of exclusion zones are made. The decontamination area(s) will begin at the perimeter of the exclusion zone and end at the entrance to the support zone.

7.1 PERSONNEL DECONTAMINATION PROCEDURES--LEVEL C

- Deposit any equipment used on-location in a segregated area prior to entering the contamination reduction zone. This segregation reduces the possibility of cross contamination.

- At the perimeter of the exclusion zone, rain gear or splash protection (if worn) should be damp-wiped or wet sprayed to remove any adhered particles. The effort will eliminate any exposure to support personnel and workers themselves during the PPE removal process (doffing).

- Robar/Tingley boots are to be scrubbed with a detergent-water solution. The boots will then be removed and placed on a rack for drying.

- Hard hats are to be removed and hung up. On a daily basis, these are to be scrubbed with a detergent-water solution.

- Outer gloves are to be cleaned and removed, and depending on condition, may be disposed in the solid wastestream (if damaged or uncleanable).

- Splash gear is to be removed, cleaned, and hung up to dry (if worn).

- Tyvek suits are to be removed and disposed of in the solid wastestream.

- Respirators are to be removed and prepared for reuse or decontaminated.

- Vinyl booties are to be removed and disposed of in the solid wastestream.

- Sample gloves are to be removed and disposed of in the solid wastestream.

- Each person is to wash his or her hands, arms, neck, and face.

7.2 SUSPECTED CONTAMINATION

Any employee suspected of experiencing skin contact with contaminated materials is to remove all clothing, shower, and don clean clothes. Following this, he/she must report to the site supervisor and/or HSO.

7.3 PERSONAL HYGIENE

Before eating, smoking, or drinking, personnel must wash hands, arms, neck, and face. Personnel may be required to shower before leaving the project area at the end of each day's activity. Personnel not required to shower on-location should do so immediately upon arrival to the motel at the end of the work shift.

7.4 EQUIPMENT DECONTAMINATION

Any equipment, vehicles, or tools that have entered an exclusion zone must be cleaned prior to removal. Some equipment decontamination may require pressurized water or steam cleaning. All water and material must be collected and placed in the designated waste disposal area. All diaphragm pumps, if used, are to be disassembled and cleaned thoroughly. These pump components may be sent to Findlay, Ohio, disassembled after having been cleaned; however, they should be collected for shipping as one parcel.

Following this cleaning, all items are to be inspected and approved by the site supervisor prior to removal from the area.

7.5 OTHER DECONTAMINATION PROCEDURES

7.5.1 General

All liquids and disposable clothing are to be treated as contaminated waste and disposed of properly. Personnel handling contaminated waste must wear Level C protection. Equipment must be cleaned prior to demobilization. Washwaters and residues must be collected for treatment and/or proper disposal.

7.5.2 Pumps (If Required)

- Don appropriate PPE

- Drain pump

- Pump decontamination solution through pump (surfactant/water solution)

- Wash outside of pump

- Disassemble pump and wipe down internal surfaces

- Soak all pump components (including hardware) in decontamination solution

- Rinse and dry

- Securely package pump and/or parts for shipment to OHM in Findlay, Ohio

- Contact resource manager to report equipment status and for dispatch

7.5.3 Cleaning 2-Inch and 3-Inch Submersible Pumps

- If pump is operational:

  - Don appropriate PPE
  - Recirculate a sufficient quantity of cleaning solution through pump
  - Recirculate rinsewater through pump
  - Wash down outside of pump and wipe off electrical cord
  - Tag for status

- If pump is not operational:

  - Don appropriate PPE
  - Remove four bolts from bottom of pump and remove casing
  - Wipe down inner surfaces and clean impeller
  - Pour cleaning solution down through top; discharge OPW fitting
  - Reassemble impeller and bottom casing
  - Wash down outside of pump and wipe off electrical cord
  - Tag for status

7.5.4 Vehicles and Heavy Equipment (Yellow Iron)

- Scrape or brush off gross residues

- Pressure wash outside of equipment paying particular attention to tires and tracks

- Vacuum (HEPA) and wipe down interior
- Clean windows with "Windex" and paper towels
- Remove belly pan (Yellow Iron)
- Dispose of residues and clean surfaces (Yellow Iron)
- Return assembled if possible; if not, then return unassembled to Findlay, Ohio (Yellow Iron)
- Contact resource manager to report equipment status and for dispatch

7.6 SAMPLING EQUIPMENT

All sampling equipment utilized should be disposable, stainless steel, or Teflon. All non-disposable sampling equipment used in obtaining samples should be cleaned or decontaminated by the following procedures:

- Scrape off soils with putty knife
- Wash with Alconox solution to remove all large particles
- Rinse with tap water
- Rinse with 1:1 isopropanol
- Rinse with double de-ionized water rinse
- Air dry

7.6.1 Sample Containers

Sample containers will be pre-cleaned to USEPA cleaning protocols as follows:

Protocol A

- Wash bottles, caps, and liners in laboratory grade, non-phosphate detergent
- Rinse three times with distilled water
- Rinse with 1:1 nitric acid (eye protection must be used and eyewash must be available nearby)

- Rinse three times with ASTM, Type 1, organic-free water
- Oven-dry for 1 hour
- Rinse with hexane (limit ignition sources, have fire extinguisher nearby, and provide ventilation)
- Oven-dry for 1 hour

Protocol B

- Wash vials, septa, and caps in laboratory grade, non-phosphate detergent
- Rinse three times in distilled water
- Rinse three times with ASTM, Type 1, organic free water
- Oven dry for 1 hour

Protocol C

- Wash bottles, caps, and liners in laboratory grade, non-phosphate detergent
- Rinse three times with distilled water
- Rinse with 1:1 nitric acid (eye protection must be used and eyewash must be available nearby).
- Rinse three times with ASTM Type 1 organic-free water
- Air dry

7.7 DECONTAMINATION WASTES GENERATED

All liquid wastes generated during decontamination procedures (i.e., aqueous and nonflammable organic solvent rinses) must be collected and temporarily stored at the soil staging areas. Personnel must recognize the need for generation of these wastestreams to be kept at a minimum throughout the project. Solid wastes shall be drummed or incorporated into other solid wastestreams for proper disposal.

7.7.1 Collection Procedures for Decontamination Wastes

All solid wastes must be collected in garbage bags and placed in 55-gallon drums (or other container as specified by disposal firm) for eventual disposal.

The liquid wastes must be collected in drums and temporarily staged in the soil staging areas. For personnel decontamination, the rinsate is to be contained in the boot and glove wash/rinse stations and then collected in drums for addition (to be staged) into the soil staging areas. For equipment decontamination, the rinsate is to be collected at the decontamination pad sumps and collected in drums for temporary staging in the soil staging areas. Treatment and disposal for these materials must be performed in a manner suitable with the compliance of RCRA 90 day disposal period.

7.8 EMERGENCY DECONTAMINATION

In addition to routine decontamination procedures, emergency decontamination procedures must be established. In an emergency, the primary concern is to prevent the loss of life or severe injury to location personnel. If immediate medical treatment is required to save a life, decontamination should be delayed until the victim is stabilized. If decontamination can be performed without interfering with essential life-saving techniques or first aid, or if a worker has been exposed to corrosive material, decontamination must be performed immediately. If an emergency due to a heat-related illness develops, protective clothing should be removed from the victim as soon as possible to reduce the heat stress. During an emergency, provisions must also be made for protecting rescue, first aid, or medical personnel from hazardous materials and for disposing of contaminated clothing and equipment.

- If decontamination can be done:
  - Wash, rinse, and/or cut off protective clothing and equipment.
- If decontamination cannot be done:
  - Wrap the victim in blankets or plastic to reduce contamination of other personnel.
  - Alert emergency and off-location medical personnel to potential contamination; instruct them about specific decontamination procedures if necessary.
  - Send along site personnel familiar with the incident.

7.8.1 Emergency Decontamination Equipment

The following equipment shall be readily available for emergency decontamination:

- Tyvek coveralls
- Nitrile gloves
- Soap and water
- Visqueen
- Towels
- Eyewash station
- Spare coveralls

8.0 RESPIRATORY PROTECTION

Respiratory protection is required to protect personnel from inhalation hazards during certain project operations.

8.1 AIR-PURIFYING RESPIRATORS

Air-purifying respirators for this project will be MSA "Ultra-twin" full-face equipped with GMC-H cartridges.* The GMC-H cartridge provides protection against organic vapors, chlorine, hydrogen chloride, sulfur dioxide, dusts, fumes, mists, radon daughters, asbestos-containing dust and mists, and radionuclides.

*Survivair 4200 equipped with 1093 cartridge and American Optical full-face "Commander" or "Seven Star" equipped with R53HE cartridges are acceptable equivalents. Survivair 1091, American Optical R51HE, and MSAGMA-H are also acceptable equivalents; however, these cartridges do not carry a NIOSH approval for acid gases and pesticides.

8.2 CARTRIDGE CHANGES

All cartridges are to be changed at a minimum of once daily; however, dusty or wet conditions may necessitate more frequent changes. Personnel are to change cartridges if breakthrough odors are detected or if resistance to breathing is substantially increased.

8.3 INSPECTION AND CLEANING

Respirators are to be checked weekly by the site supervisor or HSO and before each use by the wearer. All respirators and associated equipment must be decontaminated and hygienically cleaned daily. Respirators must be stored in sealed bags or lockers at the conclusion of each day's activity.

8.4 FACIAL HAIR

No worker who has facial hair that interferes with the respirator's sealing surface will be permitted to wear a respirator or work in the exclusion zone.

8.5 FIT TESTING

All workers have been fit tested with either isoamyl acetate or irritant smoke. Each time a worker dons a respirator, it is that worker's responsibility to perform a negative and positive pressure fit test.

8.6 CORRECTIVE LENSES

Normal eyeglasses may not be worn under full-face respirators because the temple bars interfere with the respirator's sealing surfaces. For workers requiring corrective lenses, special spectacles designed for use with respirators will be provided. Contact lenses shall not be worn with any type of respirator.

9.0 ENVIRONMENTAL MONITORING

The purpose of air monitoring at this project is to measure and/or quantitate emissions/exposures both within the work areas and at the perimeter of the area. Specifically, the intent of air monitoring during this project is to:

- o Ensure the safety of on-location personnel
  - Personnel who are most likely to be exposed to lead will be monitored to ensure compliance with 29 CFR 1910.1025. (For example, two workers in the area and the backhoe operator.)
- o Ensure the safety of people who are not on-location; but who are in the downwind vicinity of the area.
  - Samples are to be taken at the perimeter of each excavation area
  - All visible emissions of dust must be suppressed.

The following monitoring plan applies to each individual excavation location involved in this project. Separate air monitoring must be conducted and the results are to be evaluated for <u>each individual location</u>.

The analyte of concern at this project is lead; however, generic dust concentrations shall also be monitored. If dust concentrations in the ambient air cannot be effectively suppressed, the dust control procedures shall be re-evaluated until visible dusts are adequately suppressed.

Unless already wet, excavation areas must be pre-wetted to prevent visible dust emissions. If visible dust emissions can be seen emanating from the excavation location(s), the emissions control procedures shall consist of suppression by spraying a water mist into the air until dust has settled and cannot be seen visually.

9.1 AIR MONITORING METHODOLOGIES

Both time integrated sampling and real-time monitoring shall be used to characterize the ambient air at the project locations.

9.1.1 Time Integrated Sample Collection

The air sampling method (NIOSH Method 7082) for lead shall be used and requires the use of personal air sampling pumps fitted with 37 mm MCE filter cassettes. The result of this sampling is averaged over time for comparison with the OSHA-PEL.

9.2 EQUIPMENT REQUIREMENTS

The following sections identify the equipment that is necessary for air monitoring at and during this project.

9.2.1 Personal Air Sampling Pumps

These instruments are precision air pumps that can be set at a desired flow rate to capture air samples on an attached collection device. When used to collect air samples over a long period of time, large volumes of air can be obtained to detect various chemicals at lower concentrations than real-time instrumentation. Air sampling pumps are also useful for time-integrated sampling and expression of results as TWA. The analytical results are often more analyte specific than with real-time monitoring. These pumps are to be used for quantitating the concentrations of lead in the ambient air to monitor personnel exposures and fugitive emissions.

Perimeter pumps are to be installed above ground level to prevent contamination due to foot traffic and normal wind-soil movement. Personal samples are to be collected in the breathing zone of personnel.

9.2.2 Real Time Aerosol Monitoring (Mini-Ram)

This instrument measures the amount of generic aerosols (dusts, mist, fumes, particulates, etc.), in the ambient atmosphere and displays a concentration in mg/m^3. This instrument can supplement visual observations to determine if dust control is needed or is effective.

9.2.3 Calibration Equipment

Each instrument/device must be calibrated or performance tested prior to and after use. For the real-time instrumentation, the manufacturer's recommended equipment and instructions shall be used. For flow calibration of the personal air sampling pumps, a primary standard such as bubble meter or Mini-Buck calibrator is to be used. A copy of the manufacturer's instrument instructions for use and calibration should be available on-location.

9.3 DURATION OF ENTIRE AIR MONITORING PROGRAM

As discussed previously, due to the changing conditions of the area as removal continues, the air monitoring program will be re-evaluated at least weekly. In general, the location air monitoring program must be in effect before groundbreaking and until the excavation of contaminated soil is finished at each location.

9.4 POSTING OF AIR MONITORING RESULTS

All personal air monitoring results will be posted in the break area and the on-location office trailer. Analytical results for lead generally require 2-3 days to obtain. Because of the stringent dust control efforts, faster turnaround times should not be necessary. If analytical results are needed more expeditiously in response to increased dust levels, arrangements are to be made with the lab.

9.5 FUGITIVE DUST EMISSIONS

In order to maintain environmental air quality, excavation areas will be pre-wetted to prevent visible emissions of fugitive dust. If visible emissions are observed in the work area, work will shall cease until dust is suppressed.

9.6 X-RAY FLUORESCENT MONITORING

The XRF method will be utilized throughout site operations at this project, (excavation areas, etc.) to determine the presence of lead in the soil/ash.

This method uses X-radiation to excite the sample atoms and then determines the identity and quantity of material(s) present. The following health and safety precautions shall be followed during all XRF sampling:

- Become familiar with the instrument before use.
- Do not initiate sample analysis unless probe is connected and sample is in place.
- Do not remove or adjust samples while the instrument is conducting analysis.
- Avoid contact with the top of the probe.
- Never aim the probe at any person, including the user himself/herself.
- Perform necessary repairs immediately when feasible. Serious repairs should be performed by the instrument's manufacturer or other qualified source.

9.7 AIR MONITORING ACTION LEVELS

Table 9.1 describes the air monitoring action levels:

TABLE 9.1

AIR MONITORING ACTION LEVELS

Monitoring Device or Analyte	Action Level	Action
Visual	Visible emissions emanating from the excavation perimeter	Stop work; suppress dust emissions; proceed with caution.
Mini-Ram	[1]Eagle Park Acres AL= .365 mg/m³ [2]Cleveland Avenue AL= .5 mg/m³ [2]Colgate AL= .5 mg/m³ [2]Delmar AL= .5 mg/m³ [2]Sand Road AL = .5 mg/m³	Initiate dust control. Adjust operations (wet the soil) to minimize dust generation. Stop work; increase dust control measures and ensure respiratory protection is adequate.

[1]Action level is based on 50 percent of the PEL for lead concentration and samples taken on-location. The sample results are presented in Appendix K.

[2]Action level is based on 10 percent of the respirable fraction of particulates (dust) not otherwise regulated.

9.8 AIR MONITORING FREQUENCY

Table 9.2 documents the monitoring instruments which will be used on-location at the specified intervals.

TABLE 9.2

AIR MONITORING FREQUENCY

INSTRUMENT	FREQUENCY OF USE
Time Integrated Sampling (personal sampling pumps)	Samples shall be taken daily during excavation activities using employee worn air pumps with MCE filter cassettes. Samples are to be collected at each location in sufficient numbers to determine if the employees who are most likely to be exposed to chemicals above exposure limits are sufficiently protected. One employee from each job category should be sampled at each location and at least two employees should be sampled daily. Activities in which contaminated soil is not disturbed, do not require personnel monitoring. Four high volume samples should be collected daily or more often, as necessary, during excavation at each location: one in each direction (north, south, east, west) at the perimeter of each excavation location. Perimeter sampling will begin before breaking ground and will continue until all excavation at each location is completed. High volume monitoring is not required during backfill of material determined to be uncontaminated
MINI-RAM	Monitor perimeter of excavation location intermittently during optimum working hours.

9.9 FIELD CALIBRATION OF AIR SAMPLING PUMPS

Air sampling pumps shall be calibrated with a primary flow measuring device prior to and after sample collection.

10.0 GENERAL SAFETY

This section outlines general safety topics not addressed elsewhere in this plan.

10.1 SAFETY INSPECTION CHECK-OFF SHEET

The site supervisor, assisted by the HSO is to make a weekly inspection of each location using OHM's Safety Inspection Project Site Form (see Appendix J). The site supervisor must then ensure that all unsafe conditions found during this inspection are corrected.

10.2 SAFETY RE-EVALUATION

As conditions change, the site supervisor may institute more or less stringent procedures than those outlined in this plan. Any reduction of safety will be implemented only after consultation with the Regional Health and Safety Manager and approval by the USACE on-location representative.

10.3 PARKING

Parking will be permitted only in designated areas as specified by the USACE on-location representative.

10.4 ACCIDENT INVESTIGATION

All accidents or incidents will be investigated as appropriate in accordance to OHM established procedures (see Appendix I).

10.5 ILLUMINATION

Areas accessible to employees shall be adequately lighted to intensities as specified in 29 CFR 1910.120(m) Table H-120.1 while any work is in progress.

10.6 SANITATION

Sanitation requirements pertaining to potable water, nonpotable water, toilet facilities, food handling, temporary sleeping quarters, washing facilities, and shower/ change rooms, as specified in 29 CFR 1910.120(n) must be adequately addressed.

10.7 SAFETY AND HEALTH POSTER

Federal OSHA requires that Health and Safety Poster #2203 be displayed at all times. This poster is to be located in the project office trailer, where employees can are given opportunity to review it.

10.8 SAFETY EQUIPMENT

The safety equipment for this project is to be located in the decontamination trailer in the contamination reduction zone. Some safety equipment will need to be stationed in other areas for easier access. These determinations are to be made once personnel is on-location. See Appendix L for a list of safety equipment available for this project.

10.9 COMPLIANCE WITH 29 CFR 1910.120

The OSHA regulations, "Hazardous Waste Operations and Emergency Response," must be fully complied with. All location personnel are encouraged to read this regulation. Deficiencies in compliance with the contents of this regulation should be brought to the attention of the site supervisor, HSO, or the OHM Midwest Region Health and Safety Manager. All deficiencies must be addressed immediately.

11.0 TRAINING PROGRAM

Training is required by federal law to be given to all personnel that work at this project location. Training is also fundamental for personnel to become proficient in techniques that enhance personal safety, work productivity, and project quality.

11.1 OHM EMPLOYEES

All OHM employees are to have received a 40-hour training session or will have been qualified by experience as required by 29 CFR 1910.120(e), "Hazardous Waste Operations and Emergency Response" and SARA Regulations prior to performing any work at this project site. Site supervisors receive an additional 8 hours of training and all personnel are to attend an 8-hour annual refresher training course.

11.2 EMPLOYEE TRAINING

Employee Training covers:

- Review of 29 CFR 1910.120
- Hazard communication program
- Physical, chemical, toxic properties of hazardous materials
- Decontamination procedures
- PPE--donning, hazards, risks
- Respiratory protection
- Hearing conservation
- Hazardous substance spill response
- Confined space entry
- Excavation safety
- UST procedures
- Waste generation, storage, treatment, and disposal
- OSHA compliance/compliance with regulations

- Emergency event planning
- Shock sensitive and explosive materials
- Heat stress, cold stress
- Medical surveillance
- Heavy equipment/hand tool safety

11.3 JOB LOCATION TRAINING

Before commencing this project, a training session will be held to cover project-related topics. For this particular project topics would include, bur are not limited to the following:

- History of the location(s)
- Names of personnel and alternates responsible for safety and health
- Chemicals used or found on-location and their hazards (signs and symptoms of exposure)
- Physical hazards involved with the location operations
- Location control
- Work zones--locations of exclusion, contamination reduction, and support zones
- Heavy vehicles
- Passenger vehicle safety
- Levels of protection--C or D
- Decontamination procedures
- High-pressure washer safety procedures
- Excavation safety
- Using hand tools

- Emergency procedures, signals, and equipment
- Electrical and lighting safety
- Medical surveillance requirements
- Work area rules

11.4 DAILY SAFETY MEETINGS

A safety meeting is to be held daily before work commences. The scope of work for the day, hazards of the work, hazards of the materials, use of respirators, decontamination, and hazardous areas of the project will be discussed. Periodically, general subjects such as electrical safety, defensive driving, and heat/cold stress should be discussed.

11.5 RECORDS

All training sessions, topics, attendance, training officer, and date of training is to be recorded in a safety training logbook. This logbook shall remain at the work location until completion of the project.

11.6 PRE-PHASE TRAINING

Before a new phase of work is begun in an area with which the crews are not familiar, a training session is to be held covering the chemical and physical hazards related to this particular phase/area.

12.0 MEDICAL SURVEILLANCE

The OHM Medical Surveillance Program is established to ensure that the health of employees is not compromised by potential exposure to chemical or physical agents found at work locations.

12.1 GENERAL

All OHM field personnel and/or subcontractors working on an OHM project must participate in a stringent medical monitoring program as directed in 29 CFR 1910.120(f). The physical, repeated annually, qualifies personnel to work around potentially hazardous substances and safely wear respiratory protection. This physical examination consists of the following:

- Occupational and medical history
- Physical examination
- Visual test
- Audiometric test
- Urinalysis
- Blood test
- Chest x-ray
- Pulmonary functions test
- EKG or EKG stress test (as required)
- Written report

12.2 PROJECT-SPECIFIC MEDICAL SURVEILLANCE

As required by 29 CFR 1910.1025, blood lead levels must be determined and monitored for personnel working in the affected area prior to the start of work. Blood lead levels should also be determined for affected personnel at the conclusion of the project.

If signs or symptoms of lead exposure develop in any employee, the HSO or site supervisor should be immediately notified. The employee should then be taken directly to a medical center for a complete physical examination and receive treatment for the potential exposure.

Also, if an employee is exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits without the necessary protective equipment, he/she must have a medical examination following the incident.

Air monitoring samples will be collected in sufficient numbers to determine if the employees who are most likely to be exposed to chemicals above exposure limits are sufficiently protected.

12.3 ANNUAL MEDICAL EXAMINATION

Annual examinations include an updated medical history, including any occupational exposure from the previous year, and a detailed physical examination featuring the same components as the pre-employment examination. The physician pays particular attention when comparing the biochemical parameters to help ensure no recognized symptoms of toxic exposure have developed during the past year. The physician completes and signs the medical certification/rejection section. A written report of the occupational and medical history, physical examination, and all laboratory work is required.

12.4 EXIT MEDICAL EXAMINATION

An exit medical examination is required for termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 3 months. A written report of the occupational and medical history, physical examination, and all laboratory work is required.

12.5 SUBCONTRACTORS

If a subcontractor is hired in any phase of the project, the company is also required to abide by 29 CFR 1910.120(f) Medical Surveillance Program and OHM policy. Employees of the subcontractor must have a pre-employment physical examination or an examination within the last 12 months to be eligible to work on site.

12.6 ACCESS TO MEDICAL RECORDS

Employees have the right to review personal medical records collected as a result of this surveillance program. A copy of these records will be provided within 15 days of request. Please direct requests to Mark Harber, R.N., located in the Corporate Health and Safety Department (Findlay, Ohio).

13.0 EMERGENCY PROCEDURES

Written standard operating procedures are developed for emergency events. These procedures detail appropriate actions for fire, medical, and personnel exposure events. The following subsections detail specific emergency guidelines and information for this project. OHM will provide its own emergency response when feasible. Emergencies that exceed the capabilities of OHM personnel and equipment will require additional support form agencies designated below.

13.1 EMERGENCY TELEPHONE NUMBERS

The following emergency telephone numbers shall be prominently posted near each telephone:

o Ambulance Service/Paramedics	618-877-4747
o Police	911
o Fire	911
o Hospital St. Elizabeth Medical Center	618-798-3000
o Chemical--Oil Spills Cleanup (National Response Center)	800-424-8802 202-462-2657
o Chemtrec	800-424-9300
o Center for Disease Control	404-488-4100 (24 hr)
o Poison Control Center	800-252-2022
o IEMA	217-524-6887
o Illinois EPA Emergency Response	800-782-7860
o Illinois EPA Project Manager	Brian Culnan 217-782-2829
o Company Physician	419-424-0380
o Illinois EPA	217-782-3637

13.2 EMERGENCY MAP

A map showing the route to the hospital will be posted near the telephone at each location. The written description of the route including actual distances and travel time will be determined upon mobilization to the location(s).

13.3 EMERGENCY EQUIPMENT

In each operative decontamination area, an emergency equipment station will be set up and will consist of an eyewash station, a first-aid kit (which meets the requirements of 29 CFR 1926.50), emergency alarm (signal), fire blanket, and two 20-pound ABC fire extinguishers. The eyewash units will be located near the source of potential hazard. Each station will be prominently marked.

13.4 EMERGENCY SIGNALS/EMERGENCY ALARMS

The emergency signal consists of intermittent 5 second blasts (medical) or a continuous 30-second blast (fire) on a hand-held air horn. Horns will be located at the outer perimeter of the contamination reduction zone. In the event of an emergency and the horn sounds, operations will be shut down and all personnel will assemble in the contamination reduction zone, be accounted for, and given directions on how to proceed by the site supervisor or, in his absence, by the HSO. If an obvious catastrophic emergency warrants rapid egress from all areas, personnel shall exit the areas and assemble in a designated zone upwind of the emergency. This system is a requirement of OHM policy for all locations and it should be reviewed at least weekly in a daily safety meeting.

13.5 EMERGENCY RESPONSE CONTINGENCY PLAN

When either intermittent 5 second blasts (medical) or a continuous 30-second blast (fire) is sounded, all personnel should evacuate the exclusion zone and proceed to the CRZ quickly. These blasts can be carried out on a hand-held air horn located at the outer perimeter of the CRZ.

13.5.1 Emergency Routes

In an emergency, all personnel will exit through CRZ corridor and assemble in CRZ, upwind, if possible, from the exclusion zone. In an obvious catastrophic emergency, personnel should exit the exclusion zone at nearest exit and assemble in an area designated by the site supervisor upwind of the emergency.

13.6 "BUDDY" SYSTEM

All work in the exclusion zone that involves handling hazardous materials or is otherwise hazardous is to be done using the "buddy" system. Prior to entering the exclu-

sion zone, buddies are to be assigned. Buddies are responsible for ensuring the safety of their respective buddies and should be aware of the potential for exposure to materials found on-location and general hazards of the workplace. Buddies shall remain within visual sight of each other at all times.

13.7 EMERGENCY COORDINATOR

The designated emergency coordinator will be the site supervisor. In his/her absence the duties would be assumed by the HSO. If the HSO is not present, then the duty falls to the general foreman.

The duties of the emergency coordinator are as follows:

- Initially alert emergency service agencies such as fire and police departments and ambulance services that location operations are occurring, nature of project, location orientation, descriptions of PPE, and possible location events that may require their intervention. These agencies should be contacted once OHM personnel arrive on-location.

- Review emergency procedures with all site personnel. This will include the initial site orientation and a review once weekly during site-safety meetings.

- Ensure that emergency contingency plans remain up to date. As site conditions change, these plans may need to be altered. As the contingency plans change, updates to emergency service agencies may be required.

- Establish predetermined evacuation areas (upwind as necessary).

- Coordinate emergency response procedures as required.

- Ensure that practice runs are conducted along emergency routes periodically.

13.8 MEDICAL EMERGENCY AND PERSONAL INJURY

In any life-threatening situation, the safety of the individual takes precedence over all procedures designed for protection against chemical contamination on-location. When the site supervisor is unavailable, the HSO shall assume the emergency coordinator role. On-location OHM personnel certified in first aid/CPR will be identified at the project location prior to commencement of on-location work.

13.8.1 Worker Procedure

The first worker who notices that a medical emergency or personal injury has occurred shall immediately make a subjective decision as to whether the emergency is life-threatening and/or otherwise serious.

13.8.2 Life-Threatening and/or Otherwise Serious Incident

If an apparent life-threatening and/or otherwise serious incident has occurred, the first person who identifies the situation shall sound the alarm to summon the site supervisor to the contamination reduction zone (intermittent 5-second blasts repeated until the site supervisor arrives). The site supervisor shall be apprised of the situation and told where the victim(s) is/are located. As the site supervisor proceeds to the accident scene, the HSO shall be summoned and communication channels shall be opened and kept on standby until the HSO has:

- Surveyed the scene
- Performed a primary survey of the victim

The site supervisor shall then determine if the Emergency Medical Services (EMS) should be summoned, what information must be relayed, and provide emergency action principles consistent with the injury. The site supervisor shall appoint a staff person or persons who will meet the EMS and have them quickly taken to the victim. If necessary, decontamination of the individual shall be performed at the direction of the site supervisor.

13.8.3 Nonlife-Threatening Incident

Should it be determined that no threat to life is present, the worker shall assist the injured person to the contamination reduction zone and contact the site supervisor or HSO.

13.8.4 Other Procedures

The area surrounding any serious accident is not to be disturbed until any changes to the location have been cleared by the site supervisor. The site supervisor shall immediately investigate the causes of all OSHA recordable accidents. Lost time injuries shall immediately be reported to the vice president of the Midwest Region.

13.9 FIRE EMERGENCY

Because of the possible presence of flammable materials on-location, fire is an ever-present hazard. OHM personnel are not trained, professional firefighters. If there is any doubt that a fire can be quickly contained and extinguished, personnel are to

sound the fire alarm and vacate the structure or area. The following procedures will be used in the event of a fire.

13.9.1 Sound the Alarm

Anyone who sees a fire shall sound the alarm. The alarm is a 30-second blast on an air horn.

13.9.2 "Buddy" for Each Worker

Work crews shall be comprised of pairs of workers. Workers shall leave the work location with their respective "buddies" immediately after hearing the fire alarm.

13.9.3 Contained and Extinguished Fire

In the event of a small fire that the worker extinguishes, the on-scene foreman is to be summoned and the site supervisor is to be notified. All fires must be reported to the HSO and site supervisor.

13.9.4 General Alarm Response

On hearing the general alarm, the workers are to disconnect any electrical equipment in use (if possible), turn off combustion engines, and proceed to the nearest fire exit egress point.

13.9.5 Egress Instructions

Before workers begin operations in an area and on a daily basis, the site supervisor will give instructions on egress procedures and assembly points.

13.10 SPILL CONTAINMENT PROGRAM

The procedures defined below comprise the spill containment program in place for activities on-location.

13.10.1 Fuel Spills

At times, there will be quantities of fuel on-location that, if spilled, could have adverse environmental impact.

13.10.2 Measures for Preventing Fuel Spills

- Care shall be taken when transferring fuels.

- o A containment dike around the fuel storage tanks shall be constructed.

- o Inspect all fuel storage tanks for leaks daily.

- o Inspect containment structure daily.

- o Where spills, leaks, or ruptures may occur, adequate quantities of spill containment equipment (polypropylene absorbent pillows and sausages.) will be stationed in the immediate area. The spill containment program must be sufficient to contain and isolate the entire volume of hazardous substances being transferred.

- o Fire extinguishing equipment meeting 29 CFR part 1910, subpart L shall be on hand and ready for use to control fires.

13.10.3 Response

Because OHM will be providing its own emergency response with respect to spills, the response time will be immediate. The proper authorities shall be notified as soon as is feasible.

The following response procedures for a diesel fuel spill of greater than 5 gallons will be used:

- o Shut down operation in immediate area
- o Limit ignition sources
- o Suppress vapors as required
- o Survey area with CGI/don protective equipment
- o Pump liquids into drums
- o Recover contaminated solids and place in containers
- o Finish cleanup of residues

13.10.4 Notification

- o OHM personnel--Project Manager
- o USACE representative
- o Other regulatory agencies as required

13.11 EVACUATION/RE-ENTRY

In all situations, when an on-location emergency results in evacuation of the exclusion zone, personnel shall not re-enter until:

- The conditions resulting in the emergency have been corrected.
- The hazards have been reassessed.
- The SSHP has been reviewed.
- Location personnel have been briefed on any changes in the SSHP.

APPENDIX A

WORKER/VISITOR ACKNOWLEDGEMENT TO HEALTH AND SAFETY PLAN

WORKER/VISITOR ACKNOWLEDGMENT TO HEALTH-AND-SAFETY PLAN

I HAVE READ THE SITE-SAFETY PLAN FOR THIS SITE AND FULLY UNDERSTAND ITS CONTENTS. I AGREE TO FOLLOW THIS SITE SAFETY PLAN IN ALL RESPECT.

NAME	DATE

WORKER/VISITOR ACKNOWLEDGMENT TO HEALTH-AND-SAFETY PLAN

I HAVE READ THE SITE-SAFETY PLAN FOR THIS SITE AND FULLY UNDERSTAND ITS CONTENTS. I AGREE TO FOLLOW THIS SITE SAFETY PLAN IN ALL RESPECT.

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WORKER/VISITOR ACKNOWLEDGMENT TO HEALTH-AND-SAFETY PLAN

I HAVE READ THE SITE-SAFETY PLAN FOR THIS SITE AND FULLY UNDERSTAND ITS CONTENTS. I AGREE TO FOLLOW THIS SITE SAFETY PLAN IN ALL RESPECT.

NAME	DATE

APPENDIX B

LOCATION MAPS

PLOT SCALE: 1" = 1"	OHM CORPORATION FINDLAY, OHIO	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER

FIGURE 1

WORK ZONES

OHM Corporation

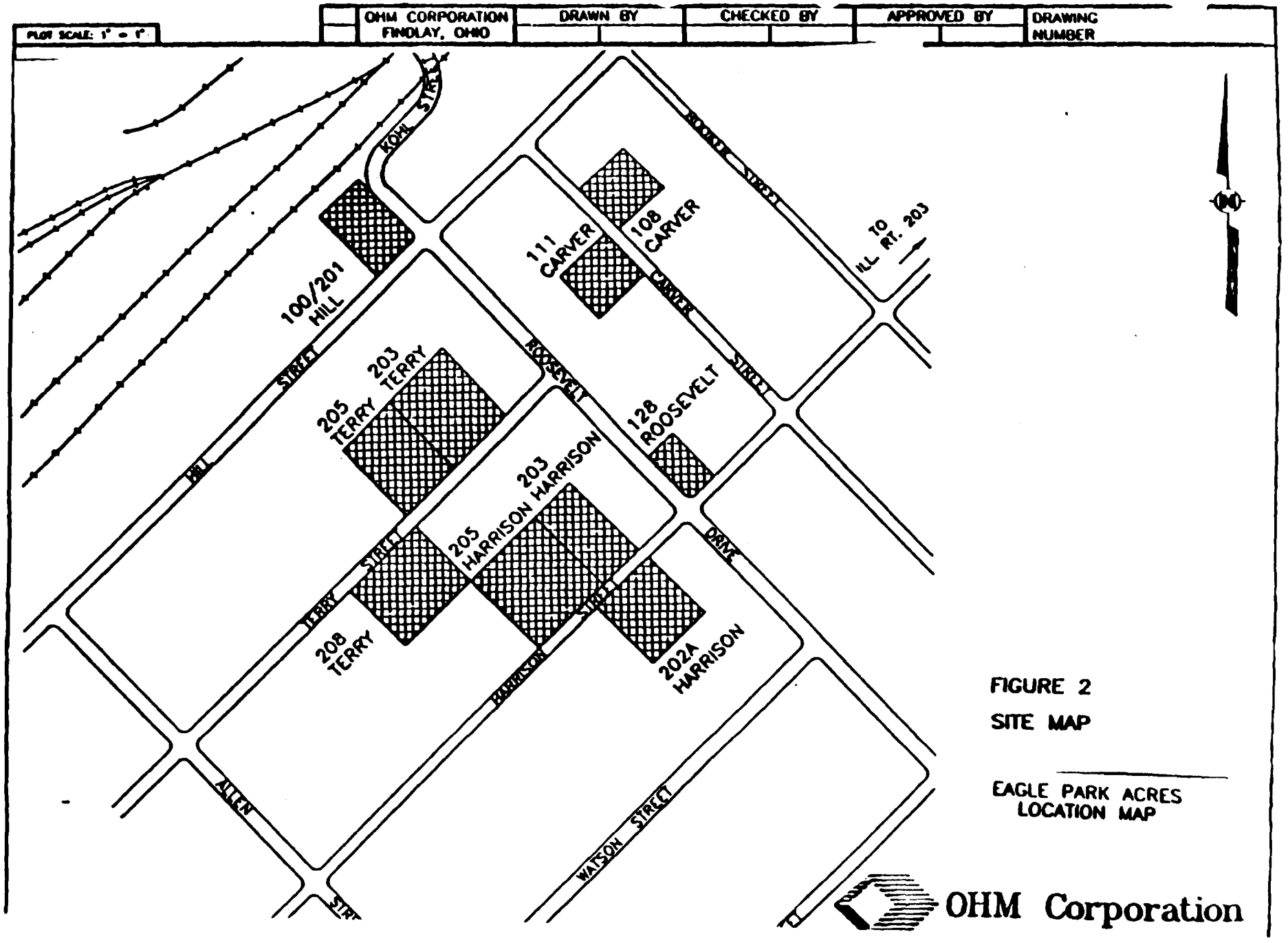


FIGURE 2

SITE MAP

EAGLE PARK ACRES
LOCATION MAP

OHM Corporation

PLOT SCALE: 1" = 1'	OHM CORPORATION FINDLAY, OHIO	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER

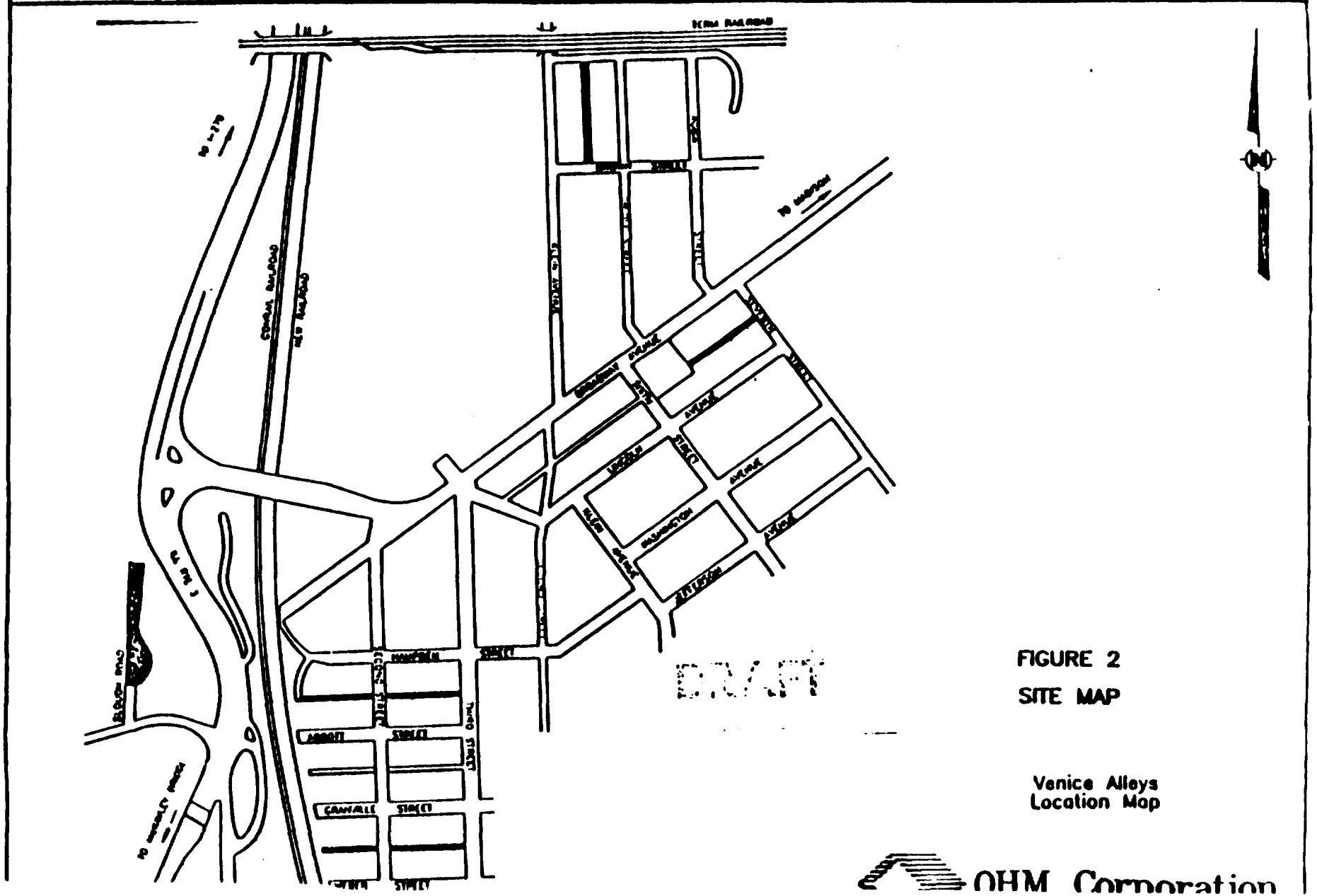


FIGURE 2

SITE MAP

Venice Alleys
Location Map

OHM Corporation

NL INDUSTRIES
GRANITE CITY SITE
GRANITE CITY, ILLINOIS
Estimated Areas of Lead Contamination
Above 500 ppm

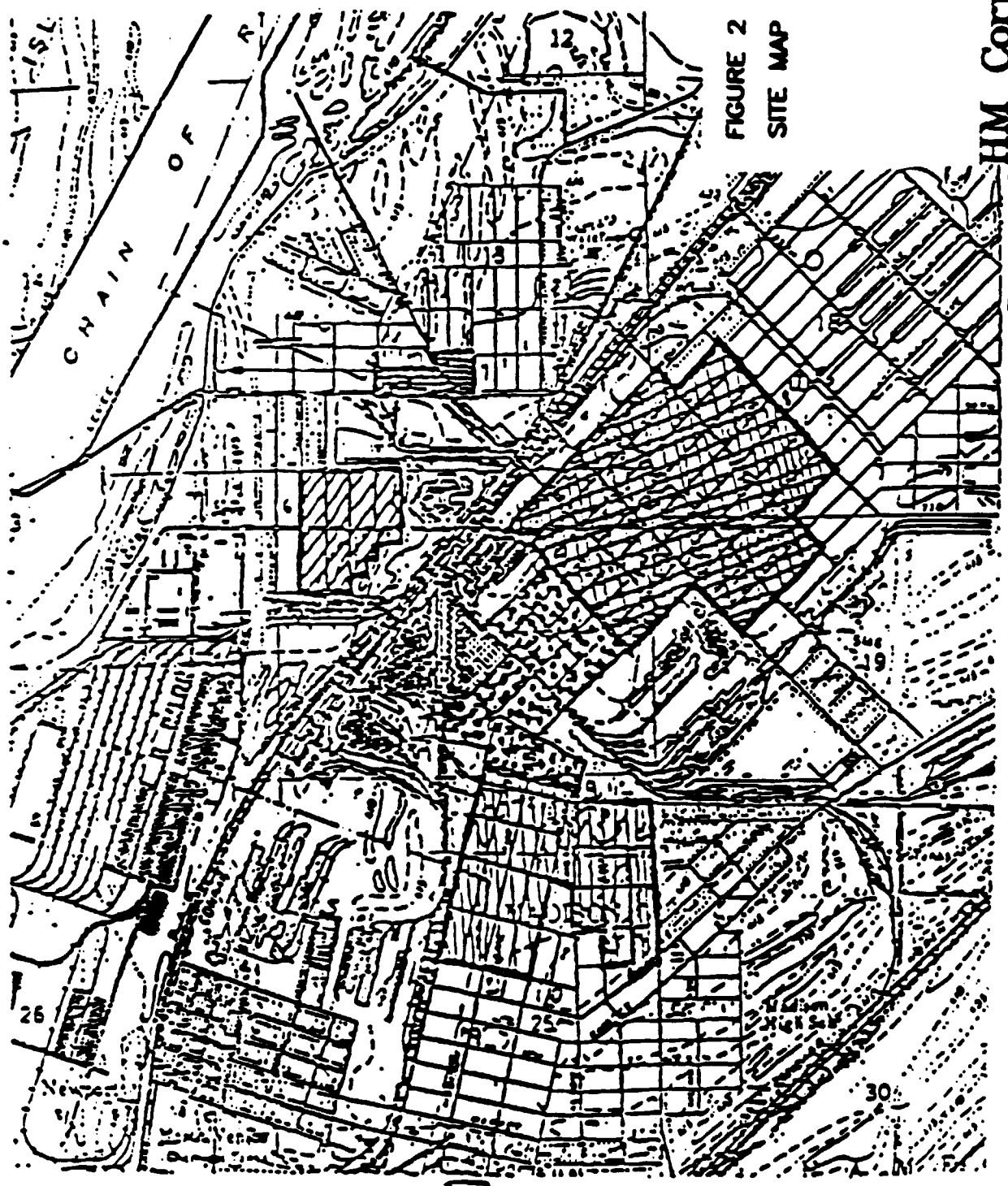


FIGURE 2
SITE MAP

HM Corporation

OHM CORPORATION FINDLAY, OHIO	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER

PLOT SCALE: 1" = 1"

PLOT SCALE: 1" = 1"	OHM CORPORATION FINDLAY, OHIO	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER

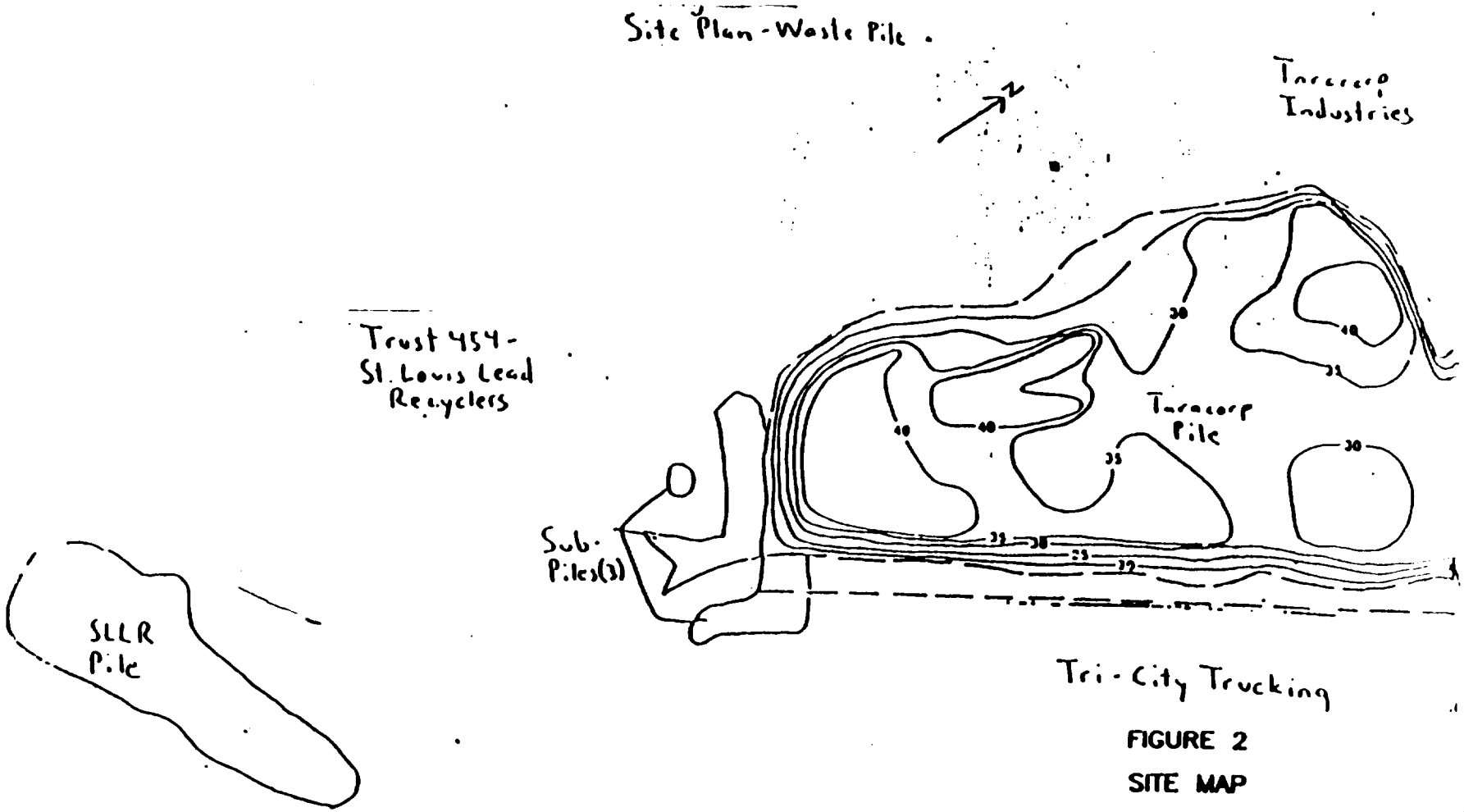


FIGURE 2

SITE MAP

OHM Corporation

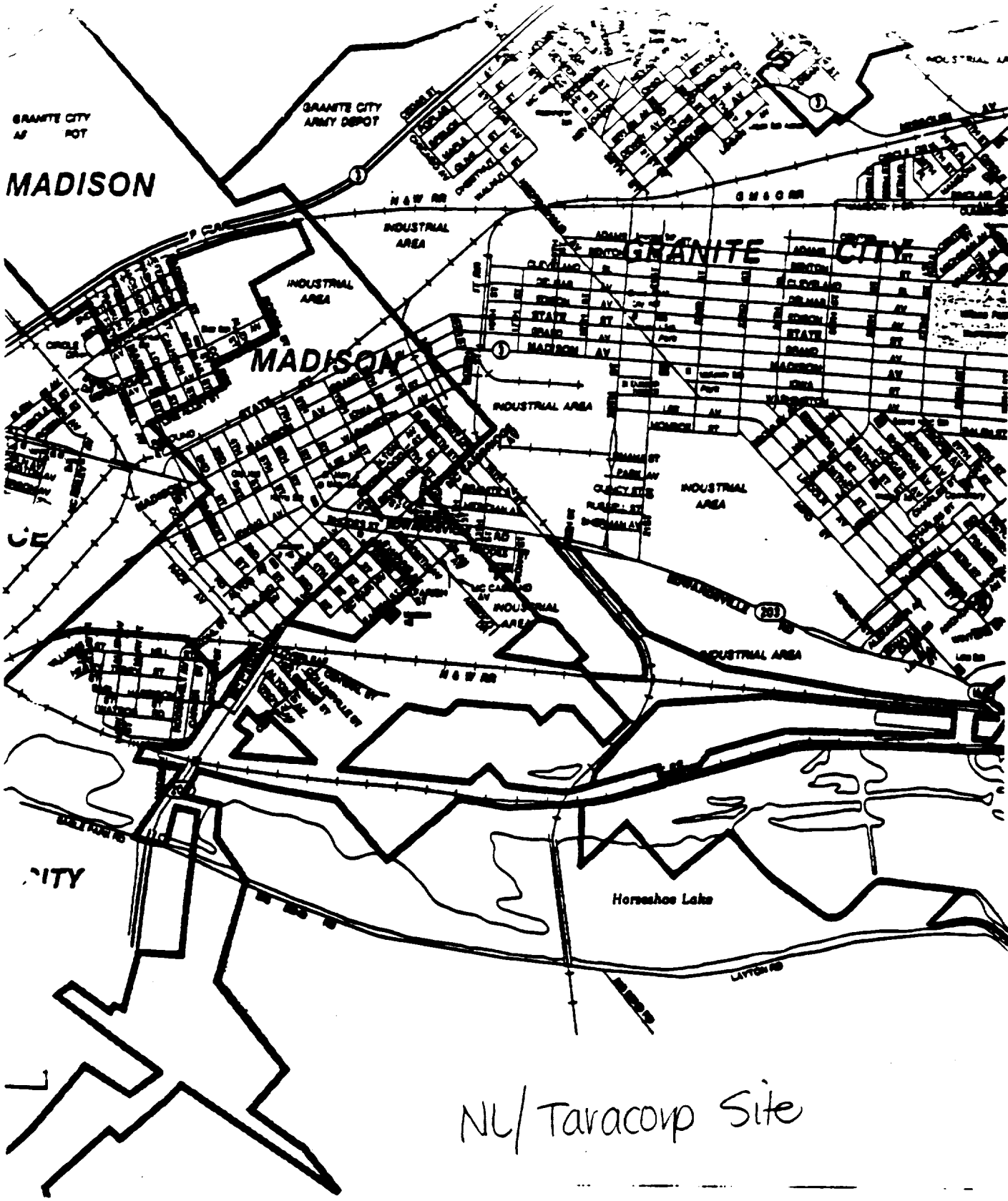
PLOT SCALE: 1" = 1"	O CORPORATION FINDLAY, OHIO	DI	CH ED BY	APPROVED BY	DRAWING NUMBER

The following pages outline routes to St. Elizabeth Medical Center. These routes were confirmed with St. Elizabeth Security as being accessible and should be used if/when necessary.

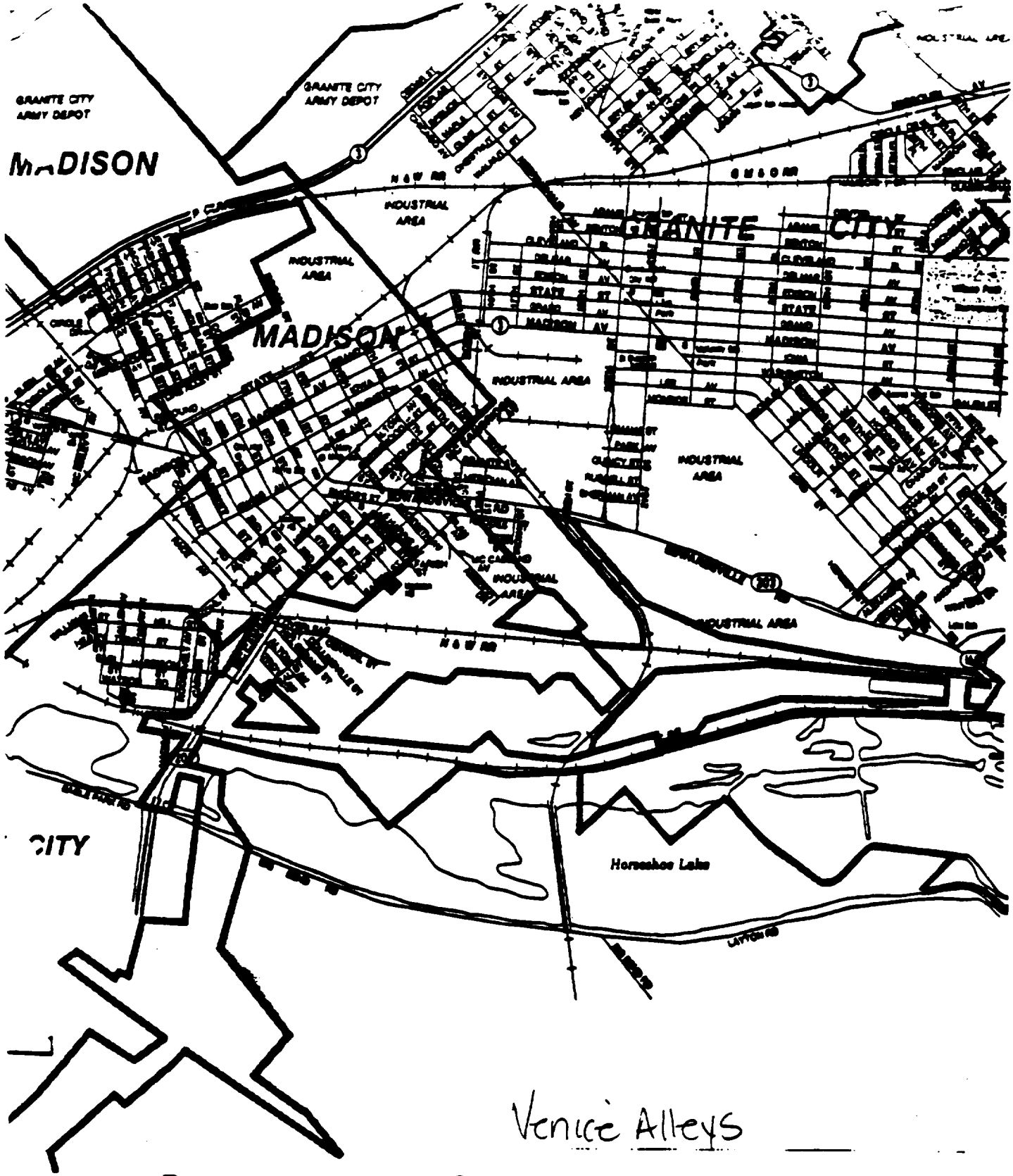
FIGURE 3

HOSPITAL MAP

OHM Corporation

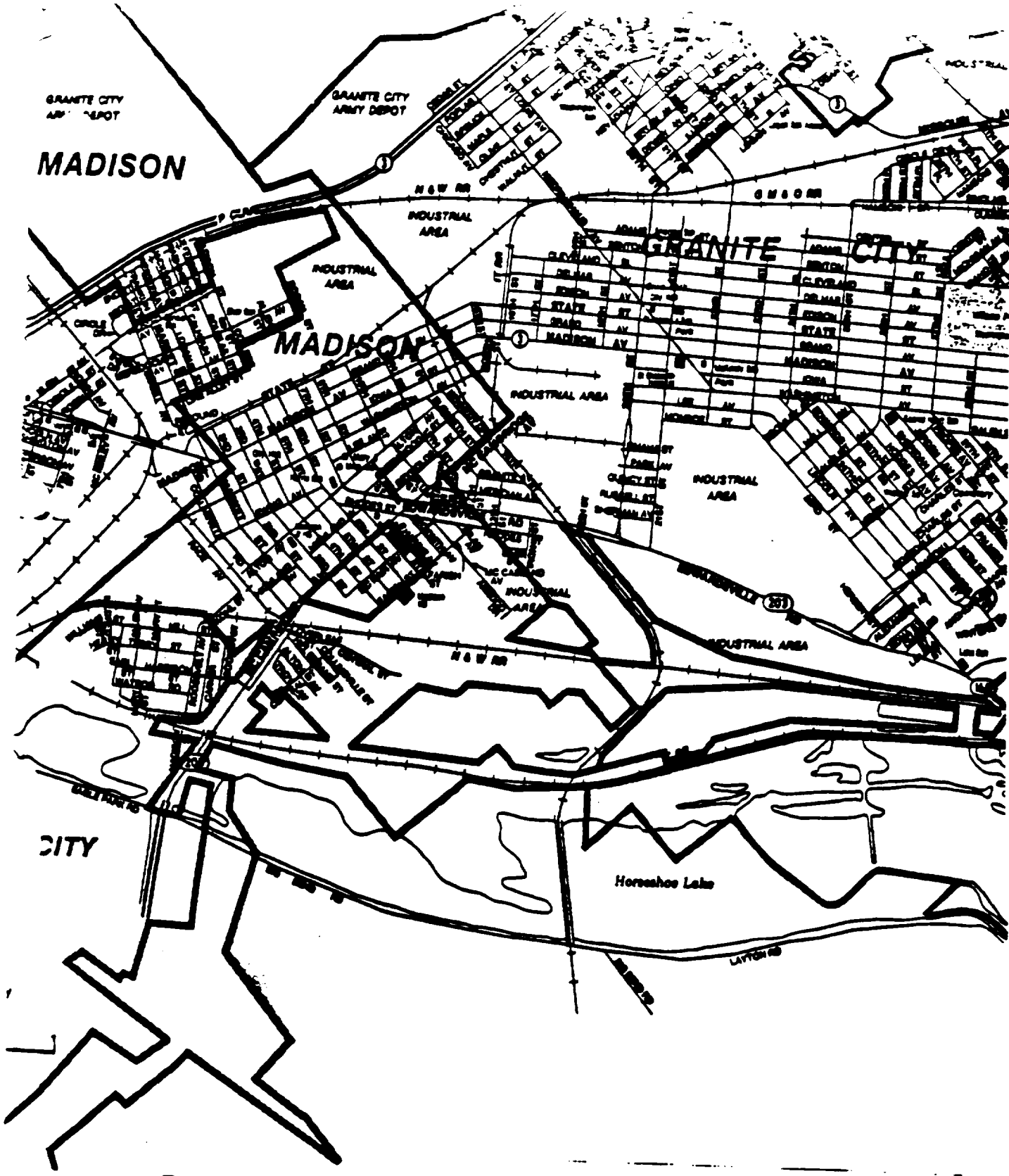

GRANITE CITY ARMY DEPOT
MADISON
INDUSTRIAL AREA
GRANITE CITY
MADISON
INDUSTRIAL AREA
INDUSTRIAL AREA
INDUSTRIAL AREA
INDUSTRIAL AREA
Horseshoe Lake
NL/ Taraconp Site

B C



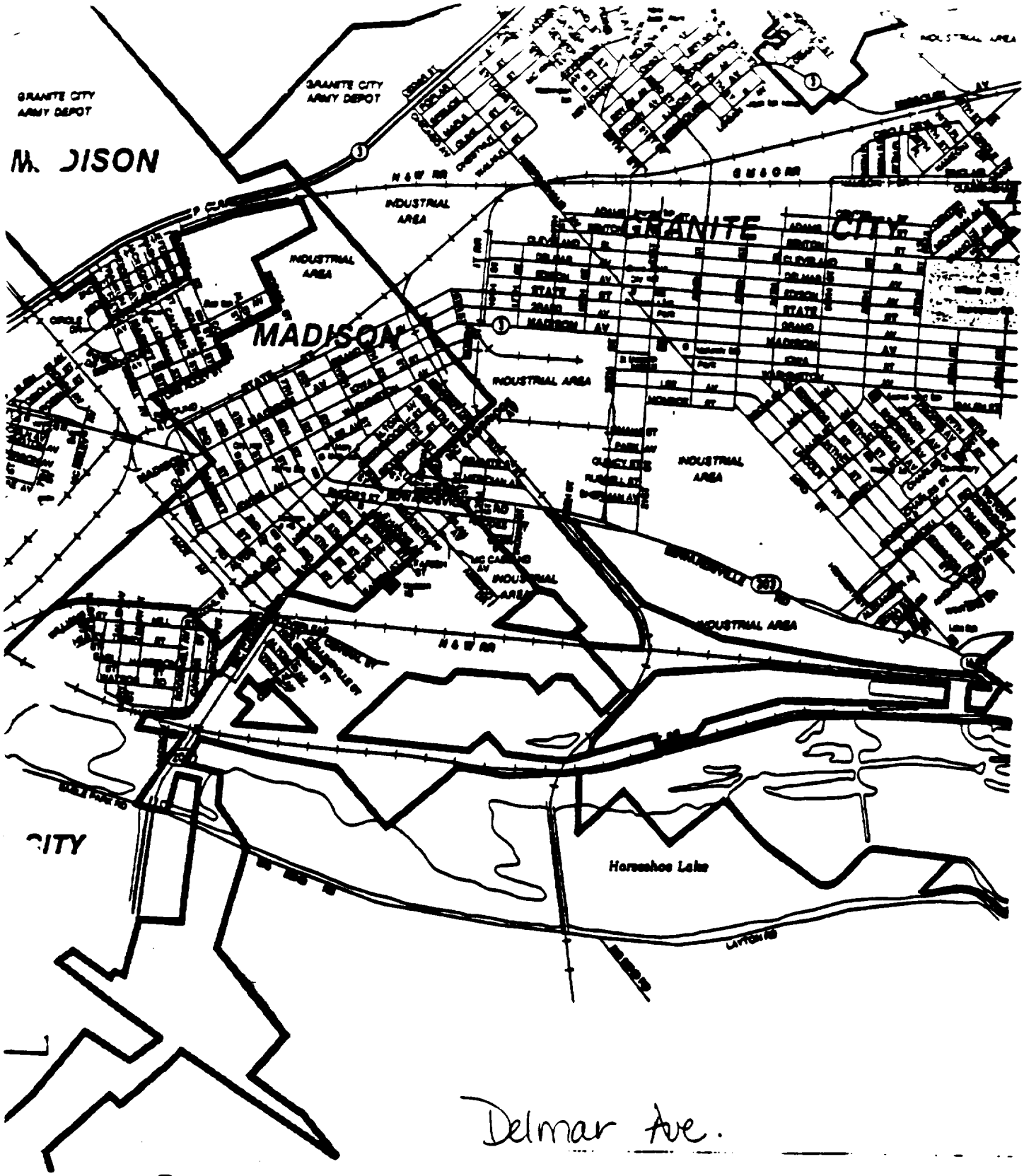
Venice Alleys

B C



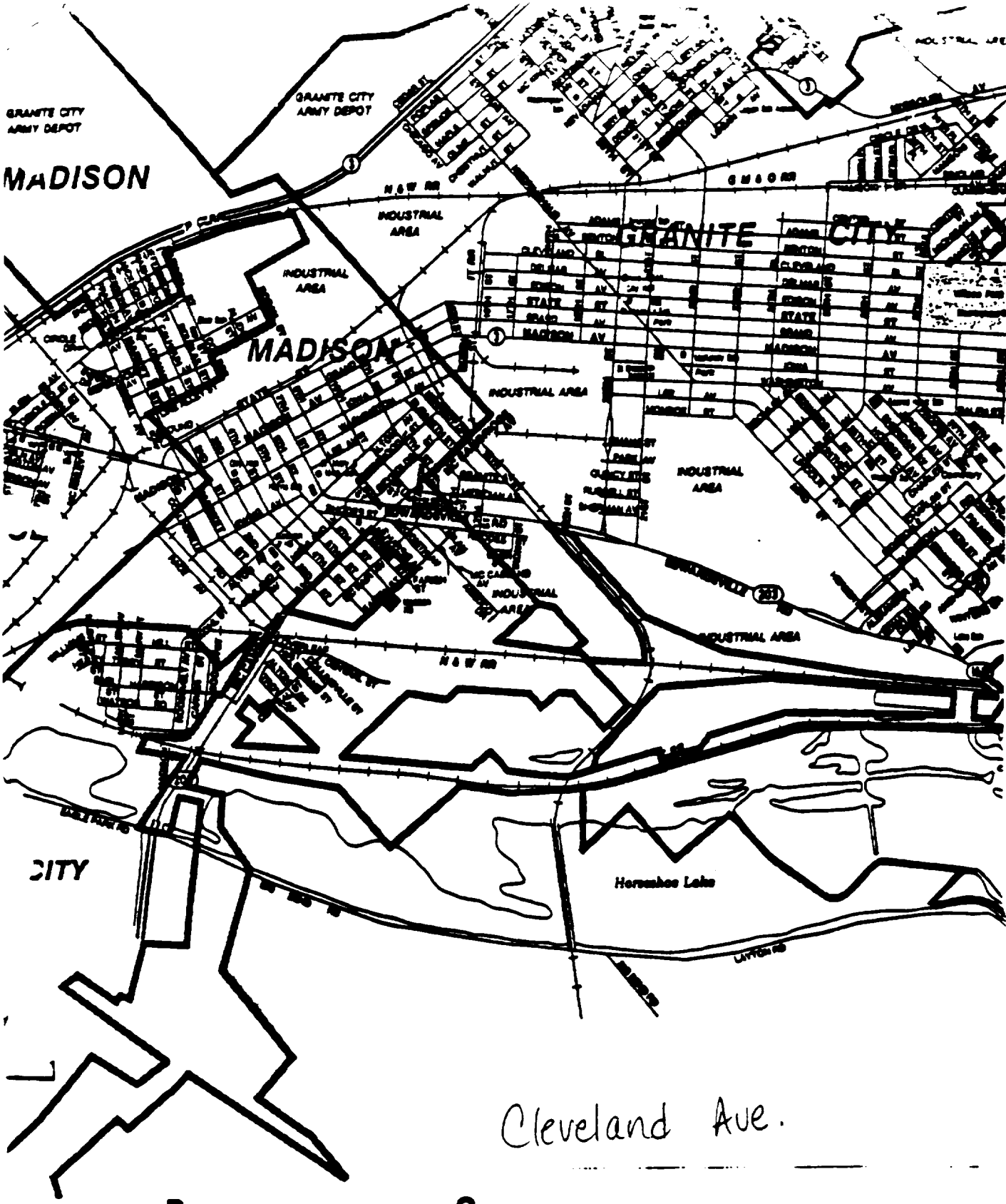
B C

Missouri Ave.



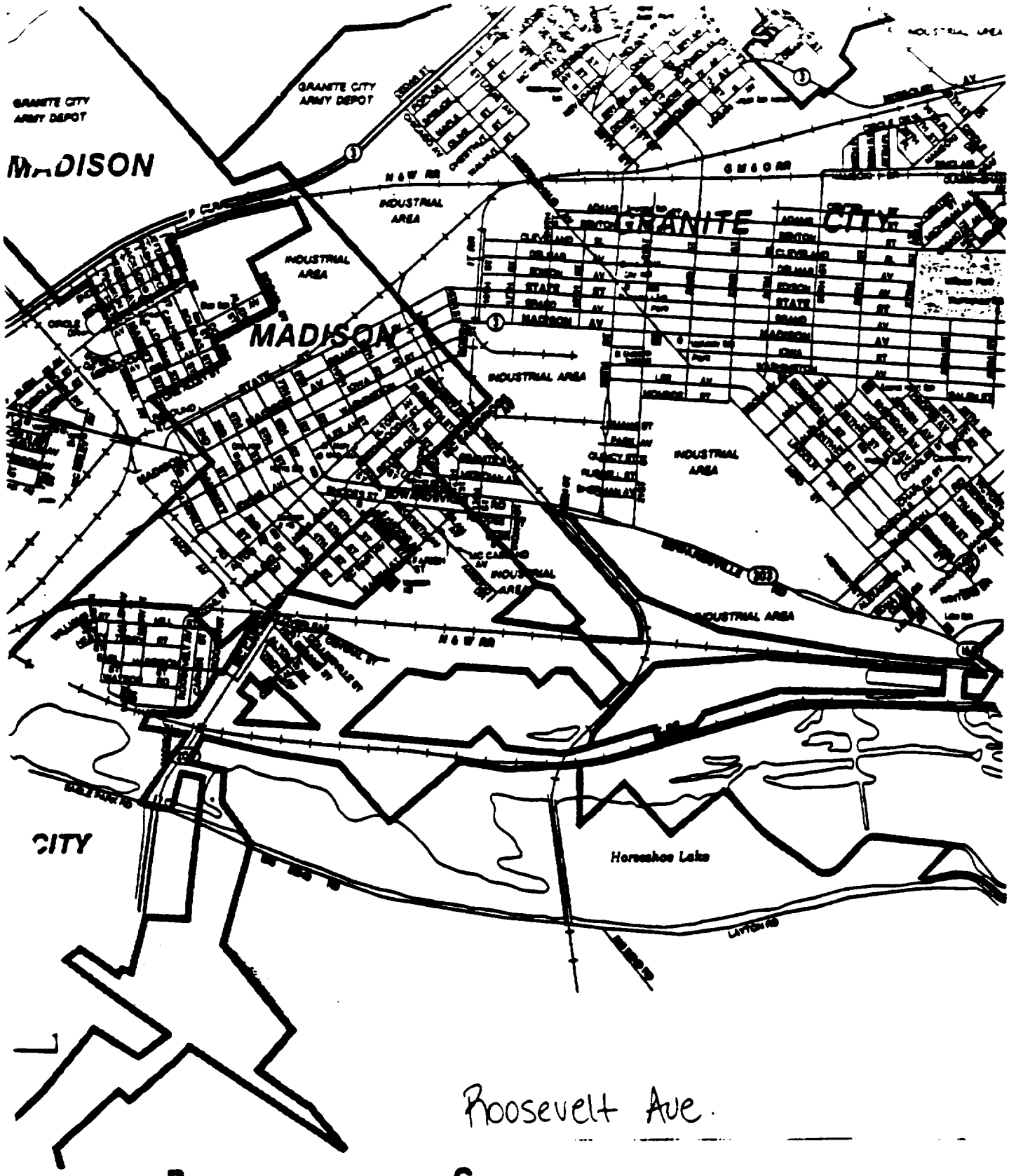
Delmar Ave.

B C



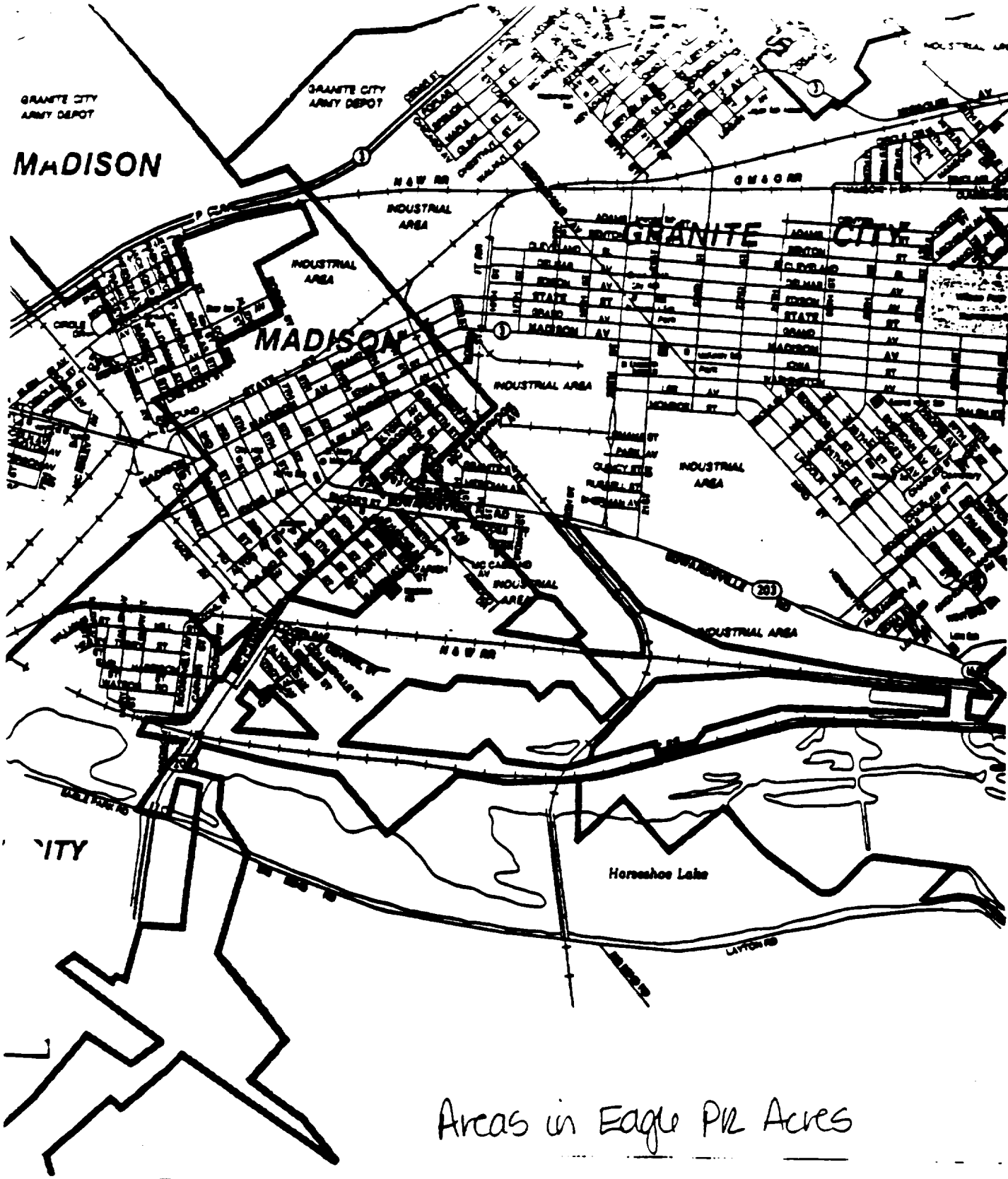
Cleveland Ave.

B C



Roosevelt Ave.

B C



Areas in Eagle Pk Acres

B C

PLOT SCALE: 1" = 1"	OHM CORPORATION FINDLAY, OHIO	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER

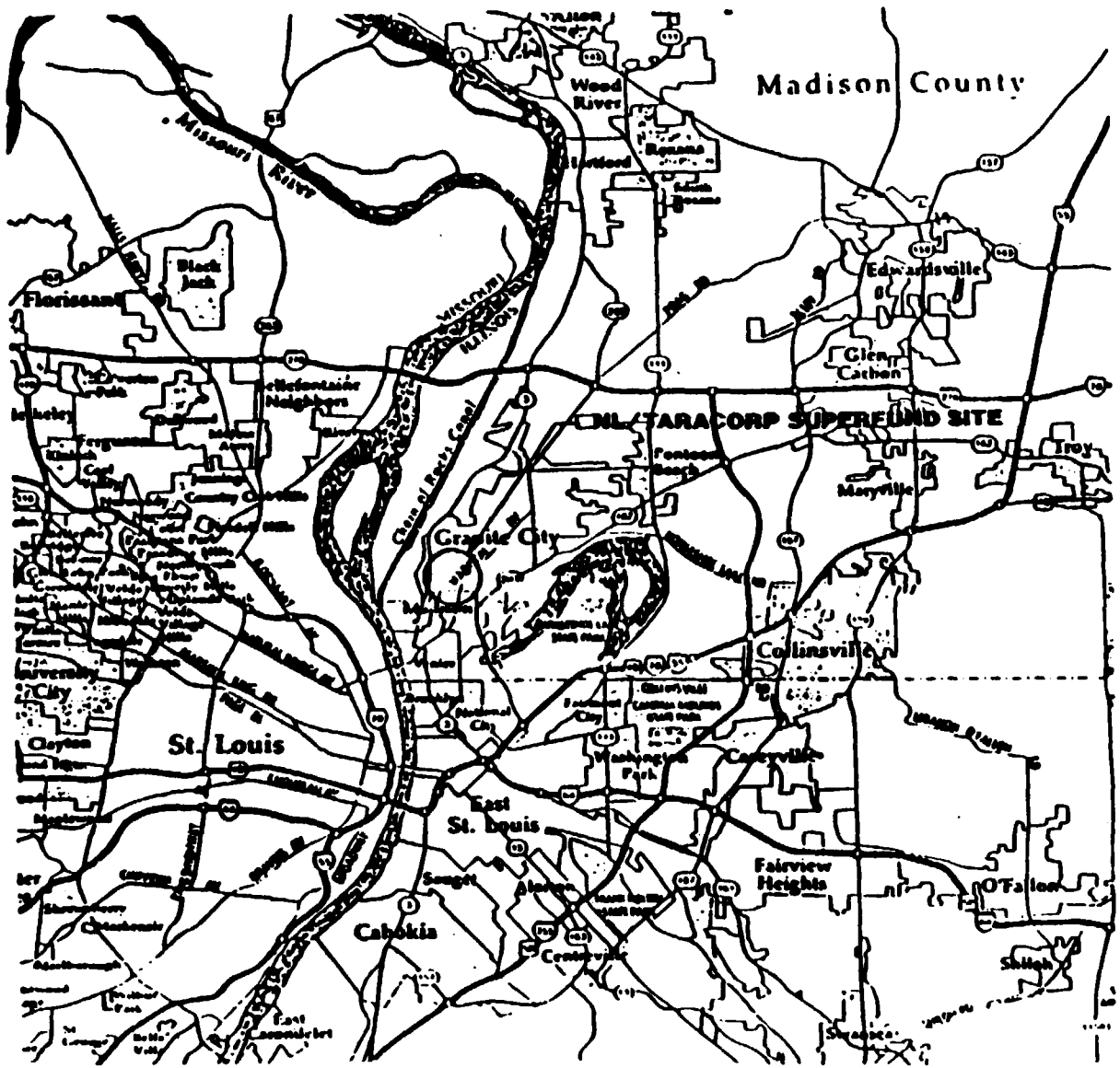


FIGURE 4

MAP TO SITE

OHM Corporation

CITRIKLEEN®

A BIODEGRADABLE, WATER SOLUBLE SOLVENT CLEANER & DEGREASER

PROPERTIES:

Physical Form & Odor ..... clear amber liquid with the odor of citrus
pH (Concentrate) 10.4
Flash Point (Concentrate) ..... 165° F. (C.O.C.)
(1:3 parts water) ..... none to boiling (212° F.)
Fire Point (Concentrate) ..... 175° F. (C.O.C.)
Freezing Point ..... approximately 32° F.
Solubility ..... complete in water, forms milky emulsion
Rinsability ..... excellent with water
Viscosity ..... BRK. Spindle No. 1 @ 60 RPM, approximately 18 cps
Metal Safety ..... safe for use on most metals

Caution: Prolonged immersion may attack certain aluminum alloys. Test before using.

TYPICAL USE DIRECTIONS:

Surface	Problem Soils	Water Dilution Rates	Method of Application
Mill housings, shovel sticks, trucks, mill stands, floors, oil cellars	Heavy grease, oils, carbonized deposits, tar, lubes	1:1 to 1:10 or undiluted	Use coarse spray, foam on or apply by brush. Rinse with water.
Automotive parts, engines housings, transmissions, all metal parts.	Heavy grease, oily deposits	1:2 to 1:20	Spray or brush on, or use in a cold tank dip. Rinse with water.
Waste Treatment plants; wet wells & wells; lift stations	Waste fats, grease, oils odor sources	1:1 to 1:5	Spray on using coarse spray under normal or low pressure. Allow 10-15 minutes dwell time. Water rinse before surface dries
Industrial plant flooring	Heavy greases, oil, rubber marks	1:10 to 1:30	Spray, mop or brush on or use power vacuum scrubber with pickup
Parts Washing	Grease, oils	1:3 to 1:20*	Used cold in recirculating dip tanks. Rinse with water or dry rag wipe.

*At these dilution ratios, Citrikleen is exempt from permit requirements under *District Rule 11(d) (37), Air Pollution Control, County of San Diego, *California.

IMPORTANT: Before using Citrikleen, always be sure to read and follow precautions and directions for use appearing on the container label.

A Subsidiary of Ash Chemical Products Inc.
74 HUDSON AVENUE TENAFLY NJ 07670
EMERGENCY TEL NO (201) 567-3000

DATE January 13, 1989

SECTION I. PRODUCT IDENTIFICATION

TRADE NAME CITRIKLEEN

FORMULA Limonene, alkyl aryl sulfonate, diethylene glycol monobutyl ether, alkyl ar polyether, ethanolamine, EDTA type chelate, butylated hydroxytoluene, water.

CHEMICAL FAMILY Liquid Cleaner

SECTION II. HAZARDOUS INGREDIENTS

COMPONENT OR MATERIAL CHEMICAL NAMES	CAS NO.	OSHA PEL	ACGIH TLV
Ethanolamine	141-43-5	3 PPM (6 PPM STEL)	3 PPM

SECTION III. PHYSICAL DATA

BOILING POINT (°F) Approximately 212	VAPOR PRESSURE, mm Hg @ 20°C (68°F) Not Applicable
EVAPORATION RATE (ETHER = 1) Not Determined	VAPOR DENSITY (AIR = 1) @ 60-80°F Not Applicable
SOLUBILITY IN H_2O, % by wt @ 20°C (68°F) Forms stable emulsion	% VOLATILES by VOL. @ 70°F Negligible
SPECIFIC GRAVITY H_2O = 1 @ 75°F 0.955	pH (10% solution): 10.0

APPEARANCE & ODOR Clear, light-yellow liquid; citrus odor

SECTION IV. FIRE AND EXPLOSION DATA

FLASH POINT (Method Used)	FLAMMABLE EXPLOSIVE LIMITS	UPPER	LOWER
165°F (C.O.C.) 125°F (P.M.C.C.)	N.D.	N.D.	N.D.

EXTINGUISHING MEDIA
CO_2, dry powder, foam type

SPECIAL FIRE FIGHTING PROCEDURES
Treat as Class B (oil type) fire

UNUSUAL FIRE & EXPLOSION HAZARDS
None

SECTION V. EMERGENCY AND FIRST AID PROCEDURES

EYES
Immediately flush with water for several minutes. See physician immediately.

SKIN
Flush with water for several minutes. If irritation develops or persists, consult p

INHALATION
Remove to fresh air. Perform artificial respiration if needed.

INGESTION
Give large amounts of milk or water. Seek medical attention

SECTION VI - HEALTH HAZARD DATA

ACUTE EFFECTS	Eyes	INHALATION X	SKIN X	INGESTION X

HEALTH HAZARDS ACUTE AND CHRONIC Acute: Corrosive to skin, eyes, mouth, & esophagus on contact. Inhalation: May cause dizziness and drowsiness and irritation to mucous membrane. Chronic: Ethanolamine has been linked to liver & kidney damage in animals.

CARCINOGENICITY	NTP N.A.	IARC MONOGRAPHS N.A.	OSHA REGULATED

SIGNS AND SYMPTOMS OF EXPOSURE
Inhalation - May cause dizziness and drowsiness and irritation to mucous membrane.
Inhalation of high vapor concentrations may cause dizziness & drowsiness.
Skin- Redness or irritation to skin.
~~Eyes- Irritation or stinging sensation.~~

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Cuts and abrasions

EMERGENCY AND FIRST AID PROCEDURES

SEE SECTION V

SECTION VII. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Product is stable

INCOMPATIBILITY: Strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS: None known

CONDITIONS CONTRIBUTING TO POLYMERIZATION: Will not occur

SECTION VIII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Collect on absorbent material or mop up with water.

NEUTRALIZING CHEMICALS: Not Applicable

WASTE DISPOSAL METHOD: Allow used emulsions to separate, skim off top oil layer and discharge bottom layer in accordance with EPA regulations.

SECTION IX. VENTILATION AND PERSONAL PROTECTIVE EQUIPMENT

VENTILATION REQUIREMENTS
Local exhaust recommended in confined areas.

SPECIAL PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY	Maintain adequate ventilation.
EYE	Splash proof goggles, if splashing is anticipated.
GLOVES	Solvent resistant (rubber/neoprene)
OTHER CLOTHING & EQUIPMENT	Use goggles, apron, boots as required.

SECTION X. SPECIAL PRECAUTIONS INCLUDING STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING & STORAGE (& more refer to user directions when using)
Do not re-use container. Dispose of container in accordance with local, state and federal EPA regulations.

DOT SHIPPING CLASSIFICATION
Alkaline Corrosive Liquid, N.O.S. (NA 1719)

The information presented herein has been compiled from sources considered to be dependable and accurate to the best of the knowledge and belief of the Chemical Products Corporation makes no warranty, express or implied, regarding the accuracy of such data or the results to be obtained from the use thereof.

3925-003

Material Safety Data Sheet
May be used to comply with
OSHA's Hazard Communication Standard.
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (as used on label and list): General "Triplex" Dry Chemical

Note: Blank spaces are not permitted. If any item is not applicable or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name: General Fire Extinguisher Corporation	Emergency Telephone Number: 312-729-4800
Address (Number, Street, City, State, and ZIP Code): 1635 Shermer Rd.	Telephone Number for Information: 312-272-7500
Northbrook, IL 60062	Date Prepared: May 6, 1986
	Signature of Preparer (optional): William R. Warnock

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Not Applicable - Dry Chemical Fire Extinguishing Agent - Monoammonium Phosphate Base				
Contains No Hazardous Ingredients				

Section III — Physical/Chemical Characteristics

Boiling Point	NA	Specific Gravity (H_2O = 1)	1.8
Vapor Pressure (mm Hg.)	NA	Melting Point	NA
Vapor Density (AIR = 1)	NA	Evaporation Rate (Butyl Acetate = 1)	NA

Solubility in Water: Water repellant. 94% soluble.

Appearance and Odor: Fine yellow Powder

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used): NA	Flammable Limits: NA	LEL: NA	UEL: NA

Extinguishing Media: NA - Fire Extinguishing agent

Special Fire Fighting Procedures:

Unusual Fire and Explosion Hazards:

Reproduce locally

OSHA 174, Sept. 1985

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	

Incompatibility (Materials to Avoid)
Do not mix with bicarbonate base fire extinguishing agents.

Hazardous Decomposition or Byproducts
Decomposes to ammonia and phosphoric acid at high temperature.

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry: NA Inhalation? NA Skin? NA Ingestion? NA

Health Hazards (Acute and Chronic) NA

Carcinogenicity: NA NTP? IARC Monographs? OSHA Regulated?

Signs and Symptoms of Exposure NA

Medical Conditions Generally Aggravated by Exposure NA

Emergency and First Aid Procedures Wash from eyes with warm water.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
Clean up in normal manner. Use vacuum to avoid causing dust.

Waste Disposal Method
Dispose of in normal manner. Use closed container to prevent dust.

Precautions to Be Taken in Handling and Storing Protect from moisture

Other Precautions

Section VIII — Control Measures

Respiratory Protection (Specify Type)
Use particle mask, 3M 8500 Non-Toxic, when handling

Ventilation	Local Exhaust: Use to remove dust	Special
	Mechanical (General)	Other

Protective Gloves: Not needed	Eye Protection: Not needed

Other Protective Clothing or Equipment
Not needed

Work/Hygienic Practices
After handling, wash exposed skin with warm water and soap.

Marathon Oil Company

PRODUCT NAME: MARAFUEL
MARATHON MSDS NO: 120MAR001

THE FOLLOWING INFORMATION IS FURNISHED SUBJECT TO THE DISCLAIMER ON THE BOTTOM OF THIS FOR

SECTION 1 - PRODUCT IDENTIFICATION

PRODUCT NAME: MARAFUEL

SYNONYMS:
MARAFUEL; MARAFUEL DIESEL; MARAFUEL DIESEL NO. 2; MARAFUEL NO. 2; WINTERIZED DIESEL; NO. 2 MARAFUEL

MANUFACTURER / DISTRIBUTOR:
MARATHON OIL COMPANY
539 SOUTH MAIN STREET
FINDLAY, OH
45840

EMERGENCY PHONE NUMBERS:
(419) 422-2121 (MARATHON)
(800) 424-9300 (CHEMTREC)

CHEMICAL FAMILY: PETROLEUM HYDROCARBON
CHEMICAL FORMULA: MIXTURE

CAS NO: MIXTURE
PRODUCT CODE:

SECTION 2 - PHYSICAL PROPERTIES

BOILING POINT
350-660 F

MELTING POINT
N.A. F

SPECIFIC GRAVITY(H2O=1)
C.A. 0.8

% SOLUBILITY IN WATER
NEGLIGIBLE

VAPOR DENSITY(AIR=1)
4-5

VAPOR PRESSURE
1 - 10 MM HG @ 100F

PH INFORMATION: PH: N.A. AT CONC.
APPEARANCE: AMBER LIQUID

ODOR: KEROSENE ODOR

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT
130 (MIN) F

AUTOIGNITION TEMP
C.A. 494 F

EXPLOSIVE LIMITS (% BY VOLUME IN AIR)
LOWER/UPPER: 0.7/5.0

NFPA CLASSIFICATION: HEALTH: 1 FIRE: 2 REACTIVITY: 1 OTHER:

EXTINGUISHING MEDIA:

- CLASS B FIRE EXTINGUISHING MEDIA SUCH AS HALON, CO2, OR DRY CHEMICAL CAN BE USED. FIRE FIGHTING SHOULD BE ATTEMPTED ONLY BY THOSE WHO ARE ADEQUATELY TRAINED.

SPECIAL FIRE FIGHTING INSTRUCTIONS:

AVOID USE OF SOLID WATER STREAMS. AVOID EXCESSIVE WATER SPRAY APPLICATION. WATER CAN BE USED TO COOL EXPOSED SURFACES.

PRODUCT NAME: MARAFUEL
MARATHON MSDS NO: 120MAR001

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA (CON'T)

STABILITY: THE MATERIAL IS STABLE AT 70 F, 760MM PRESSURE
CONDITIONS TO AVOID:

HAZARDOUS DECOMPOSITION PRODUCTS:
CARBON MONOXIDE, ALDEHYDES, AROMATICS, OTHER HYDROCARBONS

INCOMPATIBLE MATERIALS:
OXIDIZERS

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION 4 - PRODUCT COMPOSITION AND EXPOSURE LIMITS

EXPOSURE LIMITS FOR PRODUCT:	TLV	SOURCE
MARAFUEL	NONE ESTABLISHED	

COMPONENTS:	PERCENT RANGE	TLV		SOURCE
SATURATED HYDROCARBONS (PARAFFINS & CYCLOPARAFFINS)	54.00- 85.00	0.00	( )	
UNSATURATED HYDROCARBONS (OLEFINS)	1.00- 6.00	0.00	( )	
AROMATIC HYDROCARBONS	15.00- 45.00	0.00	( )	

***
COMPLEX MIXTURE OF PARAFFINIC, CYCLOPARAFFINIC, OLEFINIC AND AROMATIC HYDROCARBONS (PREDOMINANTLY C9 THROUGH C20).
***
CONTAINS <0.5% SULFUR AND <0.01% BENZENE.

SECTION 5 - POTENTIAL HEALTH EFFECTS

EYE:

SHORT-TERM LIQUID OR VAPOR CONTACT MAY RESULT IN SLIGHT EYE IRRITATION.

SKIN:

PROLONGED OR REPEATED LIQUID CONTACT CAN CAUSE DEFATTING AND DRYING OF THE SKIN WHICH MAY PRODUCE SEVERE IRRITATION OR DERMATITIS.

INHALATION:

HIGH VAPOR CONCENTRATIONS MAY PRODUCE HEADACHE, DIZZINESS, VERTIGO, AND ANESTHETIC STUPOR.

INGESTION:

INGESTION MAY RESULT IN NAUSEA, VOMITING, DIARRHEA AND RESTLESSNESS. ASPIRATION (BREATHING) OF VOMITUS INTO THE LUNGS MUST BE AVOIDED AS EVEN SMALL QUANTITIES IN THE LUNGS CAN PRODUCE CHEMICAL PNEUMONITIS AND PULMONARY EDEMA/HEMORRHAGE.

SECTION 5 - POTENTIAL HEALTH EFFECTS (CON'T)

ADDITIONAL TOXICITY INFORMATION:

LIFETIME SKIN PAINTING STUDIES IN ANIMALS WITH SIMILAR DISTILLATE FUELS HAVE PRODUCED WEAK CARCINOGENIC ACTIVITY FOLLOWING PROLONGED AND REPEATED EXPOSURE. REPEATED DERMAL APPLICATION HAS PRODUCED SEVERE IRRITATION AND SYSTEMIC TOXICITY IN SUBACUTE TOXICITY STUDIES. SOME COMPONENTS OF DISTILLATE FUELS, I.E., PARAFFINS AND OLEFINS, HAVE BEEN SHOWN TO PRODUCE A SPECIES SPECIFIC, SEX HORMONAL DEPENDENT KIDNEY LESION IN MALE RATS FROM REPEATED ORAL OR INHALATION EXPOSURE. NO. 2 DISTILLATE FUELS WERE FOUND TO BE POSITIVE IN SOME MUTAGENICITY TESTS WHILE NEGATIVE IN OTHERS. THE EXACT RELATIONSHIP BETWEEN THESE RESULTS AND HUMAN HEALTH IS NOT KNOWN. CHRONIC HUMAN HEALTH EFFECTS WOULD NOT BE EXPECTED AS LONG AS GOOD PERSONAL HYGIENE AND PROPER SAFETY PRECAUTIONS ARE PRACTICED.

LIFETIME INHALATION STUDIES INDICATE THAT WHOLE DIESEL FUEL EXHAUST HAS PRODUCED TUMORS IN RATS AND MICE.

EMERGENCY FIRST AID PROCEDURES

EYE:

FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. IF SYMPTOMS OR IRRITATION OCCUR, CALL A PHYSICIAN.

SKIN:

WASH WITH SOAP AND LARGE AMOUNTS OF WATER. REMOVE CONTAMINATED CLOTHING. IF SYMPTOMS OR IRRITATION OCCUR, CALL A PHYSICIAN.

INHALATION:

MOVE PERSON TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. CALL A PHYSICIAN.

INGESTION:

DO NOT INDUCE VOMITING. DO NOT GIVE LIQUIDS. IMMEDIATELY CALL A PHYSICIAN.

SECTION 6 - SPECIAL PROTECTION INFORMATION

VENTILATION:

LOCAL OR GENERAL EXHAUST REQUIRED WHEN SPRAYING OR USING AT ELEVATED TEMPERATURES.

PRODUCT NAME: MARAFUEL
MARATHON MSDS NO: 120MAR001

SECTION 6 - SPECIAL PROTECTION INFORMATION (CON'T)

RESPIRATORY PROTECTION:

APPROVED ORGANIC VAPOR CHEMICAL CARTRIDGE OR SUPPLIED AIR RESPIRATORS SHOULD BE WORN WHEN EXCESSIVE VAPORS OR MISTS ARE GENERATED. OBSERVE RESPIRATOR PROTECTION FACTOR CRITERIA CITED IN ANSI Z88.2 (1980). SELF-CONTAINED BREATHING APPARATUS SHOULD BE USED FOR FIRE FIGHTING.

PROTECTIVE GLOVES:

NEOPRENE, NITRILE OR PVA GLOVES TO PREVENT SKIN CONTACT.

OTHER PROTECTIVE EQUIPMENT:

USE MECHANICAL VENTILATION EQUIPMENT THAT IS EXPLOSION-PROOF.

SECTION 7 - SPILL OR LEAK PROCEDURES

ENVIRONMENTAL EFFECTS:

LIQUID CAN BE TOXIC TO AQUATIC LIFE.

STEPS TO BE TAKEN IN CASE OF SPILL, LEAK OR RELEASE:

KEEP PUBLIC AWAY. SHUT OFF SOURCE OF LEAK IF POSSIBLE TO DO SO WITHOUT HAZARD. ELIMINATE ALL IGNITION SOURCES. ADVISE NATIONAL RESPONSE CENTER (800-424-8802) IF PRODUCT HAS ENTERED A WATER COURSE. ADVISE LOCAL AND STATE EMERGENCY SERVICES AGENCIES, IF APPROPRIATE. CONTAIN LIQUID WITH SAND OR SOIL. RECOVER AND RETURN FREE LIQUID TO SOURCE. USE SUITABLE SORBENTS TO CLEAN UP RESIDUAL LIQUIDS.

WASTE DISPOSAL METHOD:

DISPOSE OF CLEANUP MATERIALS IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION 8 - HANDLING AND STORAGE PRECAUTIONS

PRODUCT SHOULD BE HANDLED AND STORED IN ACCORDANCE WITH INDUSTRY ACCEPTED PRACTICES. IN THE ABSENCE OF SPECIFIC LOCAL CODE REQUIREMENTS, NFPA OR OSHA REQUIREMENTS SHOULD BE FOLLOWED. USE APPROPRIATE GROUNDING AND BONDING PRACTICES. STORE IN PROPERLY CLOSED CONTAINERS THAT ARE APPROPRIATELY LABELED. DO NOT EXPOSE TO HEAT, OPEN FLAME, OXIDIZERS OR OTHER SOURCES OF IGNITION. AVOID SKIN CONTACT. EXERCISE GOOD PERSONAL HYGIENE INCLUDING REMOVAL OF SOILED CLOTHING AND PROMPT WASHING WITH SOAP AND WATER.

PRODUCT NAME: MARAFUEL
MARATHON MSDS NO: 120MAR001

SECTION 9 - HAZARD WARNING

WARNING!

COMBUSTIBLE LIQUID
HARMFUL OR FATAL IF SWALLOWED
PRODUCES SKIN IRRITATION UPON PROLONGED OR REPEATED CONTACT

SECTION 10 - COMMENTS

SECTION 11 - REGULATORY INFORMATION

SARA TITLE III/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 - SECTIONS 302, 304, 311, 312 AND 313.

THE FOLLOWING REGULATIONS APPLY TO THIS PRODUCT:

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS:

40 CFR PART 370 (52 FR 38344 - OCTOBER 15, 1987).

DEPENDING ON LOCAL, STATE, AND FEDERAL REGULATIONS, MATERIAL SAFETY DATA SHEETS (MSDS'S) OR LISTS OF MSDS'S (PRODUCT NAMES) MAY BE REQUIRED TO BE SUBMITTED TO THE STATE EMERGENCY RESPONSE COMMISSION, LOCAL EMERGENCY PLANNING COMMITTEE, AND LOCAL FIRE DEPARTMENT IF YOU HAVE:

10,000 POUNDS OR MORE OF AN OSHA HAZARDOUS SUBSTANCE# OR
500 POUNDS OR THE THRESHOLD PLANNING QUANTITY WHICHEVER IS LESS, OF AN EXTREMELY HAZARDOUS SUBSTANCE.

REPORTABLE QUANTITY LEVELS CAN VARY FROM STATE TO STATE AND YEAR TO YEAR DEPENDING ON APPLICABLE STATE AND/OR FEDERAL REGULATIONS.

THIS PRODUCT IS COVERED UNDER THE CRITERIA DEFINED IN OSHA'S HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200 (52 FR 31852 - AUGUST 24, 1987) AND SHOULD BE REPORTED UNDER THE FOLLOWING EPA HAZARD CATEGORIES:

XX IMMEDIATE (ACUTE) HEALTH HAZARD
DELAYED (CHRONIC) HEALTH HAZARD
XX FIRE HAZARD
SUDDEN RELEASE OF PRESSURE HAZARD
REACTIVE HAZARD

DEPARTMENT OF TRANSPORTATION:

49 CFR 172.101 AS REVISED ON OCTOBER 1, 1988.

PROPER SHIPPING NAME -- FUEL OIL, NO. 2
DOT CLASSIFICATION -- COMBUSTIBLE LIQUID
DOT IDENTIFICATION NUMBER -- NA 1993

SECTION 12 - REGULATIONS/COMMENTS CONTINUED

PRODUCT NAME: MARAFUEL
MARATHON MSDS NO: 120MAR001

INFORMATION SUPPLIED BY: COORDINATOR TOXICOLOGY AND PRODUCT SAFETY
CRAIG M. PARKER PHONE: (419)421-3070

MSDS DATE: 05/16/90 DATE OF PREVIOUS MSDS: 01/04/90

*** DISCLAIMER ***

THIS INFORMATION RELATES ONLY TO THE SPECIFIC MATERIAL DESIGNATED AND MAY NOT BE VALID I SUCH MATERIAL USED IN COMBINATION WITH ANY OTHER MATERIALS OR IN ANY PROCESS. SUCH INFO MATION IS, TO THE BEST OF MARATHON OIL COMPANY'S KNOWLEDGE AND BELIEF, ACCURATE AN RELIABLE AS OF THE DATE INDICATED. HOWEVER, NO REPRESENTATION, WARRANTY OR GUARANTEE IS MADE AS TO ITS ACCURACY RELIABILITY OR COMPLETENESS. IT IS THE USER'S RESPONSIBILITY TO SATISFY HIMSELF AS TO THE SUITABLENESS AND COMPLETENESS OF SUCH INFORMATION FOR HIS OWN PARTICULAR USE.

T.Baker
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

SAFETY SHEET

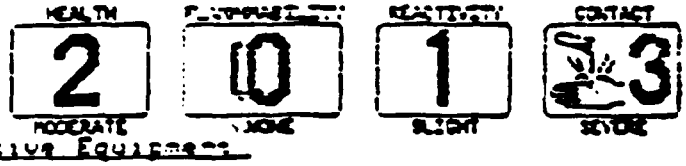
[illegible] -01 Zinc, 1000 ppm (0.100% w/v) Pa
Effective: 11/14/85 Issued: 11/1

SECTION II - PRODUCT IDENTIFICATION

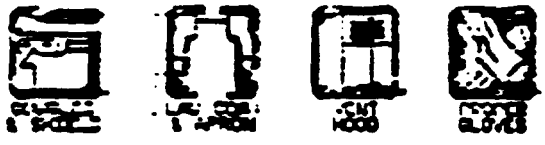
Product Name: Zinc, 1000 ppm (0.100% w/v)
Formula: Zn
Formula Wt: 65.40
CAS No.: 00000-00-0
Product Codes: 6946

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment



Precautionary Label Statements

DANGER!
CAUSES BURNS
HARMFUL IF SWALLOWED

Do not get in eyes, on skin, on clothing.
Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION III - HAZARDOUS COMPONENTS

Component	%	CAS
Zinc	0-1	7440-6
Nitric Acid (0.3 Molar)	1-2	7697-3

SECTION III - PHYSICAL DATA

Boiling Point: N/A Vapor Pressure(mmHg): N/
Melting Point: N/A Vapor Density(air=1): N/

Continued on Page: 2

SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: N/A
(H_2O=1)

Evaporation Rate: N/A
(Butyl Acetate=1)

Solubility(H_2O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Clear, colorless solution.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A NFPA 704M Rating: 3-0-0

Fire Extinguishing Media
Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures
Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode

Toxic Gases Produced
nitrogen oxides

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure
Vapors may be irritating to skin, eyes, and mucous membranes.
Liquid may cause burns to skin and eyes.
Ingestion may cause irritation and burning to mouth and stomach.

Emergency and First Aid Procedures
If swallowed, do NOT induce vomiting; if conscious, give water, milk, or milk of magnesia.
In case of contact, immediately flush eyes or skin with plenty of water fo at least 15 minutes.

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: none documented

Incompatibles: strong bases

Decomposition Products: oxides of nitrogen

Continued on Page: 3

[illegible] -01 Zinc, 1000 ppm (0.100% w/v) Page
Effective: 11/14/85 Issued: 11/14/

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. St leak if you can do so without risk. Ventilate area. Neutralize spill wi soda ash or lime. With clean shovel, carefully place material into clear dry container and cover; remove from area. Flush spill area with water.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D002 (Corrosive Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Eye - Skin Protection: This is a laboratory-use product for which no industrial protective equipment has been designated.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAFE-T-DATA™ Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Nitric acid, 40% or less solution
Hazard Class	Corrosive material (liquid)
UN/NA	NA1760
Labels	CORROSIVE
Reportable Quantity	1000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Nitric acid, solution
Hazard Class	8
UN/NA	UN2031
Labels	CORROSIVE

N.A. = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for

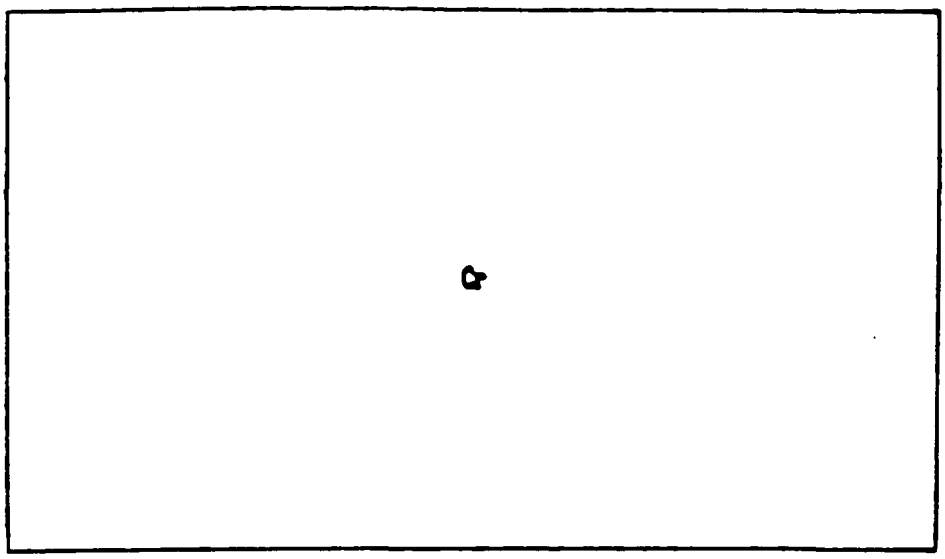
Continued on Page: 4

the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

-- LAST PAGE --

Sigma-Aldrich Corporation
1001 West Saint Paul Ave. Milwaukee, WI 53233 USA

	Sigma	Aldrich
Emergency Contact USA/Canada	800-325-5832	800-231-8327
Outside USA/Canada	314-771-5765	414-273-3850



---------- IDENTIFICATION ----------

PRODUCT #: 37484-9 NAME: CHROMIUM, CHIPS, CA. 1MM THICK, 99.995%
CAS #: 7440-47-3
MF: CR

SYNONYMS

EUGENOL N-METHYLCARBAMATE * N-METHYLCARBAMATE OF EUGENOL * PHENOL, 2-METHOXY-4-(2-PROPENYL)-, METHYLCARBAMATE (9CI) *

---------- TOXICITY HAZARDS ----------

RTECS NO: FB4200000

CARBAMIC ACID, METHYL-, 4-ALLYL-2-METHOXYPHENYL ESTER

TOXICITY DATA

ORL-RAT LD50:250 MG/KG JEENAI 60,1417,67

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

---------- HEALTH HAZARD DATA ----------

ACUTE EFFECTS

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
CAUSES EYE AND SKIN IRRITATION.
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.

DAMAGE TO THE LIVER
DAMAGE TO THE KIDNEYS

ERONIC EFFECTS
POSSIBLE CARCINOGEN.

IRST AID
CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.

---------- PHYSICAL DATA ----------

SPECIFIC GRAVITY: 7.140

PPEARANCE AND ODOR
GREY CHIPS

---------- FIRE AND EXPLOSION HAZARD DATA ----------

XTINGUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE TO SURROUNDING FIRE CONDITIONS.

PECIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

UAL FIRE AND EXPLOSIONS HAZARDS
MITS TOXIC FUMES UNDER FIRE CONDITIONS.

---------- REACTIVITY DATA ----------

NCOMPATIBILITIES
STRONG ACIDS
STRONG OXIDIZING AGENTS

AZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
NATURE OF DECOMPOSITION PRODUCTS NOT KNOWN.

---------- SPILL OR LEAK PROCEDURES ----------

TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH DRY LIME OR SODA ASH, PICK UP, KEEP IN A CLOSED CONTAINER AND HOLD FOR WASTE DISPOSAL.
SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

E DISPOSAL METHOD
MATERIAL IN THE ELEMENTAL STATE SHOULD BE RECOVERED FOR REUSE OR RECYCLING.
OBSERVE ALL FEDERAL, STATE, AND LOCAL LAWS.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
USE ONLY IN A CHEMICAL FUME HOOD.
SAFETY SHOWER AND EYE BATH.
DO NOT BREATHE DUST.
AVOID ALL CONTACT.
WASH THOROUGHLY AFTER HANDLING.
IRRITANT.
POSSIBLE CARCINOGEN.
TOXIC.
KEEP TIGHTLY CLOSED.

ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA ALDRICH SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Sheet No. 723
Nickel Metal

Issued: 8/90

Section 1. Material Identification

Nickel (Ni) Description: Found in ores in combination with sulphur, oxygen, antimony, arsenic, and/or silica. The Orford (sodium sulfide and electrolysis) and the Mond (nickel carbonyl) processes are used to refine nickel. Used in electroplating, casting operations for machine parts, manufacturing acid-resisting and magnetic alloys and tapes, synthesizing acrylic esters; in surgical and dental prostheses, coinage, catalytic gasification of coal, paint pigments, Ni-Cd batteries, ceramics and glass; and as a catalyst in hydrogenation of fats and oils.

Other Designations: CAS No. 7440-02-0, Raney alloy, Raney nickel.*

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*™ for a suppliers list.

Cautions: Nickel is an eye, skin, and respiratory tract irritant. *Chronic inhalation of nickel dust or fumes may cause cancer of the lungs and nasal passages. Nickel powder (Raney nickel) is a dangerous fire hazard.*

		NFPA	Genium
R	0		
I	3		
S	2		
K	1		

catalyst	metal
HMIS	HMIS
H 2	H 2
F 4	F 1
R 0	R 0
PPG†	PPG†

† Sec. 8

* Raney nickel is prepared by leaching (with 25% caustic soda solution) aluminum from an alloy of 50% aluminum and 50% nickel. It is used as a catalyst for hydrogenation. Raney nickel, a silvery gray metal powder, is a dangerous fire risk and ignites spontaneously in air (Sec. 4). Nickel catalysts cause many industrial accidents.

Section 2. Ingredients and Occupational Exposure Limits

Nickel, ca 100%

1989 OSHA PEL	1989-90 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data*
8-hr TWA: 1 mg/m³	TLV-TWA: 1 mg/m³	0.015 mg/m³	Dog, intravenous, LD_{Lo}: 10 mg/kg Guinea pig, oral, LD_{Lo}: 5 mg/kg Rat, implant, TD_{Lo}: 250 mg/kg

* See NIOSH, *RTECS* (QR5950000), for additional mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 4946 °F (2730 °C)
Melting Point: 2651 °F (1455 °C)
Vapor Pressure: 1 mm at 3290 °F (1810 °C)
Atomic Weight: 58.71
Density: 8.90 at 25 °C
Water Solubility: Insoluble

Appearance and Odor: A silvery-white, hard, malleable and ductile metal.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Smother with suitable dry powder or use large amounts of water.

Unusual Fire or Explosion Hazards: Nickel is combustible as dust or powder. Raney nickel ignites spontaneously in air. Nickel carbonyl (*MSDS Collection*, No. 226), a highly toxic substance, may form under fire conditions.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since nickel dust or powder is toxic if inhaled, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Nickel is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Nickel can react violently with fluorine, ammonium nitrate, hydrogen + dioxane, performic acid, selenium, sulfur, ammonia, hydrazine, phosphorus, and titanium + potassium chlorate. Nickel is also incompatible with oxidants. Raney nickel catalysts may initiate hazardous reactions with sulfur compounds, *p*-dioxane, hydrogen, hydrogen + oxygen, ethylene + aluminum chloride, magnesium silicate, methanol, and organic solvents + heat.

Conditions to Avoid: Avoid incompatibilities.

Hazardous Products of Decomposition: Thermal oxidative decomposition of nickel can produce highly toxic nickel carbonyl

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Section 6. Health Hazard Data

Carcinogenicity: The IARC and NTP classify nickel as, respectively, a human carcinogen (Group 1) and an anticipated human carcinogen.
Summary of Risks: Nickel dust or fume is a respiratory irritant; those with chronic exposure may cause nasal or lung cancer in humans. The average latency period for the induction of these cancers appears to be about 25 yr (within a 4- to 51-yr range). Experimental studies show nickel also has neoplastigenic, tumorigenic, and teratogenic effects in laboratory animals. Hypersensitivity to nickel is common and can cause conjunctivitis, allergic contact dermatitis, and asthma. The allergic contact dermatitis ("nickel-itch," a pink papular erythema with pustulation and alteration) usually clears within one week, but sensitization is permanent.
Medical Conditions Aggravated by Long-Term Exposure: Chronic pulmonary, upper respiratory tract, and skin disorders. Carcinomas of the paranasal sinuses, larynx, and lung may also develop.
Target Organs: Nasal cavities, lungs, skin.
Primary Entry Routes: Inhalation, dermal contact, and ingestion.
Acute Effects: Exposure to nickel fumes can cause upper respiratory tract irritation (with nonproductive cough, rapid breathing, dyspnea, chest tightness), metal fume fever (chills, fever, flu-like symptoms), asthma, inflammation of the lungs (noninfectious pneumonia), eye irritation (conjunctivitis), nausea, vomiting, and abdominal pain. Dermal exposure causes "nickel itch." Ingesting large doses causes nausea, vomiting, and diarrhea.
Chronic Effects: Prolonged or repeated contact can cause nickel sensitization. Symptoms of sensitization include nickel dermatitis with eczematous skin and lichenification (hardened and leathery skin). Chronic inhalation exposure can cause chronic pulmonary irritation, chronic thickening of the mucous membranes of the nose, nasal sinusitis, anosmia (loss or impairment of the sense of smell), and perforation of the nasal septum. Chronic exposure to dust and fumes may cause carcinoma of paranasal sinuses, larynx, and lung.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Since oral toxicity for elemental nickel is low, inducing vomiting is seldom necessary. In cases of severe vomiting or diarrhea, treat for fluid replacement.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: Chronic exposure to nickel dust may cause *eosinophilic pneumonitis* (Loeffler's syndrome) which responds well to systemic corticosteroids. There are cases of host rejection of nickel-containing prostheses after development of nickel sensitivity.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and dermal contact. Avoid dust generation. Using nonsparking tools, carefully scoop spilled material into appropriate containers for reclamation or disposal. After completing material pickup, wash spill site. Do not release to sewers or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

RCRA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z2-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency and nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL, ACGIH TLV, and NIOSH REL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[1,2]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work area. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from incompatible materials (Sec. 2). Protect against physical damage. Store Raney nickel under water, grease or water in tightly closed containers away from heat or ignition sources, acids, caustics, and oxidizing materials.
Engineering Controls: Minimize all possible exposures to potential carcinogens. Avoid vapor inhalation and dermal contact. Use only with appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures.
Other Precautions: Provide preplacement and periodic medical examinations that emphasize the skin, nasal cavities, and lungs, including a 14" x 17" chest roentgenogram and urine nickel determinations.

Transportation Data (49 CFR 172.102)
DOT Shipping Name: Nickel catalyst, wetted with not less than 40% water or other suitable liquid, by weight, finely divided, activated, or spent
DOT Hazard Class: 4.2
ID No.: UN1378
IMO Label: Spontaneously combustible
IMDG Packaging Group: II

MSDS Collection References: 26, 38, 73, 84, 85, 88, 89, 97, 98, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 140, 142, 143
Prepared by: MJ Allison, BS, Industrial Hygiene Review: [illegible] Wilson, CIH, Medical Review: MJ Hardies, MD; Edited by: JR Starr, MS

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GENIUM PUBLISHING CORP.

MERCURY
(Revision C)
Issued: September 1981
Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: MERCURY

Description (Origin/Uses): Used in barometers, thermometers, hydrometers, and pyrometers; in mercury arc lamps producing ultraviolet rays; in switches and fluorescent lamps; as a catalyst in oxidations of organic compounds; in alloys; in explosives; and for extracting gold and silver from ore.

Other Designations: Colloidal Mercury; Metallic Mercury; Quicksilver; Hg; Hydrargyrum;

CAS No. 7439-97-6

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

Comments: Inorganic and organic mercury compounds are highly toxic, as is pure mercury.

Genium

HMIS
H 3
F 0
R 0
PPG*
*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Mercury, CAS No. 7439-97-6	Ca 100	OSHA PEL Ceiling: 1 mg per 10 m³ ACGIH TLV (Skin*), 1987-88 TLV-TWA: 0.05 mg/m³ as Hg (Mercury Vapor) Toxicity Data** Rabbit, Inhalation, LC_{10}: 29 mg/m³ (30 Hrs)

*Mercury can be absorbed through intact skin, which contributes to overall exposure.

**See NIOSH, *RTECS* (OV4550000), for additional data with references to reproductive, mutagenic, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 673°F (357°C)

Specific Gravity (H_2O = 1): 13.546 at 68°F (20°C)

Vapor Pressure: 0.0018 Torr at 77°F (25°C)

Water Solubility (%): Insoluble

Molecular Weight: 201 Grams/Mole

Melting Point: -37.93°F (-38.85°C)

Appearance and Odor: A silver, heavy liquid; odorless. Danger: Mercury vapor has no warning properties.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
•	•	% by Volume	•	•

Extinguishing Media: *Mercury does not burn. Use extinguishing agents that will put out the surrounding fire.

Unusual Fire or Explosion Hazards: When exposed to the high temperatures that occur during a fire, mercury can vaporize to form extremely toxic fumes.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Mercury is stable in closed containers at room temperature under normal storage and handling conditions. It cannot undergo hazardous polymerization.

Chemical Incompatibilities: Hazardous reactions involving mercury and acetylene, ammonia, boron phosphodiiodide, chlorine, chlorine dioxide, methyl azide, sodium carbide, nitric acid, oleum, and sulfuric acid are reported (Genium ref. 84).

Conditions to Avoid: Do not expose mercury to incompatible chemicals.

Hazardous Products of Decomposition: Extremely toxic mercury metal fumes are likely to be produced during fires.

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[illegible]

SECTION 6. HEALTH HAZARD INFORMATION

[illegible] as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Mercury is very toxic due to its liquid and [illegible] properties. It is a slowly cumulative poison that concentrates in the brain, kidneys, and liver. It is very hazardous when spilled or heated. Mercury and its vapor are rapidly absorbed by the membranes lining the respiratory tract, the gastrointestinal (GI) tract, and the skin. Mercury is a teratogen (causes physical defects in embryos). **Medical Conditions Aggravated by Long-Term Exposure:** Preexisting problems of the target organs can be worsened. Provide preplacement and periodic medical exams emphasizing the target organs. **Target Organs:** Skin, eyes, respiratory system, central nervous system (CNS), kidneys. **Primary Entry:** Skin absorption/contact, inhalation. **Acute Effects:** Erosion of the respiratory GI tracts, nausea, vomiting, bloody diarrhea, shock, headache, metallic taste. Inhalation of high concentrations for short periods can cause pneumonitis, chest pain, dyspnea, coughing, stomatitis, gingivitis, and salivation. **Chronic Effects:** Tremors, emotional problems, loss of concentration, depression, drowsiness, fatigue, insomnia, loss of memory, kidney problems, eye lesions, vision disturbances, sore mouth and throat, problems with the sense of taste or smell, nosebleeds, nasal inflammation, loss of weight or appetite, poor hand-eye coordination, awkwardness, and unsteadiness, as well as dermatitis. **FIRST AID: Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Immediately wash the affected area with soap and water because of the increased exposure from skin absorption. **Inhalation.** Remove exposed person to fresh air; restore and/or support his or her breathing as needed. Have medical personnel administer oxygen to treat the chemical pneumonitis that may develop. **Ingestion.** Never give anything by mouth to someone who is unconscious or convulsing. Note to physician: If indicated by degree of ingestion, saline cathartics and charcoal should be used. Chelation therapy with d-penicillamine may also be indicated.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. Treatment of chronic mercury poisoning requires expert medical care. At the first signs, immediately remove the exposed person from further exposure and have him or her examined and treated by a physician trained in occupational mercury poisoning.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, restrict access to the spill area to necessary personnel, and provide adequate ventilation. Clean up spills promptly. Specialized equipment and/or techniques may be required to safely deal with large mercury spills; if large quantities of mercury are used in the workplace, detailed, prior spill-management planning is recommended. Collect spilled mercury by using a suction pump and an aspirator bottle with a long capillary tube. For finely divided mercury in inaccessible cracks, corners, etc., treatment with calcium polysulfide and excess sulfur is recommended to convert the mercury globules into mercury sulfide. Vacuum cleaners may be used if they are equipped with specially designed mercury-absorbent exhaust filters. Collect the mercury into tightly sealed containers for later disposal or reclamation. Cleanup personnel must use the recommended personal protective equipment (see sect. 8).
Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Do not pour mercury down a drain. Mercury is very harmful to the environment. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Air Contaminant (29 CFR 19010.1000 Subpart Z)

EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste No. U151
CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg)*

*Per the Clean Water Act, § 407 (a); Clean Air Act, § 112; and Resource Conservation and Recovery Act, § 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of mercury may occur, wear a full face shield or splash guard. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent any contact with mercury and the skin.
Ventilation: Install and operate general and local ventilation systems powerful enough to continuously maintain airborne levels of mercury below the OSHA PEL standard cited in section 2.
Safety Stations: Make emergency eyewash stations, washing facilities, and safety/quick-drench showers available in work areas.
Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean mercury from shoes and equipment. Separate work and street clothes; store work clothes in special lockers and always shower before changing to street clothes.
Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store mercury in a cool, dry, well-ventilated area in tightly closed unbreakable polyethylene containers. Protect these containers from physical damage.
Special Handling/Storage: Construct storage areas to have smooth, hard, nonporous floors with no cracks or spaces so that spilled mercury globules do not form in inaccessible areas.
Comments: Mercury evaporates slowly, but if it is spilled it can form many tiny globules that evaporate much faster than a single pool of it will. In an unventilated area, significant concentration of mercury vapor can develop from this enhanced evaporation effect. This poisonous vapor is particularly hazardous if breathed over a long period of time, so spills or releases of mercury require very meticulous cleaning procedures.
Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Mercury, Metal	**DOT Label:** None	**IMO Class:** 8
DOT Hazard Class: ORM-B	**DOT ID No.** NA2809	**IMO Label:** Corrosive

References: 1, 2, 8, 26, 38, 83-84, 100.

Integrated as to the accuracy of information herein for purchaser's purposes are reasonably purchaser's responsibility. Therefore, while gt reasonable care has been taken in the preparation of this information, Genium Publishing Corp. assumes no responsibility for the accuracy and assumes no responsibility [illegible] or applicability of this information to purchaser's intended purpose or any use [illegible]

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

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J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

N2820 -02 Nickel, 1000 ppm (0.100% w/v)
Effective: 09/03/86 Issued: 09/

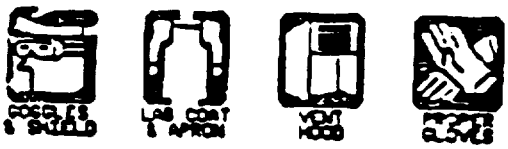
SECTION I - PRODUCT IDENTIFICATION

Product Name: Nickel, 1000 ppm (0.100% w/v)
Formula: Ni in HNO_3
Formula Wt: 58.70
CAS No.: 00000-00-0
Product Codes: 6936

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

Laboratory Protective Equipment



Precautionary Label Statements

POISON! DANGER!
HARMFUL IF SWALLOWED OR INHALED
CAUSES IRRITATION AND MAY CAUSE BURNS.
CAUTION: CONTAINS NICKEL, CANCER HAZARD.
EXCEPTIONAL HEALTH AND CONTACT HAZARDS - READ MATERIAL SAFETY DATA SHEET
Do not get in eyes, on skin, on clothing.
Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS
Nickel	0-1	7440-0
Nitric Acid (0.3 Molar)	1-2	7697-3

SECTION III - PHYSICAL DATA

Boiling Point: 100°C (212°F) Vapor Pressure(mmHg): N/
Melting Point: 0°C (32°F) Vapor Density(air=1): N/

Continued on Page: 2

SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 1.00 (H_2O=1)

Evaporation Rate: N/A (Butyl Acetate=1)

Solubility(H_2O): Complete (in all proportions)

% Volatiles by Volume: 100

Appearance & Odor: Clear, pale green solution.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

NFPA 704M Rating: 3-0-0

Flammable Limits: Upper - N/A % Lower - N/A %

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures:

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

Toxic Gases Produced

nitrogen oxides

SECTION V - HEALTH HAZARD DATA

This substance is listed as NTP anticipated human carcinogen, IARC probable human carcinogen (Groups 2A and 2B).

Threshold Limit Value (TLV/TWA): 1 mg/m^3 (ppm)

Permissible Exposure Limit (PEL): 1 mg/m^3 (ppm)

Carcinogenicity: NTP: Yes IARC: Yes Z List: No OSHA reg: No

Effects of Overexposure

Vapors may be irritating to skin, eyes, and mucous membranes.
Contact with skin or eyes may cause severe irritation or burns.
Ingestion may cause irritation and burning to mouth and stomach.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

Ingestion, inhalation, eye contact, skin contact

Continued on Page: 3

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Nitric acid, 40% or less solution
Hazard Class	Corrosive material (liquid)
ID	NA1760
Labels	CORROSIVE
Reportable Quantity	1000 LBS

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Nitric acid, solution
Hazard Class	8
ID	UN2031
Labels	CORROSIVE

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

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(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 713
Lead (Inorganic)

Issued: 8/90

Section 1. Material Identification

Lead (Inorganic) (Pb) Description: Exists widely throughout the world in a number of ores. Its main commercial source is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, drossing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (bearings, pipes, casting); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a construction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation, and for x-ray and atomic radiation protection.
Other Designations: CAS No. 7439-92-1, lead cadmium; lead salts, inorganic; metallic lead; plumbum.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*™ for a suppliers list.

R	0	Genium
I	4	
S	-	
K	0	

HMIS
H 3
F 1
R 0
PPG*
* See 8

Cautions: *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affected organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure.

Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

1989 OSHA PELs (Lead, inorganic compounds)
8-hr TWA: 50 μg/m³
Action Level TWA*: 30 μg/m³

29 CFR 1910.1025 Lead Standard
Blood Lead Level: 40 μg/100 g

1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts)
TLV-TWA: 150 μg/m³

1988 NIOSH REL
10-hr TWA: <100 μg/m³

1985-86 Toxicity Data†
Human, inhalation, TC_{Lo}: 10 μg/m³ affects gastrointestinal tract and liver
Human, oral, TD_{Lo}: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, TD_{Lo}: 790 mg/kg affects multigeneration reproduction

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *RTECS* (OF7525000), for additional mutagenic, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 3164 °F (1740 °C)
Melting Point: 621.3 °F (327.4 °C)
Vapor Pressure: 1.77 mm Hg at 1832 °F (1000 °C)
Viscosity: 3.2 cp at 621.3 °F (327.4 °C)
Molecular Weight: 207.20
Specific Gravity (20 °C/4 °C): 11.34
Water Solubility: Relatively insoluble in hot or cold water*
Appearance and Odor: Bluish-white, silvery, gray, very soft metal.

* Lead dissolves more easily at a low pH.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Unusual Fire or Explosion Hazards: Flammable and moderately explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Mixtures of hydrogen peroxide + nitric acid explode on contact with lead. Lead is incompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
Conditions to Avoid: Rubber gloves containing lead may ignite in nitric acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

Section 6. Health Hazard Data

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
Summary of Risks: Lead is a potent, systemic poison that affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system. The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead can be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
Medical Conditions Aggravated by Exposure: Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood pressure can aggravate cardiovascular disease.

Continue on next page

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Section 6. Health Hazard Data, *continued*

Target Organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.
Chronic Effects: Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival (gum) tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irritability, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often, ankle extensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if any, symptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men, and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage or developmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by severe headache, convulsions, coma, delirium, and possibly death.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Consult a physician if any health complaints develop.
Inhalation: Remove exposed person to fresh air and support breathing as needed. Consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with Ipecac syrup. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic anemia and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and gingival lead line. Use Ca-EDTA to treat poison, but *never* chelate prophylactically. Consult an occupational physician or toxicologist.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dusts or fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formation of dust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled material into closed containers for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33, Appendix II—EP Toxicity Test Procedures)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.
Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[100]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially washing hands before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all incompatible materials, direct sunlight, and heat and ignition sources.
Engineering Controls: Educate worker about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid inhalation of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate and launder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures. For a variety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.
Other Precautions: Provide preplacement and periodic medical examinations which emphasize blood, nervous system, gastrointestinal tract, and kidneys, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, allergies, smoking history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for medical surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of employment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead absorption level. Maintain worker PbBs at or below 40 µg/100 g of whole blood. To minimize adverse reproductive health effects to parents and developing fetus, maintain the PbBs of workers intending to have children below 30 µg/100 g. Elevated PbBs increase your risk of disease, and the longer you have elevated PbBs, the greater your chance of substantial permanent damage.

Transportation Data (49 CFR 172.102)
DOT Shipping Name: Lead compounds, soluble, n.o.s.
DOT Hazard Class: 6.1
UN No.: UN2291
IMO Label: St. Andrews Cross (X, Stow away from foodstuffs)
IMDG Packaging Group: III

MSDS Collection References: 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: MJ Upfal, MD, MPH; Edited by: JR Stuart, MS

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Schenectady, NY 12303-1836 USA
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Sheet No. 148
Manganese Metal/Powder

Issued: 9/85 Revision: A. 11/89

Section 1. Material Identification

30

Manganese Metal/Powder Description: A metallic element associated with iron ores such as pyrolusite, manganite, psilomelane, and rhodochrosite found mainly in open-hearth slags. Manganese is obtained from the reduction of the oxide with aluminum or carbon. Pure manganese is obtained electrically from chloride or sulfate solution. Used in ferroalloys (steel manufacture); for wagon buffers, rock crushers, railway points and crossings; as a purifying and scavenging agent in metal production; in the manufacture of aluminum by Toth process, dry-cell batteries, glass, welding rods, inks, rubber and wood preservatives, paints, and ceramics; high-purity salt for various chemical uses.
Other Designations: Manganese; colloidal manganese; magnacat; Mn; CAS No. 7439-96-5.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R 1
I 3
S 1
K -

Genium

HMIS
H 3
F 2
R 1
PPE*
* See 8

Section 2. Ingredients and Occupational Exposure Limits

Manganese, ca 100%

OSHA PEL
Ceiling limit: 5 mg/m³ (manganese compounds, as Mn)

ACGIH TLVs, 1988-89
TLV-TWA: 5 mg/m³ (dust and compounds)
TLV-TWA: 1 mg/m³ (fume)
STEL: 3 mg/m³ (fume)

NIOSH REL, 1987
Ceiling limit: 5 mg/m³ (manganese and compounds, as Mn)
Toxicity Data*
Human, inhalation, TC_{Lo}: 2300 µg/m³

* See NIOSH, *RTECS* (OO9275000), for additional data with references to mutagenic and tumorigenic effects.

Section 3. Physical Data

Boiling Point: 3803 °F (2095 °C)*
Melting Point: 2300 °F (1260 °C)
Vapor Pressure: 1 mm Hg at 2358 °F (1292 °C)

Atomic Weight: 54.94
Specific Gravity (H_2O = 1 at 39 °F (4 °C)): 7.20
Water Solubility: Impure Mn decomposes slowly

Appearance and Odor: Reddish-grey or silvery powder or metal. No odor.

* Other sources (Genium refs. 7, 89, and 126) give 3807 °F (2097 °C), 3564 °F (1962 °C), and 3452 °F (1900 °C) boiling points, respectively.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: *	LEL: *	UEL: None reported

Extinguishing Media: Use dry chemical extinguishing agent designed for metal fires.
Unusual Fire or Explosion Hazards: Manganese dust or powder is flammable and moderately explosive when exposed to flame or heated in carbon dioxide. Mixtures of manganese dust and aluminum dust may explode in air. Ammonium nitrate and manganese may explode when heated. Flammable hydrogen gas is generated under certain conditions (Sec. 5).
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* Manganese metal/powder can present a dust explosion hazard under favoring conditions of particle size and airborne dust dispersion. The minimum explosive concentration of Mn is 0.125 oz/ft³, with a minimum ignition temperature of 842 °F (450 °C). Oxygen concentrations of less than 15% prevent ignition.

Section 5. Reactivity Data

Stability/Polymerization: Manganese is stable at room temperature in closed containers. Hazardous polymerization cannot occur.
Chemical Incompatibilities: The powdered metal ignites on contact with hydrogen peroxide, bromine pentafluoride, fluorine, chlorine and heat, and sulfur dioxide and heat. It reacts violently with oxidants and nitrogen dioxide (NO_2), and incandescently with nitric acid, phosphorus, and nitryl fluoride. Manganese reacts slowly with water at 21 °F (100 °C), forming hydrogen gas (flammable). Contact with acids (including dilute acids) readily dissolves Mn, with the evolution of hydrogen. Hot, concentrated potassium and sodium hydroxides also dissolve Mn, forming hydrogen and manganese hydroxide.
Hazardous Products of Decomposition: Thermal oxidative decomposition of manganese can produce manganese oxides.

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APPENDIX C

MATERIAL SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET

IDENTITY: SIGHT SAVERS brand ANTI-FOG LIQUID

Catalog # 24, 25, 68, 69

SECTION 1: MANUFACTURER'S NAME AND ADDRESS

Bausch & Lomb
1400 N. Goodman St.
Rochester, NY 14609

(800) 553-5340 — MEDICAL EMERGENCY 8AM/4PM
MON.-FRI. 8AM/5PM
Other times: Call Local Poison Control Center

(800) 553-5340 — ALL OTHER QUESTIONS

Date Prepared February 7, 1990

SECTION 2: HAZARDOUS INGREDIENTS

Ingredient (CAS#)	%	PEL	UNITS	TLV	UNITS	STEL	UNITS	S
Isopropanol (67-63-0)	12	400	PPM	400	PPM	500	PPM	
Sodium Lauryl Sulfate(151-21-3)	2	None	-	None	-	None	-	
Dipropylene Glycol Monomethyl Ether (34590-94-8)	2	100	PPM	100	PPM	150	PPM	

SECTION 3: PHYSICAL DATA

Boiling Point (C): 100
Specific Gravity: 1.0
Vapor Pressure(mm Hg): 30
Melting Point: N/A
Vapor Density: (air=1): Not determined
Evaporation Rate: less/1
Solubility: soluable in water
ph: not determined
Appearance and Odor: Purple liquid, odor of rubbing alcohol

SECTION 4: FIRE AND EXPLOSION HAZARD DATA

Flash Point (F): 105 Open Cup
Flammable Limits: not determined

Extinguishing Media: CO_2, Foam, Dry Chemical, Water Fog

Fire Fighting Procedures: Use self contained breathing apparatus

Unusual Fire and Explosion Hazards: None

SECTION 5: REACTIVITY DATA

Stability: Stable

Incompatibility: Hydrogen & Palladium, Nitroform, Oleum, Potassium-Tert-Butoxide, Aluminum, Aluminum Isopropoxide, Crotonaldehyde, Oxidants, Phosgene

Hazardous Decomposition Products: CO, CO_2, SiO_2

Hazardous Polymerization: Will not occur

Conditions to avoid: Sources of ignition, heat, open flame

SECTION 6: HEALTH HAZARD DATA

Route(s) of Entry:
Inhalation: Irritation, central nervous system depression
Skin Contact: defatting,dermatitis possible
Ingestion: nausea, vomiting, headache, dizziness, coma possible abdominal pain,vomiting,diarrhea
Eye Contact: irritation

Health Hazards (Acute and Chronic):
Carcinogenicity: NTP: N/A IARC Monographs: N/A
OSHA Regulated: N/A
Signs and Symptoms of Exposure: N/A

Medical Conditions Generally Aggravated by Exposure: N/A

Emergency and First Aid Procedures:

Inhalation: Move to fresh air, get medical help
Skin Contact: Wash with soap and water
Ingestion: Gastric lavage, give fluids, get medical help
Eye Contact: Flush with water for 15 minutes, get medical help

SECTION 7: PRECAUTIONS FOR SAFE HANDLING AND USE

Spill Procedure: Remove sources of ignition, absorb with vermiculite

Waste Disposal: As per local, state and Federal regulation

Spill Reporting Information (49 CFR 171.8, 40 CFR 117)
Hazardous Substance: None
Reportable Quantity: None
Concentration of Hazardous Substance: N/A
Reportable Quantity of Product: N/A

Precautions to be taken in handling and storing:
Store in a cool, dry, well ventilated place

SECTION 8: CONTROL MEASURES

Respiratory Protection: NIOSH Approved Respirator if exposure exceeds the permissible exposure limit (PEL)

Ventilation: Sufficient to keep exposure below the PEL, general room air circulation sufficient for normal use of product

Eye and Face Protection: Safety Glasses and whatever is required by other occupational conditions

Protective Clothing: None required for normal use of product

Work/Hygenic Practices: N/A

Approved By: _____

The above information is believed to be accurate and represents the best information currently available to us. However, we make no warr of merchantability or any other warranty, express or implied, with respec such information, and we assume no liability resulting from its use. Use should make their own investigations to determine the suitability of the information for their particular purposes.

CONDITIONS CONTRIBUTING TO INSTABILITY

CONTACT WITH CARBON DIOXIDE IN MOIST AIR AND ACIDS

INCOMPATABILITY

CONTACT WITH ACIDS, CORROSIVE TO ALUMINUM

HAZARDOUS DECOMPOSITION PRODUCTS

N.A.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

N.A.

VII DISPOSAL, SPILL OR LEAK PROCEDURES

AQUATIC TOXICITY (E.G. 96HR TLM)

N.A.

WASTE DISPOSAL METHOD

CAN BE SALVAGED FOR USE OR EMPTIED IN SEWER OR REMOVED TO DUMP

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

NORMAL CLEANING

NEUTRALIZING CHEMICALS

ANY STRONG ACID: H_2, SO_4, HC_1, etc

VIII SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS APPLY ADEQUATE VENTILATION TO KEEP DUST CONCENTRATIO BELOW 15 mg/cu.m

VENT TO DUST COLLECTIOR

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT LONG SLEEVE SHIRT WITH BUTTONED COLLAR, L PANTS EXTENDING OVER WORK SHOES, PROTECTIVE CREAM ON EXPOSED SKIN.

RESPIRATORY

PROTECTIVE FILTER MASK IN DUSTY ENVIRONMENT

EYE

TIGHT FITTING SAFETY GOGGLES

GLOVES

IN MANUAL HANDLING

OTHER CLOTHING AND EQUIPMENT

IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

KEEP PRODUCT DRY AND AVOID DUSTING

OTHER HANDLING AND STORAGE REQUIREMENTS

HYDRATED LIME IS A SAFE MATERIAL TO USE IF WORKERS WILL ONLY FOLLC A FEW PRECAUTIONS AND DRESS PROPERLY (AS DESCRIBED IN VII).

DON'T PERMIT DUST TO ACCUMULATE ON EXPOSED SKIN OR CLOTHING. BRU IT OFF.

ADDITIONAL REGULATORY CONCERNS

FEDERAL:

FDA	GENERALLY REGARDED AS SAFE AS FOOD ADDITIVE
USDA	NO RESTRICTIONS
CPSC	USE CAUTIONARY LABELS FOR BAGGED MATERIAL SOLD FOR HOME USE
TSCA	
OTHER	NOT A SUSPECTED CARCINOGEN.
STATE:	N.A.

PREPARED BY JIM BRYANT

TITLE CHIEF CHEMIST

COMPANY DRAVO LIME COMPANY-LONGVIEW DIVISION

ADRESSS P.O. BOX 37

SAGINAW, AL 35137

MATERIAL SAFETY DATA SHEET
CFR 1910.1200 OSHA Hazard
Communication Rule Format

MINE SAFETY APPLIANCES COMPA
P.O. Box 426
Pittsburgh, PA 15230
PHONE (412) 967-3000

This product contains pentane, oxygen and nitrogen, substances subject to the Pennsylvania Worker and Community Right-To-Know Act.

PRODUCT IDENTITY

LABEL IDENTITY - MSA P/N 466193 Calibration Check Gas, 0.75% Pentane in air.

CHEMICAL NAME - Pentane, Oxygen, Nitrogen Mixture

ADDITIONAL IDENTITIES - MSA P/N 466193 Calibration Gas

FORMULA - C_5H_{12} in Air

APPLICABLE CHEMICAL CONTENTS

	%	TL
Pentane (CAS 109-66-0), STEL 750 ppm (ACGIH 1987-88)	0.75	0.06
Air	Balance	None

E: Gas Under Pressure, 250 PSIG at 70°F
Approx. 17 Liters Gas at Atmospheric Pressure

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR - Colorless Gas, Faint Hydrocarbon Odor
BOILING POINT - N/A
VAPOR PRESSURE - N/A
VAPOR DENSITY (AIR = 1) - > 1
SPECIFIC GRAVITY (H_2O = 1) - N/A
PERCENT VOLATILE BY VOLUME - N/A
SOLUBILITY IN WATER - Pentane — 11 cm^3/100 ml (16°C)
Oxygen — 3.2 cm^3/100 ml (25°C)
Nitrogen -- 2.3 cm^3 100 ml (0°C)

PHYSICAL HAZARD INFORMATION

PHYSICAL HAZARD - Compressed Gas 250 PSIG at 70°F

CONDITIONS OR MATERIALS TO AVOID - None

FLASH POINT - N/A (Pentane) LEL (1.4%) UEL (8

EXTINGUISHING MEDIA - This Gas Mixture is Not Flammable

SPECIAL FIRE FIGHTING PROCEDURES - See Next Item

UNUSUAL FIRE AND EXPLOSION HAZARDS - Gas Under Pressure, 250 PSIG at 70°F. Do Not Exceed

HEALTH HAZARDS

HEALTH HAZARDS - Pentane may be irritating to mucous membranes.

SIGNS AND SYMPTOMS OF EXPOSURE - Respiratory Tract Irritation

PRIMARY ROUTES OF ENTRY - Inhalation

TARGET ORGANS - Respiratory Tract

MEDICAL CONDITIONS GENERALLY RECOGNIZED AS BEING AGGRAVATED BY EXPOSURE - No Information

EXPOSURE LIMITS - ACGIH, Pentane 600 ppm, 750 ppm STEL (1987-88)

CARCINOGENICITY DATA - Component Cases Not Listed in NIOSH RTECS.

EMERGENCY AND FIRST AID PROCEDURES - Remove From Exposure

SAFE HANDLING AND USE

HYGIENIC PRACTICES - Avoid Breathing Gas

PROTECTIVE MEASURES DURING REPAIR AND MAINTENANCE OF CONTAMINATED EQUIPMENT - Not Applica

PROCEDURES FOR SPILL OR LEAK CLEANUP - Ventilate Area. Avoid Breathing Gas.

WASTE DISPOSAL - Do not puncture or incinerate cylinder. Before discarding cylinder, sl
release contents to a safe exhaust.

STORAGE - Store in a cool, dry, well-ventilated area. Do not exceed 120°F.

CONTROL MEASURES

PERSONAL PROTECTIVE EQUIPMENT - Due to the limited amount of gas in the cylinder, and the
release rate employed in instrument calibration, respirat
protection is not indicated under conditions of intended

ENGINEERING CONTROLS - Mechanical ventilation is suitable.

WORK PRACTICES - Avoid breathing gas. Use in well-ventilated areas. Follow the calibrat
procedure detailed in the MSA instruction manual provided with the instr
under calibration.

DATE OF PREPARATION - Rev. 2, February 1988

The information provided herein has been compiled from sources believed to be reliable. However, Mine Safety Appliances Company makes no warranty as to the accuracy, completenes or sufficiency of the information and in no event will Mine Safety Appliances Company be responsible for loss or damage of any nature whatsoever resulting from use of the information.

ROUTES OF EXPOSURE INHALATION	STRONG SENSITIZER		
SKIN CONTACT	STRONG SENSITIZER		
SKIN ABSORPTION	N.A.		
EYE CONTACT	MILD IRRITANT		
INGESTION	NON-TOXIC, GRAS APPROVED AS FOOD ADDITIVE		
EFFECTS OF OVEREXPOSURE			
ACUTE OVEREXPOSURE	MILD IRRITANT		
CHRONIC OVEREXPOSURE	CAN CAUSE EXCESSIVE DRYING OF SKIN AND POSSIBLE IRR		

EMERGENCY AND FIRST AID PROCEDURES

EYES: FLUSH OUT IMMEDIATELY WITH WATER AND SEE A PHYSICIAN

SKIN: WASH OFF LIME DUST WITH CLEAN WATER, RINSE SKIN WITH DILUTED VIN. APPLY BURN OINTMENT TO AFFECTED AREAS.

INHALATION: N.A.

INGESTION: N.A.

NOTES TO PHYSICIAN

I PRODUCT IDENTIFICATION

FACTURER'S NAME: DRAVO LIME COMPANY-LONGVIEW DIVISION	REGULAR TELEPHONE NO. 205-664-2-5 EMERGENCY TELEPHONE NO. 205-663-075

.SS: P.O. BOX 37, SAGINAW, ALABAMA 35137

TRADE NAME: LONGVIEW, PELICAN

SYNONYMS: CALCIUM HYDROXIDE, HYDRATED OR SLAKED LIME (Ca(OH)2)

SHIPPING NAME[1]
DOT: LONGVIEW OR PELICAN HIGH CALCIUM HYDRATED LIME
DATA: NOT RESTRICTED

II HAZARDOUS INGREDIENTS[2]

MATERIAL OR COMPONENT	CAS NO.	%	HAZARD DATA
Available calcium hydroxide		95.93	See sections III
Available Lime Index		71.2	IV,V,VI,VII,VIII
Silica		.62	IX
R_2O_3		.52	
L.O.I.		24.44	
MgO		1.16	

III PHYSICAL DATA

BOILING POINT, 760MM HG	N.A.	MELTING POINT	N.A.
SPECIFIC GRAVITY (H_2O=1)	2.3 - 2.4	VAPOR PRESSURE	N.A.
VAPOR DENSITY (AIR=1)	N.A.	SOLUBILITY IN H_2O% BY WT	Neglibible 0.85-0.0
% VOLATILES BY VOLUME	25% max. at 540°C	EVAPORATION RATE (BUTYL	N.A.
APPERANCE AND ODOR	White powder, faint Musty, earthy odor	Ph (AS IS) Ph (1% SOLN)	

IV FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD)	N.A.	AUTOIGNITION TEMPERATURE	N.A.		
FLAMMABLE LIMITS IN AIR, % BY VOLUME		LOWER	N.A.	UPPER	N.A.
EXTINGUISHING MEDIA	N.A.				
SPECIAL FIRE FIGHTING PROCEDURES	N.A.				
[illegible]AL FIRE AND EXPLOSION HAZARD	N.A.				

1. See references 1 and 2 2. See instructions and references 1 to 8

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists manganese as a carcinogen.

Summary of Risks: Although an essential element for man, manganese is also toxic to humans in several ways. Acute or chronic manganese poisoning can result from excessive inhalation or ingestion. The immune system reacts to acute exposures with "metal fume fever," characterized by: fever, chills, nausea, weakness, body aches, frontal headache, occasional blurred vision, low back pain, muscle cramping, shallow respiration, throat dryness and irritation, a dry cough, a sweet or metallic taste, and chest tightness occurring over several hours. Progressive and permanent injury can result from chronic, untreated Mn poisoning. Its most notable effects are the neurological disorders caused by its ability to inhibit the chemical transmission of electrical impulses in the central nervous system. The lungs may become inflammed (manganese pneumonitis), as reported in workers exposed to manganese ores and compounds. Sufficient evidence proves that in several species, manganese is embryolethal at toxic doses. Impotence is a common symptom in grossly contaminated men.

Medical Conditions Aggravated by Long-Term Exposure: Degenerative brain changes, muscle weakness, change in motor activity.

Target Organs: Central nervous system (CNS), respiratory system, kidneys, blood.

Primary Entry: Inhalation, ingestion.

Acute Effects: High-concentration exposures may cause metal fume fever, with its onset occurring over several hours. Inhalation of large concentrations may cause manganese pneumonitis. This material is a skin and eye irritant leading to dermatitis, conjunctivitis, and corneal damage.

Chronic Effects: Exposure to manganese fume over 6 months to 2 years may harm the central nervous system, with symptoms progressing from headache, restless sleep or sleepiness, personality changes, irritability and inappropriate laughing or crying to visual hallucinations, double vision, uncontrolled impulse behavior, euphoria, and to abnormal reaction to painful stimuli, excess salivation, trembling in the extremities and head, impaired walking, and other signs similar to Parkinson's disease.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: After rinsing affected area with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.

After first aid, get appropriate in-plant, paramedic, or community medical attention and support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Remove heat and ignition sources. Ventilate spill area. Cleanup personnel should wear appropriate respiratory protective equipment. Carefully scoop spilled material, avoiding dust generation, into a suitable salvage container.

Disposal: Return scrap material to supplier or processor for recovery. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Wear a NIOSH-approved respirator where airborne concentrations exceed the ceiling limit. Fume or high-efficiency particulate filter respirators are acceptable for concentrations up to 50 mg/m³ (250 mg/m³ with full facepiece). Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below OSHA, ACGIH, and NIOSH standards. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Cenium ref. 103). Consider the dust explosion potential of finely divided Mn powder when designing exhaust ventilation systems and other process equipment to contain heavily dust-laden air.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from ignition sources, acids, alkali, and other incompatible materials. Protect containers from physical damage.

Engineering Controls: Use with adequate ventilation. Avoid breathing dust and fumes. Maintain good housekeeping practices to prevent dust accumulation. Use cleanup procedures that minimize dust generation. Practice good personal hygiene. Examine exposed personnel at regular intervals with emphasis on the respiratory and central nervous systems.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 2, 4, 7, 8, 9, 12, 14, 20, 25, 27, 38, 44, 47, 55, 58, 81, 89, 90, 100, 124, 126

Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: Warren Silverman, MD

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Material Safety Data Sheet

from Genium's Reference Collection
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Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 23

CADMIUM
(Revision C)
Issued: September 1977
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

Material Name: CADMIUM

Description (Origin/Uses): Used in electroplating other metals; in dentistry; in alloys; in nickel-cadmium batteries; and in reactor control rods.

Other Designations: Cd; CAS No. 7440-43-9

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

Genium

HMIS
H 3 R 1
F 1 I 4
R 0 S 1
PPG* K 4 (Dus
*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS, EXPOSURE LIMITS

Cadmium, CAS No. 7440-43-9, ca 100%

OSHA PEL
8-Hr TWA: 0.1 mg/m³ (Cd Fume)
Ceiling: 0.3 mg/m³ (Cd Fume)
8-Hr TWA: 0.2 mg/m³ (Cd Dust)
Ceiling: 0.6 mg/m³ (Cd Dust)

ACGIH NIC,* 1988-89
TLV-TWA: 0.01 mg/m³ (Cadmium and Compounds, as Cd)
ACGIH A2, Suspected Human Carcinogen

ACGIH TLVs, 1988-89
TLV-TWA: 0.05 mg/m³ (Cadmium Dusts and Salts, as Cd)
TLV-Ceiling: 0.05 mg/m³ (Cadmium Oxide Fume, as Cd)
TLV-TWA: 0.05 mg/m³ (Cadmium Oxide Production)

Toxicity Data**
Human, Inhalation, LC_{Lo}: 39 mg/m³ (20 Minutes)

*Notice of Intended Changes, Genium reference 116, p. 39.
**See NIOSH, *RTECS* (EU9800000), for additional data referring to reproductive, tumorigenic, and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 1413°F (767°C)
Melting Point: 610°F (321°C)
Vapor Pressure: 0.095 Torr at 610°F (321°C)

Molecular Weight: 112 Grams/Mole
Solubility in Water (%): Insoluble
Specific Gravity (H_2O = 1): 8.642

Appearance and Odor: A soft, blue white, malleable, lustrous metal that can be cut easily with a knife; odorless.
Comments: Cadmium has a significant vapor pressure of 0.000021 torr (corresponding to 0.12 mg/m³) at 315°F (157°C). Heating this metal without using correct engineering controls and/or personal protective equipment can result in overexposure.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method*	Autoignition Temperature*	LEL*	UEL*

Extinguishing Media: *Cadmium metal burns readily in air if it is heated. As with most metals, the reactivity-dust-cloud-explosion hazard increases as the cadmium metal becomes more finely divided. In fact, finely divided, powdered cadmium metal can be pyrophoric (it burns spontaneously in air without any source of ignition). Carbon dioxide, dry chemical, or sand are recommended extinguishing agents for cadmium fires. Unusual Fire or Explosion Hazards: Cadmium dust can explode during a fire. Massive cadmium metal does not present this potential explosion hazard; however, certain work operations such as grinding, welding, or cutting, can produce dust made of finely divided cadmium particles. Warning: Do not create a dust cloud of cadmium particles, especially during cutting, grinding, or welding operations. Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability Polymerization: Cadmium is stable in closed containers during routine operations. Hazardous polymerization cannot occur. Chemical Incompatibilities: Cadmium reacts dangerously with ammonium nitrate, hydrazoic acid, tellurium, and zinc (Genium ref. 84). Conditions to Avoid: Avoid all exposure to sources of ignition and to incompatible chemicals. Hazardous Products of Decomposition: When heated, which is likely during fires and work operations such as welding and machining, cadmium metal can decompose into cadmium metal fume and cadmium oxide fume.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: The ACGIH classifies cadmium and its compounds as suspected human carcinogens (group A2); the IARC lists them as probable human carcinogens (group 2B); and the NTP classifies them as anticipated human carcinogens (group b). Summary of Risks: Heating cadmium metal produces intensely irritating cadmium metal fume. The acute effects of its excessive inhalation, which include severe tracheobronchitis, pneumonitis, and pulmonary edema, are life threatening and are usually delayed for several hours; their mortality rate is about 20%. Nonfatal pneumonitis has resulted from exposure to 0.5 to 2.5 mg/m³; a fatality has been reported for five hours' exposure at 9 mg/m³ and for 1 hour's exposure at 40 to 50 mg/m³. There is no warning discomfort or immediate irritation from exposure to cadmium fume. Acute gastroenteritis and symptoms of metal fume fever are associated with even lower acute exposure. Symptoms of acute overexposure include excessive salivation, a dry, burning throat; headache; aching muscles; coughing; chest tightness and pain; nausea; chills, and fever chills; and fever. Medical Conditions Aggravated by Long-Term Exposure: None reported. Target Organs: Skin, eyes, respiratory system, kidneys, and blood. Primary Entry: Inhalation, skin contact. Acute Effects: See Summary of Risks, above. Chronic Effects: Long-term, chronic inhalation of cadmium dust, salts, or fume causes chronic cadmium poisoning characterized by a distinctive, nonhypertrophic emphysema with or without renal tubular injury, accompanied by the urinary excretion of a protein with a molecular weight

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SECTION 6. HEALTH HAZARD INFORMATION, cont.

of 20,000 to 30,000. This protein is used as a sign of early but reversible renal poisoning. (Possible chromosomal abnormalities and decreased birth weight among babies of women exposed to cadmium have been noted.) Danger: Continued overexposure from inhalation causes irreversible renal tubular damage. Cancer, anemia, eosinophilia, anosmia, chronic rhinitis, yellowed teeth, and bone changes have been reported. Bone pain in the ribs, backbone, and femur is common; disorders of calcium metabolism develop; and kidney stones and pulmonary fibrosis have been described. FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. Skin. Rinse the affected area with flooding amounts of water, then wash it with soap and water. Inhalation. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Ingestion. If a physician is not readily available, give the exposed person 2 to 3 glasses of water to drink and induce vomiting. A physician may administer a gastric lavage followed by saline catharsis. Comments: A comprehensive medical program is advised for those who work with cadmium or its compounds. This should include chest X rays and forced-vital-capacity tests. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. Note to Physician: Chelation therapy may be useful in treatment; calcium disodium edetate and penicillamine are recommended. Dimercaprol (BAL) is not recommended because of reported renal toxicity of the cadmium-BAL complex.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate ventilation. Cleanup procedures must not create dusty conditions. Pick up the spilled material using vacuuming, mopping, or wet-sweeping techniques. Cleanup personnel need protection against inhalation of dust and fume (see sect. 8). Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations. Concentrated solutions of cadmium waste can be precipitated with lime and collected by filtration. Effluent should be treated as needed to reduce the concentration of the cadmium to a level that is within regulatory compliance limits.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. D006 (40 CFR 261.24 [Characteristic of EP toxicity])
CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg), per the Clean Water Act (CWA), § 307 (a).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of a cadmium solution is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). Respirator: Use a NIOSH-approved respirator per Gemtech reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. Warning: Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. Other: Wear impervious gloves, boots, aprons, and gauntlets, to prevent prolonged or repeated skin contact with this material. Ventilation: Install and operate general and local maximum explosion-proof ventilation systems powerful enough to maintain airborne levels of cadmium below the OSHA PEL cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Gemtech reference 103 for detailed recommendations. Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again, clean this material from your shoes and equipment. Do not wear work clothes home. Comments: Practice good personal hygiene, always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in any work area. Do not inhale cadmium fume. Do not expose individuals with lung, liver, kidney, and blood ailments to cadmium until such exposure is approved by a physician.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store cadmium in closed containers in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage. Avoid storage situations where corrosion can occur. Keep powdered cadmium in closed containers, prevent the airborne dispersion of powdered cadmium. Engineering Controls: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, producing, and sampling operations to prevent static sparks. Other Precautions: The toxic effects of cadmium are influenced by the presence or absence of other elements such as zinc and selenium. If these materials are present in the workplace, careful evaluation of any exposure to cadmium is required to understand any contributing factors.

Hazardous Materials Table (49 CFR 172.101): Not Listed
Optional Hazardous Materials Table (49 CFR 172.102)

ID No. UN2570

IMO Shipping Name: Cadmium Compounds
IMO Hazard Class: 6.1
IMO Labels: Poison or Saint Andrew's Cross (X)*

***Harmful—Stow away from Foodstuffs (IMO Label, Materials of Class 6.1 Packaging Group III).**

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

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Prepared by PJ Igoe, BS

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Medical Review: W Silverman, MD

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APPENDIX D

LOCKOUT/TAGOUT PROCEDURES

1. OBJECTIVE

Lockout is the preferred OHM Remediation Services Corp. (OHM) method of isolating machines or equipment from energy sources. This procedure establishes the minimum requirements for the lockout or tagout of equipment. This procedure shall be used to ensure that the machine or equipment being worked on is isolated from all potential hazardous energy sources, and locked out or tagged out before an employee performs any servicing or maintenance activity where that unexpected energization, start-up or release of energy could cause an injury. Energy sources can be electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

2. PURPOSE

This procedure establishes the minimum safety requirements to ensure the proper deactivation of movable, electrically energized, pressurized equipment and systems, and systems containing hazardous materials prior to repairing, cleaning, oiling, adjusting, or similar work. This procedure complies with the requirements in 29 CFR 1910.147.

3. REQUIREMENTS

This procedure applies to all equipment that receives energy from electrical power, hydraulic fluid under pressure, compressed air, steam, energy stored in springs, potential energy from suspended parts, or any other source that may cause unexpected movement when it is necessary to perform work on that system. It also applies to similar functions performed on systems containing hazardous materials.

4. DEFINITIONS

4.1 **Lockout** - The placement of a lockout device on an energy isolating device, in accordance with this procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed. The lockout device can be key operated or a combination device.

4.2 Tagout - The placement of a tagout device on an energy isolating device, in accordance with this procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed by the authorized person who originally placed the tagout device in position.

4.3 Authorized employee. A person who locks or implements a tagout system procedure on machines or equipment to perform the servicing or maintenance on that machine or equipment.

5. PROGRAM ELEMENTS

Prior to initiating any repairs, modifications and/or adjustments to operating equipment, these steps will be followed.

5.1 The immediate supervisor with jurisdiction over the equipment and all affected employees will be notified that the energy sources are to be deactivated.

5.2 All sources of power that must be locked out, blocked or released will be identified by the immediate Supervisor and the employee who will work on the equipment.

5.3 In order to ensure that the equipment cannot be re-energized while maintenance activities are performed, the employee will lockout / blank out all potential energy sources. (The employees will be assigned padlocks with their names or identification numbers affixed to the locks. The locks will be individually keyed to prevent another employee from removing the lock inadvertently.) If more than one employee is assigned to work on the equipment, a multi-lockout hasp will be used so that all employees working on the equipment can apply their locks and ensure their safety.

5.4 A tagout device will be affixed to all components or systems de-energized to indicate that lockout has been performed.

Prior to performing any work activities, the employee will operate the start and stop controls on the equipment to ensure that the equipment has been properly deactivated. After the test, the equipment must be in neutral or off.

5.6 After the servicing and/or maintenance is complete and the equipment is ready for normal operations, check the area around the machine or equipment. After all tools have been removed from the machine or equipment, guards have been reinstalled, remove all lockout or tagout devices. Operate the energy isolating devices to restore energy to the machine or equipment.

6. SPECIAL CONDITIONS

During certain operations it may be necessary to energize the equipment for a short period of time. Employees in the immediate area will be notified and directed to stay clear of the equipment. If the operation is to be deactivated again, the employee should repeat steps 5.3 to 5.6 of this procedure before work resumes.

In some instances work will carry over to another shift. The maintenance supervisor shall affix a department lock to the equipment to ensure that it is not energized during the transition. During subsequent slight operations, employees will ensure that steps 5.2 to 5.6 are complete before work resumes on the equipment.

If the work is completed and a lock remains on the equipment, it shall not be removed until the employee responsible for the lock is found or the supervisor of the employee investigates and ascertains that the equipment is safe to operate. Unauthorized removal of a lock will subject the violator to disciplinary action up to dismissal.

7. TRAINING

Initial and annual training will be given to all employees to ensure that the purpose and function of this energy and control program are understood.

8. PERIODIC INSPECTION

Corporate health and safety will conduct an annual audit of the energy control program to ensure that the requirements of their procedures are being followed. A record of annual audits will be kept to comply with the certification requirement of periodic inspections.

APPENDIX E

HIGH PRESSURE WASHER SAFETY PROCEDURES

SUBJECT: HIGH PRESSURE WASHER (LASER)	NUMBER	24
	PAGE	1 of 2
	DATE FIRST PUBLISHED	5/89

1. POLICY

All users of high-pressure washers (Lasers) will comply with this procedure. The Laser is a very effective but potentially dangerous piece of equipment. Only trained, authorized personnel will operate the high-pressure washer.

2. PURPOSE

This procedure describes requirements for the safe operation of the high-pressure washer.

3. PERSONAL PROTECTIVE EQUIPMENT

The following equipment will be worn by operators and assistants:

3.1 Safety shoes or boots

3.2 Metal foot and shin guards

3.3 Hearing protection

3.4 Eye protection (goggles and face shield)

3.5 Hard hat with faceshield

3.6 PVC rain suit or PVC acid suit

3.7 Heavy gloves such as monkey grips

3.8 In addition, chemical protective equipment may be required.

4. PROCEDURE

4.1 Only trained, authorized personnel will operate the high-pressure washer.

4.2 The lance must always be pointed at the work area.

4.3 The operator must maintain good footing.

4.4 The operator must have an assistant to aid in moving the hose to different areas and backing up the operator. The assistant must remain in back of the operator.

4.5 Non-operators must remain a safe distance from the operator. The distance must be a minimum of 25 feet.

4.6 The operating pressure should never exceed that which is necessary to complete the job.

4.7 No unauthorized attachment may be made to the unit. (The trigger should never be tied down.)

4.8 Operators should be changed at frequent intervals to avoid fatigue (at least hourly).

4.9 Equipment should be cleaned often to avoid dirt build-up, especially around the trigger and guard area.

4.10 An assistant should always be standing by at the pressure generator.

4.11 All users must be trained in emergency shut down procedures and general equipment maintenance.

APPENDIX F

HEAT STRESS/COLD STRESS INFORMATION

1. POLICY

Project supervision is to be aware of the symptoms and causes of heat-related illnesses and take appropriate steps to prevent their occurrence.

2. PURPOSE

This procedure describes the causes, symptoms, treatment, and/or prevention of heat-related illness.

3. GENERAL INFORMATION

3.1 Heat-related illnesses are generally caused by the body's inability to remove metabolic heat while being exposed to excessive environmental heat.

3.2 A period of adjustment or acclimatization is necessary before maximum tolerance to heat is acquired. Most workers require 7 to 10 working days of gradually increasing workload to become fully acclimatized.

3.3 The body's core temperature must be maintained below 100 degrees Fahrenheit or else heat stress can occur.

3.4 Pulse rate is another good indicator of heat stress. The pulse rate after one minute of recover should be less than 110.

3.5 Heat-related illnesses are caused by the loss of water and electrolytes.

4. HEAT-RELATED ILLNESSES

4.1 Heat rash can be caused by continuous exposure to hot and humid air.

Signs and Symptoms: The condition is characterized by a localized red skin rash and reduced sweating. Aside from being a nuisance, the ability to tolerate heat is reduced.

Treatment: Keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

4.2 Heat cramps are caused by profuse perspiration with inadequate fluid intake and salt replacement.

Signs and Symptoms: Muscle spasm and pain in the extremities and abdomen.

Treatment: Remove affected person to a cool place and give sips of salted water (1 teaspoon of salt to 1 quart of water). The salted water should quickly mitigate the cramps. Manual pressure may also be applied to the cramped muscles.

4.3 Heat exhaustion is a mild form of shock caused by sustained physical activity in heat and profuse perspiration without adequate fluid and salt replacement.

Signs and Symptoms: Weak pulse; shallow breathing; pale, cool, moist (clammy) skin; profuse sweating; dizziness; fatigue

Treatment: Remove affected person to a cool place and remove as much clothing as possible. Give sips of salted water and fan the person continually to remove heat by convection. CAUTION: Do not allow the affected person to become chilled -- treat for shock if necessary.

4.4 Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death.

Signs and Symptoms: Red, hot, dry skin; body temperature of 105 degrees Fahrenheit or higher; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma

Treatment: Heat stroke is a true medical emergency. Transportation of the victim to a medical facility must not be delayed. Prior to transport, remove as much clothing as possible and wrap the victim in a sheet soaked with water. Fan vigorously while transporting to help reduce body temperature. Apply cold packs, if available; place under the arms, around the neck, or any other place where they can cool large surface blood vessels. If convulsions develop, prevent victim from biting his tongue. If transportation to a medical facility is delayed, reduce body temperature by immersing victim in an ice/water bath (however, be careful not to over chill the victim once body temperature is reduced below 102 degrees Fahrenheit). If this is not possible, keep victim wrapped in a sheet and continuously douse with water and fan.

5. SPECIFIC REQUIREMENTS

5.1 A section of site-safety plans will address heat stress if the ambient temperature is expected to exceed 70 degrees Fahrenheit.

5.2 The site-safety plan will discuss work-rest cycles and provisions for monitoring the level of heat stress (i.e., pulse rate).

5.3 Workers are to be advised not to drink caffeinated or alcoholic beverages because they increase the rate of body water loss.

5.4 Increased dietary salt or lightly salted (0.2 percent) water is adequate to replace lost salt. Salt tablets are not to be used.

5.5 If juice or electrolyte drinks are used, they should be diluted prior to drinking.

4.3.2 Means of Egress from Trench Excavations

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees.

4.4 EXPOSURE TO VEHICULAR TRAFFIC

Employees exposed to public vehicular traffic shall be provided with and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

4.5 EXPOSURE TO FALLING LOADS

No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with 29 CFR 1926.601(b)(6), to provide adequate protection for the operator from falling objects during loading and unloading operations.

4.6 WARNING SYSTEM FOR MOBILE EQUIPMENT

When mobile equipment is operated adjacent to an excavation or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals or stop logs. If possible, the grade should be away from the excavation.

4.7 HAZARDOUS ATMOSPHERES

4.7.1 Testing and Controls

In addition to the requirements set forth, 29 CFR 1926.50 - 1926.107; to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill

areas or excavations in areas where hazardous substances are suspected, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet in depth.

Adequate precautions shall be taken, to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation as needed.

Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 10 percent of the lower explosive limit (LEL) of the gas or vapor. When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

4.7.2 Emergency Rescue Equipment

Emergency rescue equipment, such as self contained breathing apparatus (SCBA), a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

Employees entering bell-bottom pier holes or other similar deep and confined excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

4.8 PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control

the level of accumulating water, or use of a safety harness and lifeline.

If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams); diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to run-off from heavy rains will require an inspection by a competent person.

4.9 STABILITY OF ADJACENT STRUCTURES

Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

The excavation is in stable rock; or

A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

Sidewalks, pavements, and other structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

4.10 PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the excavation face to stop and contain falling material; or other means that provide equivalent protection.

Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

4.11 Inspections

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are required when employee exposure can be reasonably anticipated. An Excavation/Trenching Permit must be completed by the competent person to document the inspections.

Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

4.12 FALL PROTECTION

Where employees or equipment are required or permitted to cross over excavations; walkways, or bridges with standard guardrails shall be provided.

Adequate barrier for physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc. shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be covered or backfilled.

5. SOIL CLASSIFICATION

OSHA Soil Classification (Appendix A to Subpart P)

5.1 Type A means:

Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

5.1.1 The soil is fissured; or

5.1.2 The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

5.1.3 The soil has been previously disturbed; or

5.1.4 The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

5.1.5 The material is subjected to other factors that would require it to be classified as a less stable material.

5.2 Type B means:

5.2.1 Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

5.2.2 Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

5.2.3 Previously disturbed soils except those which would otherwise be classed by Type C soil.

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MATERIAL SAFETY DATA SHEET

PRODUCT NAME Compressed Air	CAS # N/A
TRADE NAME AND SYNONYMS Compressed Air; Air; Compressed Air, Breathing Quality	DOT ID No. UN 1002
CHEMICAL NAME AND SYNONYMS See last page.	DOT Hazard Class: Nonflammable gas
	Formula: See last page.
ISSUE DATE AND REVISIONS 25 November 1985	Chemical Family: N/A

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT
None listed (ACGIH, 1985-86)

SYMPTOMS OF EXPOSURE Air is nontoxic and necessary to support life. Inhalation of air in a high pressure environment such as underwater diving, caissons or hyperbaric chambers can result in symptoms similar to overexposure to pure oxygen. These include tingling of fingers and toes, abnormal sensations, impaired coordination and confusion. Decompression sickness pains or "bends" are possible following rapid decompression.

TOXICOLOGICAL PROPERTIES
High pressure effects (greater than two atmospheres of oxygen) are on the central nervous system. Improper decompression results in the accumulation of nitrogen in the blood.

RECOMMENDED FIRST AID TREATMENT
Facilities or practices at which air is breathed in a high pressure environment should be prepared to deal with the illnesses associated with decompression (bends or caisson disease). Decompression equipment may be required.

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HAZARDOUS MIXTURES OF OTHER LIQUIDS SOLIDS OR GASES

N/A

PHYSICAL DATA

BOILING POINT -317.8°F (-194.3°C)	LIQUID DENSITY AT BOILING POINT 54.56 lb/ft^3 (874 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C): Above the critical temp. of -221.1°F (-140.6°C)	GAS DENSITY AT 70°F, 1 atm .0749 lb/ft^3 (1.200 kg/m^3)
SOLUBILITY IN WATER Very slightly	FREEZING POINT N/A
EVAPORATION RATE N/A	SPECIFIC GRAVITY (AIR=1) 1.0

APPEARANCE AND ODOR
Colorless, odorless gas

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS % BY VOLUME LEL N/A UEL N/A
EXTINGUISHING MEDIA Nonflammable gas		ELECTRICAL CLASSIFICATION Nonhazardous

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS
Compressed air at high pressures will accelerate the burning of materials to a greater rate than they burn at atmospheric pressure.

REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID
Unstable		
Stable	X	N/A

INCOMPATIBILITY (Materials to avoid)
None

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID
May Occur		
Will Not Occur	X	N/A

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

N/A

WASTE DISPOSAL METHOD

N/A

RESPIRATORY PROTECTION (Specify Type)
N/A

VENTILATION	LOCAL EXHAUST	SPECIAL
N/A	N/A	N/A
	MECHANICAL (Gen.)	OTHER
	N/A	N/A

PROTECTIVE GLOVES
Any material

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Air, compressed DOT Hazard Class: Nonflammable gas
DOT Shipping Label: Nonflammable gas I.D. No.: UN 1002

SPECIAL HANDLING RECOMMENDATIONS
Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations, consult the Compressed Gas Association's Pamphlets P-1, G-7 and G-7.1.

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excesssive periods of time.

For additional storage recommendations, consult the Compressed Gas Association's Pamphlets P-1, G-7, and G-7.1.

SPECIAL PACKAGING RECOMMENDATIONS
Dry air is noncorrosive and may be used with all materials of construction. Moisture causes metal oxides which are formed with air to be hydrated so that they increase in volume and lose their protective role (rust formation). Concentrations of SO_2, Cl_2, salt, etc. in the moisture enhances the rusting of metals in air.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

CHEMICAL FORMULA: (Continued)

Atmospheric air which is compressed is composed of the following concentrations of gases

Gas	Molar %
Nitrogen	78.09
Oxygen	20.94
Argon	0.93
Carbon Dioxide	0.033*
Neon	18.18×10^{-4}
Helium	5.239×10^{-4}
Krypton	1.139×10^{-4}
Hydrogen	0.5×10^{-4}
Xenon	0.086×10^{-4}
Radon	6×10^{-18}
Water vapor	Varying concentrations

*Concentrations may have slight variations.

Compressed air is also produced by reconstitution using only oxygen and nitrogen. This product contains 79 molar percent nitrogen and 21 molar percent oxygen plus trace amounts of other atmospheric gases which are present in the oxygen and nitrogen.

5.2.4 Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration; or

5.2.5 Dry rock that is not stable; or

5.2.6 Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1H), but only if the material would otherwise be classified as Type B.

5.3 Type C means:

5.3.1 Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

5.3.2 Granular soils including gravel, sand, and loamy sand; or

5.3.3 Submerged soil or soil from which water is freely seeping; or

5.3.4 Submerged rock that is not stable; or

5.3.5 Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

6. TIMBER SHORING, ALUMINUM HYDRAULIC AND ALTERNATIVES TO SHORING

Refer to 29 CFR 1926 Subpart P (Appendices C, D, and E) for details on shoring shields and trenchboxes.

7. SELECTION OF PROTECTIVE SYSTEMS

Refer to 29 CFR 1926 Subpart P (Appendix F) for the decision logic in selecting protective systems.

8. PERMITS

An Excavation/Trenching Permit must be completed by the competent person each day that an excavation is open and personnel may be required to enter the excavation. The excavation permit follows this procedure.

OHM Corporation

EXCAVATION/TRENCHING PERMIT

PERMIT NO.____

Good on This Date Only:_____ From:_____ AM___ PM___

Name of Competent Person:_____ - A competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization t take prompt corrective measures to eliminate them. The competent person shall also be capable of classifying soil types.

Description of Job or Special Procedures:_____

_____

EMPLOYEE TRAINING AND PRE-EXCAVATION BRIEFING

1. Safe Excavation and Rescue Training Conducted on: _____ (DATE)
2. Mandatory pre-excavation briefing conducted on: _____ (DATE)
3. Does this job require special training: YES___ NO___

ELECTRICAL SAFETY

1. Are all electrical devices grounded, double insulated, or GFCI protected? YES___ NO___ N/A___
2. Have all power cords and tools been visually inspected? YES___ NO___ N/A___

SURFACE ENCUMBRANCES

1. Have all surface encumbrances that are located so as to create a hazardto employees been removed or supported, as necessary, to safeguard employees? YES___ NO___ N/A___

UNDERGROUND INSTALLATIONS

1. Have the estimated locations of all underground installation been determined prior to excavation? YES___ NO___ N/A___
2. Have utility companies been contacted and advised of proposed work? YES___ NO___ N/A___
3. Are underground installations protected, supported or removed while excavations are open? YES___ NO___ N/A___

ACCESS AND EGRESS

1. Are structural ramps that are used solely by personnel as a means of access or egress from excavations designed by a competent person? YES___ NO___ N/A___
2. Are structural ramps that are used for access and egress of equipment designed by a competent person qualified in structural design and constructed in accordance with the design? YES___ NO___ N/A___
3. Are ramps and runways constructed so structural members are connected to prevent displacement? YES___ NO___ N/A___

4. Are structural members used for ramps and runways of uniform thickness? YES___ NO___ N/A___
5. Are cleats used in connecting runway structural members attached in a manner to prevent tripping? YES___ NO___ N/A___
6. Are structural ramps used in lieu of steps provided with cleats or other surface treatment to prevent slipping? YES___ NO___ N/A___

MEANS OF EGRESS FOR TRENCHES DEEPER THAN 4 FEET

1. Are stairways, ladders, or ramps provided every 25 feet? YES___ NO___ N/A___

EXPOSURE TO VEHICULAR TRAFFIC

1. Are personnel exposed to public vehicular traffic wearing reflectorized or high visibility vests? YES___ NO___ N/A___

EXPOSURE TO FALLING LOADS

1. Are employees prohibited from standing underneath loads handled by lifting or digging equipment? YES___ NO___ N/A___
2. Are employees prohibited from standing next to vehicles being loaded or unloaded? YES___ NO___ N/A___

WARNING SYSTEMS FOR MOBILE EQUIPMENT

1. Are warning systems such as barricades, hand or mechanical signals, or stop logs utilized when mobile equipment is operated adjacent to or at the edge of an excavation? YES___ NO___ N/A___

TESTING FOR HAZARDOUS ATMOSPHERES

1. Are the atmospheric hazards that can be reasonably expected to exist in excavations greater than 4 feet deep tested and controlled? YES___ NO___ N/A___

	READING:	TIME:	INITIAL:
2. Test for Oxygen Content:	_____ % 02 (19.5% Minimum)	_____	_____
3. Test for Flammable Concentrations:	_____ % LEL (10% Maximum)	_____	_____
4. Test for Toxic Concentration:	_____ PPM of _____	_____	_____

5. Is testing conducted as often as necessary to ensure safety or personnel? YES___ NO___ N/A___

EMERGENCY RESCUE EQUIPMENT

1. Is emergency rescue equipment such as SCBA, safety harness and line, or basket stretcher readily available and attended when hazardous atmospheric conditions exist? YES___ NO___ N/A___
2. Are employees who enter bell-bottom pier holes or other similar deep and confining excavations wearing a body harness with a life-line? YES___ NO___ N/A___

PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

1. Are employees prohibited from entering excavations that have accumulated water? YES___ NO___ N/A___
2. Is water being controlled or prevented from accumulating in excavation by the use of water removal equipment? YES___ NO___ N/A___

3. Is [illegible] equipment operation being monitored by a competent person? YES___ NO___ N/A___

4. Are diversion ditches, dikes, or other suitable means used to prevent surface water from entering excavation? YES___ NO___ N/A___
5. Are excavations subjected to run-off from heavy rain immediately re-inspected by a competent person? YES___ NO___ N/A___

STABILITY OF ADJACENT STRUCTURES

1. Are support systems such as shoring, bracing, or underpinning provided to ensure stability of adjoining structures (i.e., buildings, walls) endangered by excavation activities? YES___ NO___ N/A___
2. Has any excavation below the level of the base or footing of foundations or retaining walls been:
   - Provided with a support system such as under pinning to ensure the safety of employees and stability of the structure YES___ NO___ N/A___
   - Performed in stable rock YES___ NO___ N/A___
   - Determined by a registered professional engineer that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity YES___ NO___ N/A___
   - Determined by a registered professional that the excavation work will not pose a hazard to employees YES___ NO___ N/A___
3. Is the undermining of sidewalks and pavement structures prohibited? YES___ NO___ N/A___

PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

1. Is adequate protection provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face? YES___ NO___ N/A___
2. Are employees protected from excavated or other material and equipment by placing this material a minimum of two (2) feet from the edge of excavations or by the use of retaining devices? YES___ NO___ N/A___

INSPECTIONS

1. Are daily inspections of excavations where employee exposure can be reasonably anticipated being done by the competent person? YES___ NO___ N/A___
2. Are inspections being performed by a competent person after every rainstorm or other hazard increasing occurrence? YES___ NO___ N/A___
3. Are employees removed from the excavation if the competent person finds evidence at any time of a situation that could result in a possible cave-in, protective system failure, hazardous atmosphere or other hazardous condition? YES___ NO___ N/A___

FALL PROTECTION

1. Are standard guardrails provided on walkways and bridges that cross over excavations? YES___ NO___ N/A___
2. Are all remotely located excavations adequately barricaded or covered? YES___ NO___ N/A___
3. Are temporary wells, pits, shafts and similar exploratory operations backfilled upon completion? YES___ NO___ N/A___

OHM Corporation

EXCAVATION/TRENCHING AUDIT FORM

PROJECT NAME:_____
PROJECT LOCATION:_____
EXCAVATION COMPETENT PERSON:_____
INSPECTORS NAME:_____
DATE:_____

EMPLOYEE TRAINING AND PRE-EXCAVATION BRIEFING

1. Has safe excavation and rescue training been conducted?	YES___	NO___	N/A___
2. Are mandatory pre-excavation briefing conducted?	YES___	NO___	N/A___
3. Does this job require special training?	YES___	NO___	N/A___

ELECTRICAL SAFETY

1. Is electrical equipment and wiring properly guarded?	YES___	NO___	N/A___
2. Are electrica lines, extension cords, and cables guarded and maintained in good condition?	YES___	NO___	NA/___
3. Are extension cords kept out of wet area?	YES___	NO___	N/A___
4. Is damaged electrica equipment tagged and taken out of service?	YES___	NO___	N/A___
5. Has a positive lock-out system been established by the project electrician?	YES___	NO___	N/A___
6. Are GFCI's being used as needed?	YES___	NO___	N/A___
7. Are extension cords being inspected daily for ground continuity and structural integrity?	YES___	NO___	N/A___
8. Is extension cord inspection documented?	YES___	NO___	N/A___

SURFACE ENCUMBRANCES

1. Have all surface encumbrances that are located so as to create a hazard to employees been removed or supported, as necessary, to safeguard employees?	YES___	NO___	N/A___

UNDERGROUND INSTALLATIONS

1. Have the estimated locations of all underground installation been determined prior to excavation?	YES___	NO___	N/A___
2. Have utility companies been contacted and advised of proposed work?	YES___	NO___	N/A___
3. Are underground installations protected, supported or removed while excavations are open?	YES___	NO___	N/A___

ACCESS AND EGRESS

1. Are structural ramps that are used solely by personnel as a means of access or egress from excavations designed by a competent person?	YES___	NO___	N/A___
2. Are structural ramps that are used for access and egress of equipment designed by a competent person qualified in structural design and constructed in accordance with the design?	YES___	NO___	N/A___
3. Are ramps and runways constructed so structural members are connected to prevent displacement?	YES___	NO___	N/A___

4. Are structural members used for ramps and runways of sufficient strength? YES___ NO___ N/A___
5. Are cleats used in connecting runway structural members attached in a manner to prevent tripping? YES___ NO___ N/A___
6. Are structural ramps used in lieu of steps provided with cleats or other surface treatment to prevent slipping? YES___ NO___ N/A___

MEANS OF EGRESS FOR TRENCHES DEEPER THAN 4 FEET

1. Are stairways, ladders, or ramps provided every 25 feet? YES___ NO___ N/A___

EXPOSURE TO VEHICULAR TRAFFIC

1. Are personnel exposed to public vehicular traffic wearing reflectorized or high visibility vests? YES___ NO___ N/A___

EXPOSURE TO FALLING LOADS

1. Are employees prohibited from standing underneath loads handled by lifting or digging equipment? YES___ NO___ N/A___
2. Are employees prohibited from standing next to vehicles being loaded or unloaded? YES___ NO___ N/A___

WARNING SYSTEMS FOR MOBILE EQUIPMENT

1. Are warning systems such as barricades, hand or mechanical signals, or stop logs utilized when mobile equipment is operated adjacent to or at the edge of an excavation? YES___ NO___ N/A___

TESTING FOR HAZARDOUS ATMOSPHERES

1. Are the atmospheric hazards that can be reasonably expected to exist in excavations greater than 4 feet deep tested and controlled? YES___ NO___ N/A___

	READING:	TIME:	INITIAL:
2. Test for Oxygen Content:	_____ % 02 (19.5% Minimum)	_____	_____
3. Test for Flammable Concentrations:	_____ % LEL (10% Maximum)	_____	_____
4. Test for Toxic Concentration:	_____ PPM of _____	_____	_____

5. Is testing conducted as often as necessary to ensure safety or personnel? YES___ NO___ N/A___

EMERGENCY RESCUE EQUIPMENT

1. Is emergency rescue equipment such as SCBA, safety harness and line, or basket stretcher readily available and attended when hazardous atmospheric conditions exist? YES___ NO___ N/A___
2. Are employees who enter bell-bottom pier holes or other similar deep and confining excavations wearing a body harness with a life-line? YES___ NO___ N/A___

ACCUMULATED WATER HAZARDS

1. Are employees prohibited from entering excavations that have accumulated water? YES___ NO___ N/A___
2. Is water being controlled or prevented from accumulating in excavation by the use of water removal equipment? YES___ NO___ N/A___

Is water control equipment operation being monitored by a competent person?	YES___	NO___	N/A___
4. Are diversion ditches, dikes, or other suitable means used to prevent surface water from entering excavation?	YES___	NO___	N/A___
5. Are excavations subjected to run-off from heavy rain immediately re-inspected by a competent person?	YES___	NO___	N/A___

STABILITY OF ADJACENT STRUCTURES

1. Are support systems such as shoring, bracing, or underpinning provided to ensure stability of adjoining structures (i.e., buildings, walls) endangered by excavation activities?	YES___	NO___	N/A___
2. Has any excavation below the level of the base or footing of foundations or retaining walls been:			
- Provided with a support system such as under pinning to ensure the safety of employees and stability of the structure	YES___	NO___	N/A___
- Performed in stable rock	YES___	NO___	N/A___
- Determined by a registered professional engineer that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity	YES___	NO___	N/A___
- Determined by a registered professional that the excavation work will not pose a hazard to employees	YES___	NO___	N/A___
3. Is the undermining of sidewalks and pavement structures prohibited?	YES___	NO___	N/A___

PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

1. Is adequate protection provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face?	YES___	NO___	N/A___
2. Are employees protected from excavated or other material and equipment by placing this material a minimum of two (2) feet from the edge of excavations or by the use of retaining devices?	YES___	NO___	N/A___

INSPECTIONS

1. Are daily inspections of excavations where employee exposure can be reasonably anticipated being done by the competent person?	YES___	NO___	N/A___
2. Are inspections being performed by a competent person after every rainstorm or other hazard increasing occurrence?	YES___	NO___	N/A___
3. Are employees removed from the excavation if the competent person finds evidence at any time of a situation that could result in a possible cave-in, protective system failure, hazardous atmosphere or other hazardous condition?	YES___	NO___	N/A___

FALL PROTECTION

1. Are standard guardrails provided on walkways and bridges that cross over excavations?	YES___	NO___	N/A___
2. Are all remotely located excavations adequately barricaded or covered?	YES___	NO___	N/A___
3. Are temporary wells, pits, shafts and similar exploratory operations backfilled upon completion?	YES___	NO___	N/A___

CRANES AND RIGGING

1. Are cranes inspected daily?	YES___	NO___	N/A___
2. Are crane swing areas barricaded or demarked?	YES___	NO___	N/A___
3. Is all rigging equipment tagged with an identification number and rated capacity?	YES___	NO___	N/A___

4. Is rigging equipment inspection documented? YES___ NO___ N/A___
5. Are slings, chains, and rigging inspected before each use? YES___ NO___ N/A___
6. Are damaged slings, chains, and rigging tagged and taken out of service? YES___ NO___ N/A___
7. Are slings padded or protected from sharp corners? YES___ NO___ N/A___
8. Do employees keep clear of suspended loads? YES___ NO___ N/A___
9. Are employees in the lift area wearing hard hats? YES___ NO___ N/A___

CONFINED SPACES

1. Have employees been trained in the hazards of confined spaces? YES___ NO___ N/A___
2. Are confined space permits available on project site? YES___ NO___ N/A___
3. Is a company confined space safety procedure on the project? YES___ NO___ N/A___
4. Has a rescue plan been established? YES___ NO___ N/A___

I HAVE REVIEWED THIS INSPECTION CHECKLIST WITH THE SAFETY INSPECTOR AND FULLY UNDERSTAND THE RECOMMENDATION AND WILL MAKE EVERY ATTEMPT TO CORRECT THEM IMMEDIATELY.

SITE SUPERVISOR:_____

PROJECT MANAGER:_____

REGIONAL HEALTH AND SAFETY MANAGER:_____

VICE PRESIDENT:_____

DIVISION MANAGER:_____

APPENDIX H

HOT WORK PROCEDURES PERMIT

1. POLICY

No work involving a flame or spark producing operations is to be conducted without preparing a hot work permit and following the provisions of this procedure.

2. PURPOSE

This procedure establishes requirements for cutting or burning operations.

3. REQUIREMENTS

3.1 The site safety officer is to issue the hot work permit for any flame- or spark-producing operation. This procedure is to be conducted daily whenever such operations occur.

3.2 This procedure is to be read and complied with by any employee conducting hot work.

3.3 The OHM site supervisor or site safety officer will complete the following procedures prior to beginning hot work:

3.3.1 Conduct a visual inspection of area. Remove any combustible material surrounding the work area. Special attention will be paid to areas where hot slag can fall or spatter. Any combustible material which cannot be readily removed will be covered or otherwise protected from the hot materials. For example, covering a combustible surface with one inch of soil or wetting it may be sufficient.

3.3.2 Designate a fire watch. This person's (or persons') sole responsibility will be to monitor the welding or burning operation and have immediate access to a fire extinguisher of sufficient size and type for the potential combust-

ible material. In addition, this person(s) shall be trained in the proper use of the appropriate fire extinguisher and be knowledgeable of the emergency signal and evacuation procedures as well as emergency shutdown procedures.

3.3.3 Do not begin until all spaces, pipes, and sumps have been opened and tested for the presence of flammables. If any flammable or combustible vapors exceed 10 percent lower explosive limits (LEL), no work will begin until levels are reduced. As a rule, no hot work will begin when any combustible vapor is present.

3.3.4 Personnel working in the area of the hot work will be alerted to the fact that hot work is taking place.

3.3.5 A hot-work permit will be completed and posted

4. BURNING OPERATION SAFETY RULES

4.1 Wear adequate flame and heat resistant apparel and appropriate eye protection. This includes chipping operations.

4.2 Ensure that the area below is roped off and posted if work is overhead.

4.3 Protect personnel and equipment in near vicinity against exposure from arc or sparks.

4.4 Observe good housekeeping practices; keep excess hoses, cables, and equipment out of aisle ways, stairways, and your work station.

4.5 Never use oil, grease, or pipe fitting compounds to make up connections on oxy-acetylene welding equipment.

4.6 Store fittings in a manner to prevent contamination.

4.7 Do not interchange oxygen and acetylene hoses; oxygen is coded green and acetylene is coded red.

4.8 Do not force connections or strike or force valve wheels.

4.8.1 Before connecting cylinders, read the label to ensure that the proper gas is being used.

4.8.2 Cylinders must not be placed where they might form part of an electrical circuit. Keep cylinders away from grating, layout tables and piping systems that may be used for ground of electrical welding circuits.

4.9 Open oxygen valves momentarily to remove dust or dirt; stand on one side of the valve and avoid contact of gas with any combustible material.

4.9.1 Pressure-adjusting screws on regulators will be fully released before the regulator is attached to a cylinder and the cylinder valve opened. Open the cylinder valves slowly; stand to one side, not in front of pressure regulator gauge faces when opening cylinder valves.

4.9.2 Do not use adjustable wrenches on acetylene cylinders; use the T-wrench provided. Keep it in place at the cylinder.

4.9.3 Never open an acetylene cylinder valve more than one and one half turns.

4.10 Do not store tools or equipment in the recessed top of an acetylene cylinder, and do not allow water to accumulate there.

4.11 Inspect the welding hose for defects before each use. Keep hoses clear of equipment and hot slag.

4.12 Do not use oxygen for cleaning, pressurization, or for ventilation.

4.13 Do not relight flame on hot work when in an enclosed space. Allow time for gases to escape and then use friction lighter.

4.14 A metal part which is suspiciously light probably has a void inside and an opening should be drilled before heating. Electrical boxes at the end of conduit should be opened prior to cutting conduit. Valves on both ends of piping should be opened.

4.15 Never lay work that is to be heated or welded on a concrete floor because when sufficiently heated, concrete may spall and fly with danger of injury.

4.16 Do not cut material in such a position that severed parts will fall striking legs or feet of the operator or assistant, or damaged gas lines.

4.17 When a flashback occurs, both gases should be shut off -- first oxygen, then acetylene. Before lighting the torch again, see that it is cool and that no damage has been done to the torch, hose, or regulator.

4.18 Mark work "HOT" if left unattended or where others may come in contact with hot surfaces.

4.19 When burning operations are to be stopped for a few minutes during the course of the work, it is permitted to close torch valves only. When work is stopped for a longer period or is left unattended, the following steps must be taken:

- Close oxygen and acetylene cylinder valves
- Open torch valves to relieve pressure, then close again
- Release regulator pressure adjusting screws

4.20 Before regulator is removed from a cylinder, the cylinder valve will be closed and the gas released from the regulator.

5. PERSONAL PROTECTIVE EQUIPMENT

The normal personal protective equipment worn when working with hazardous materials generally provides inadequate protection from flames or heat. The person performing the work shall supplement the existing equipment with the following:

- Welding gloves fashioned from leather or other fire-resistant material
- Apron or jacket fashioned from leather or other fire-resistant material
- Chapps, if necessary, for leg protection
- Eye protection and face protection with appropriate ANSI darkened lenses
- If necessary, flash-fire protection. Note: normal chemical protective clothing is inappropriate for fire situations.

6. HOT WORK PERMIT

6.1 No employee of OHM is to begin hot work unless a hot work permit has been obtained. It is the responsibility of the project supervisor to request this permit. The hot-work permit shall be signed by the supervisor and site safety officer and explained to each affected employee.

6.1.1 It is the responsibility of the project supervisor to see that workers comply with all safety practices of the hot work permit.

OHM

HOT WORK PERMIT

Date:_____ Time: _____

Location: _____

Isssued to: _____

Site Safety Officer: _____

Supervisor: _____

Do not cut or use other open-flame or spark producing equipment until the following precautions have been taken.

Protective Equipment used _____

_____

(Initial Each Item)

_____ The location where the work is to be done has been personally examined.

_____ Any available fire protection systems are in service.

_____ There are no flammable dusts, vapors, liquids or unpurged tanks (empty) in the area.

_____ Explosimeter reading <10% LEL

_____ All combustibles have been moved away from the operation, or otherwise protected with fire curtains or equivalent.

_____ Ample portable fire extinguishing equipment has been provided.

_____ Arrangements have been made to patrol the area for at least 1/2 hour after the work has been completed.

_____ The phone number for the local Fire Department is _____.

This form must be filled out daily whenever HOT WORK is being conducted and posted at the jobsite.

6.2 The hot work permit will be valid for a single work shift only. On projects requiring more than a single work shift, a new permit shall be completed at the start of each shift. The permit shall be displayed at the project site.

6.3 At the conclusion of the project, the hot work permits will be forwarded to the site project control technician and placed in the project file.

APPENDIX I

OHM ACCIDENT/INJURY/ILLNESS REPORTING PROCEDURES

ACCIDENT/INJURY/ILLNESS REPORTING PROCEDURES

OBJECTIVE

It is the objective of OHM Corporation to minimize accidents, to the fullest extent as practical through compliance with OSHA regulations and OHM Corporation Standard Operating Procedures (SOPs), as well as supervisor and employee safety training, site safety audits, and constant attention to safety. In the event of an accident involving injury, OHM will strive to obtain competent medical care for the injured employee. Following the accident/incident, a thorough investigation will be performed in an effort to determine and correct or eliminate the causative agent(s).

SCOPE

All employees of OHM Corporation.

PROCEDURE

The following procedures are minimum requirements for reporting all accidents/incidents. These procedures may be expanded upon, by the Regional Health and Safety Manager, to meet the specific needs in each region.

REPORTING OF INCIDENT: All accidents/injuries/illnesses, no matter how minor, are to be reported immediately by the employee to the employee's immediate supervisor/manager. Failure to timely report an injury/illness incident (within 24 hours of occurrence) may result in the Company disputing the injury/illness claim.

The Employee is responsible to report any accident, injury or illness, in which the employee is involved, to his/her immediate supervisor/manager. If the employee's immediate supervisor/manager is not available, the incident must be reported to the Division Manager or Worker's Compensation Handler at the employee's home division.

The Supervisor/Manager is responsible to see that the employee receives immediate first aid and/or prompt medical treatment should an injury/illness occur. It is the responsibility of the supervisor/manager to ensure that all accidents and injuries/illnesses are immediately investigated, reported and documented and distributed in a timely manner as outlined in these procedures.

The Regional Health and Safety Manager is responsible for notifying OSHA of any incidents involving a fatality or hospitalization of 5 or more employees.

OHM ACCIDENT/INJURY/ILLNESS REPORTING PROCEDURES

The Employee Accident/Injury/Illness Report must be completed for all accidents/incidents including but not limited to:

- Any work-related injury involving muscles and joints (strains/sprains)
- All work-related back injuries
- All work-related chemical exposures
- Any work-related injury/illness which involves first aid and/or medical treatment
- Any work-related accident that results in death of an employee
- Any incident that involves property damage but not necessarily employee injury.
- Any work-related incident (near miss) in which an injury could have occurred and that attention is needed to prevent similar incidents from occurring and preventing an injury accident

Stabilize the accident scene and job site. An accident site should not be disturbed until the investigation is completed. In severe cases, (lost time, serious injury), cordon off the area with caution tape. Consult with Regional Health and Safety personnel to determine if the initial accident investigation was sufficient and if photographs should be taken. All employees involved in the incident or response must remain at the jobsite until investigation interviews are completed.

The supervisor/manager must ensure that employees whose work related injuries required medical treatment (the employee was taken to a doctor, hospital, clinic, etc.) are not permitted to resume work without a written return to work statement from the treating physician. This statement should give diagnosis, prognosis, date of return to work and any work limitations. Should a statement such as "light duty" be given, call the treating physician to determine the exact restriction that is needed. (See Injury/Illness Status Report attached as Appendix B.)

DESIGNATE A HEALTH CARE PROVIDER: For cost containment reasons, the use of an emergency room facility should be limited to emergency situations whenever possible. Minor injuries and illnesses should be referred to private physicians and/or out patient clinics. Plans for the treatment of injuries/illnesses should be made well in advance of any incident. Arrangements should be made with a local health care provider to provide medical services to employees for work related injuries/illnesses. The name, address and phone number of this provider should be posted at all project sites and OHM offices.

OHM ACCIDENT/INJURY/ILLNESS REPORTING PROCEDURES

RESTRICTED WORK: Supervisory personnel must assume responsibility that the Company's policy on light duty is communicated to physicians and employees. (Restricted work policy statement should be posted at all jobsites and OHM offices.)

Restrictions given by the physician are to be followed. The supervisor shall contact the treating physician or the Corporate Occupational Health Supervisor, at Corporate Health and Safety in Findlay at extension 6064 should there be any question regarding an employee's ability to return to work.

When the jobsite is unable to accommodate restricted work activity, the site supervisor must coordinate transfer of the injured employee to his/her home division. The injured employee, upon return to his/her home division, must report to work upon arrival for job assignment and/or evaluation by the Company physician. Any deviation from this procedure must receive prior approval from the Corporate Occupational Health Supervisor.

MEDICAL BILLS/PRESCRIPTIONS: All bills and receipts (including medications) pertaining to work related injuries should be sent to the employee's home division to the attention of the person who handles worker's compensation claims. Do not use a cash advance for payment of any medical treatment or prescriptions unless there is no other alternative. The employee should obtain and submit a receipt when required to pay for injury related expenses.

I. ACCIDENTS WITHOUT INJURY OR ACCIDENTS CAUSING MINOR INJURIES REQUIRING JOB SITE ADMINISTERED FIRST AID ONLY

- Injured employee's supervisor/manager must complete an *Employee Accident/Injury/Illness Report* (Attached as Appendix A). The report must be completed, within 24 hours of an incident or knowledge of an incident, using the injured employee's own words to describe events and injury. The injured employee must sign the report. The supervisor/manager must ensure that the report is completely and accurately filled out and sign the report.

- **Send all original reports, within 5 working days of the incident, to the division secretary handling worker's compensation for the injured employee. (Home Division) For Ohio employees only, send all original reports to Corporate Health and Safety.** Original reports are to be retained in the employee's worker's compensation file.

- Fax or forward a copy of all reports to the Corporate Occupational Health Supervisor at Health and Safety in Findlay within 24 hours of the incident. (Fax: 419-425-6039)

- Retain a copy in job site safety file.

OHM ACCIDENT/INJURY/ILLNESS REPORTING PROCEDURES

II. ACCIDENTS CAUSING INJURY THAT REQUIRE MEDICAL TREATMENT OR RESULTS IN RESTRICTED WORK ACTIVITIES OR LOST TIME

- The *Injury/Illness Status Report* is to be completed whenever an injured/ill employee is evaluated or given treatment at a hospital, clinic, doctor's office, etc. The upper portion of this form is to be completed by the supervisor/manager or person sending the employee for treatment and the lower portion of the form is to be completed by the treating physician. The employee must return the original form to his supervisor/manager prior to returning to work or within 24 hours of a lost time incident.

- Injured employee's supervisor/manager must complete an *Employee Accident/Injury/Illness Report* (Attached as Appendix A). The report must be completed, within 24 hours of an incident or knowledge of an incident using the injured employee's own words to describe events and injury. The injured employee must sign the report. Supervisor/manager must ensure report is completely and accurately filled out and sign the report.

- Supervisor/manager must immediately investigate the accident and should obtain additional information as needed for complete investigation of the incident (photographs, diagrams, witness statements, doctor slips, etc.).

  The supervisor/manager must provide a written report, in memo format, detailing the accident/injury incident.

- Send all original reports, within 48 hours of the incident, to the division secretary handling worker's compensation for the injured employee. (Home Division) For Ohio employees only, send all original reports to Corporate Health and Safety. Original reports are to be retained in the employee's worker's compensation file.

- Fax or forward a copy of all reports to the Corporate Occupational Health Supervisor at Health and Safety in Findlay within 24 hours of the incident. (Fax: 419-425-6039).

- Retain a copy of all reports in job site safety file.

- The Division Manager must IMMEDIATELY notify the Regional Manager.
- The Regional Safety Manager must IMMEDIATELY notify the Vice President of Health an Safety, consult Corporate Legal Counsel and notify OSHA.
- The Regional Manager must IMMEDIATELY notify the President and Chief Executive Officer of the Corporation.
- A complete investigation of the incident will be conducted by the Vice President of Health and Safety and/or his appointed designee(s).

OHM ACCIDENT/INJURY/ILLNESS REPORTING PROCEDURES

FORMS

OHM EMPLOYEE ACCIDENT/INJURY/ILLNESS REPORT: *(Form 0084)(Appendix A)*

This form must be completed for all accidents and signed by the employee, supervisor/manager and safety official. The supervisor/manager must complete and sign the report following a complete investigation of the incident. This reports should be completed using the employee's "own words" to describe the details of events involved in the incident. The employee must sign the report unless medically unable to do so.

This report meets the requirements of the OSHA Form No. 101 and provides necessary information for completion of a first report of injury for worker's compensation claim. Forms may be obtained through Corporate Health & Safety.

INJURY/ILLNESS STATUS REPORT: *(Form 0085)(Appendix B)*

This report must be completed at the time of each medical evaluation relating to an injury/illness. Information provided on this report is necessary to determine the employee's ability to work, if the incident is OSHA recordable and for the administration of worker's compensation claims.

This report also serves as an authorization to release medical information which is required to obtain doctor's reports, emergency room records, x-ray reports, lab reports, etc., pertaining to the work-related incident. The medical release must be signed by the employee.

The upper portion of this report is to be completed by the supervisor/manager or person sending the employee for treatment and the lower portion of the form is to be completed and signed by the treating physician. The white copy of the report must be given to the employee or the immediate supervisor, the treating physician/agency retains the yellow copy. Forms may be obtained through Corporate Health & Safety.

NOTICE OF LOST TIME INJURY/DEATH: *(Appendix C)*

This report is required to be completed in any accident/injury case in which lost time or death is involved. The notice must be completed by the Division Manager and presented to Corporate Health and Safety within 24 hours of the incident. Forms may be obtained through Corporate Health & Safety.

WITNESS FORM *(Appendix D)*

This form is to be used to obtain a signed statement from individuals who have witnessed the injury/incident or have pertinent information relating to the incident. Forms may be obtained through Corporate Health & Safety.

OHM Corporation

POSITION STATEMENT ON MODIFIED WORK

It is the objective of OHM Corporation to minimize accidents to the fullest extent as practical through strict compliance with OSHA regulations and OHM Corporation Standard Operating Procedures (SOPs), as well as supervisor and employee safety training, site safety audits, and constant attention to safety. Should an employee have the misfortune of being injured or becoming ill in the course of, and arising from his/her employment, OHM Corporation will endeavor to provide an injured employee an alternate, temporary assignment when the employee can return to work with a restriction. Modified (Light Duty) work will be made available in order to bring the injured employee back to the work environment, for the benefit of the employee and the Company, whenever medically appropriate.

Employees are expected to return to modified work when medically capable. The work assigned the injured employee will be work that will not aggravate the medical condition and meets the restrictions set forth by the treating and/or Company physician. Examples of modified work include, but are not limited to, office work, dispatching, and light shop work.

Employees accepting modified work will be paid the rate of pay they were earning immediately prior to the period of disability and are subject to evaluation by the Company physician, at the Company's discretion.

OHM Corporation

ACCIDENT/INJURY/ILLNESS REPORT FORM

Form 3084
H & S Dept.
6.91

☐ Accident	☐ Injury	☐ Illness
Property Damage	☐ Yes	☐ No
Vehicle Involved	☐ Yes	☐ No

Health & Safety Use Only

Case # _____
☐ First Aid Only
☐ Medical Treatment
☐ Lost Workdays – Restricted Activity
☐ Lost Workdays – Away from Work
☐ Fatality

Exact Date and Time of Incident _____ ____ a.m. ____ p.m. Shift ☐ 1st ☐ 2nd ☐ 3rd

OHM CORPORATION _____
(Employee's Home Division/Regional Office/Subsidiary)

Address _____
City State

PROJECT IDENTIFICATION (Project Related Incidents Only)

Project No. _____ Project Start Date _____ Completion Date _____

Location (Full Address) _____

Telephone _____ Project Manager _____

EMPLOYEE INFORMATION

Employee's Full Name _____ Employee No. _____

☐ Regular Full Time ☐ Regular Part Time ☐ Temporary ☐ Non-Employee

Home Address _____

Date of Birth _____ Age ____ Social Security No. ____ - ____ - _____ Sex ☐ M ☐ F

Job Title _____ Department _____ Date Hired _____

Length of Employment ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs. Time in Job Class ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs

Name of Employee's Direct Supervisor _____

Supervision at Time of Accident ☐ Directly Supervised ☐ Indirectly Supervised ☐ Not Supervised

Specific Location Where Incident Occurred _____

_____ ☐ OHM Facility ☐ Project Site ☐ Other _____

To Whom Was Incident Reported? _____ When? _____

Witness Name/Address _____

Witness Job Title/Reason in Area _____

Describe Employee's Job Duties Being Performed When Injured _____

_____

_____

Describe Fully the Events Which Resulted in the Accident/Injury/Illness _____

_____

_____

PLEASE CONTINUE ON BACK OF THIS FORM

OHM Corporation

Form
691

INJURY/ILLNESS STATUS REPORT

Employee _____ Social Security No. ____ - ____ - ____

Home Address _____ Phone _____

Job Title _____ Home Division _____

Date/Time of Injury/Illness _____ ____ a.m. Location: ☐ OHM Facility ☐ Project Site

____ p.m. ☐ Other _____

Description of Injury/Illness _____

AUTHORIZATION TO RELEASE INFORMATION

I hereby authorize all physicians, hospitals, clinics and all persons to discuss with, and release to OHM Corporation and its authorized a any information or copies thereof acquired in the course of my examination or treatment for the injury identified above. This authorization not extend to any other medical condition, past or present, unless the same is causally or historically relevant or related to the injury refe to above.

Employee Signature _____ Date _____

PHYSICIANS OR MEDICAL PERSONNEL TO COMPLETE REMAINDER OF FORM

WORK STATUS

☐ Patient may return to work with no limitations

_____
Date

Patient may return to work on _____
Date
with limitations indicated. These restrictions are in effect until _____ or until Reevaluation
Date
on _____
Date

Patient may work _____ hours in a work day.

☐ Patient is totally incapacitated at this time. Patient will be reevaluated on _____
Date

DEGREE

☐ Sedentary Work. Lifting 10 pounds maximum and occasionally lifting and/or carrying such articles as dockets, ledgers, and small tools. Although a sedentary job is defined as one which involves sitting, a certain amount of walking and standing is often necessary in carrying out job duties. Jobs are sedentary if walking and standing are required only occasionally and other sedentary criteria are met.

☐ Light Work. Lifting 20 pounds maximum with frequent lifting and/or carrying of objects weighing up to 10 pounds. Even though the weight lifted may be only a negligible amount, a job is in this category when it requires walking or standing to a significant degree or when it involves sitting most of the time with a degree of pushing and pulling of arm and/or leg controls.

☐ Medium Work. Lifting 50 pounds maximum with frequent lifting and/or carrying of objects weighing up to 25 pounds.

☐ Heavy Work. Lifting 100 pounds maximum with frequent lifting and/or carrying of objects weighing up to 50 pounds.

☐ Very Heavy Work. Lifting objects in excess of 100 pounds with frequent lifting and/or carrying of objects weighing 50 pounds or more.

LIMITATIONS

1. The patient may:
   a. Stand/walk
      ☐ None ☐ 1-4 hours
      ☐ 4-6 hours ☐ 6-8 hours
   b. Sit
      ☐ 1-3 hours ☐ 3-5 hours
      ☐ 5-8 hours
   c. Drive
      ☐ 1-3 hours ☐ 3-5 hours
      ☐ 5-8 hours
2. Patient may use hands for repetitive:
   ☐ Single grasping ☐ Pushing & pulling
   ☐ Fine manipulation
3. Patient may use feet for repetitive movement as operating foot controls:
   ☐ Yes ☐ No
4. Patient is able to:

	Frequently	Occasionally	Not at All
a. Bend	☐	☐	☐
b. Squat	☐	☐	☐
c. Climb	☐	☐	☐

PHYSICIANS REPORT

Diagnosis _____

Prognosis _____

Other _____

_____

☐ Referred to company physician
☐ Patient referred/admitted:

To Whom _____

Address _____

Phone _____

Date _____ Time _____

Date of this Report _____ Physician's Signature _____

Address _____ Phone _____

White - Client
Canary - Clinic Copy

16406 U.S. Route 224 E. • P.O. Box 551 • Findlay, OH 45839-0551 • (419) 425-6054

(Use Extra Page If Needed)

Describe the Injury/Illness in Detail; Indicate Part of Body Affected

Name of Object/Substance Which Directly Injured Employee

Has/Will Employee Seek Treatment? ☐ Yes ☐ No Did Employee Die? ☐ Yes ☐ No

Name/Address of Hospital/Doctor

Describe Treatment Given

Was Employee Able To Return To Work? ☐ Yes ☐ No

If YES: ☐ Regular Work ☐ Work with Restricted Activities

Restriction

If NO: Date Lost Time Began Date/Est. Date To Return

Identify Personal Protective Equipment Used by Injured Employee

What Training or Instruction Had Been Given?

How Could This Accident Have Been Prevented?

Corrective Action

Are You Reporting This Incident as an Industrial Injury/Illness? ☐ Yes ☐ No

Signature (Employee) Date

Signature (Supvr/Manager) Date

Signature (Safety Officer) Date

Signature (Proj. Manager) Date

Signing This Report does Not Constitute Certification of an Industrial Claim

DISTRIBUTION Original To: Division Secretary at Employee's Home Office

Copy To: ☐ Corporate Health & Safety ☐ Regional Health & Safety Manager
☐ Project Manager ☐ Site Safety File

OHM Corporation

NOTICE OF LOST TIME INJURY/DEATH

Please Type or Print

Employee's Name: _____

Employee's No.: _____

Location: _____

Supervisor's Name: _____

Date of Injury/Death: _____ Time: _____

Brief Description of Incident: _____

_____

_____

Immediate Corrective Action: _____

_____

_____

Tentative Follow-up Corrective Action: _____

_____

Signature: _____ Supervisor Manager

Date: _____

Distribution

- Fax to the following:
  1) Fred Halvorsen, Vice President, Health and Safety
     Fax (419) 425-6039; Phone (419) 424-4910
  2) Regional Manager
- Original: Corporate Health and Safety
- Copy: Site Safety File

WITNESS FORM

NAME _____ AGE _____

ADDRESS _____

PHONE _____ MARITAL STATUS _____

OCCUPATION _____

DATE ACCIDENT WITNESSED _____ TIME _____

LOCATION OF ACCIDENT _____

MY POSITION AT TIME OF ACCIDENT _____

MY LOCATION AT TIME OF ACCIDENT _____

_____

NARRATIVE REPORT

Describe in your own words what happened. (What did you see, hear, smell, do, etc.):

_____

_____

_____

_____

_____

_____

_____

_____

_____

I have read the above report and it is true and correct to the best of my knowledge. I do not recall any other facts of this accident.

_____ _____/_____/_____

(Signature of witness) (date)

OHM WORKERS' COMPENSATION CONTACTS

May 20, 1992

CORPORATE OFFICE/OHIO DIVISION	*Mark Harber*	800-537-9540
MIDWEST REGION	*James Joice* *	800-537-9540
Illinois Division	Kelly Cruise	708-759-9493
Minnesota Division	Geneva Anderson	612-593-9119
Missouri Division	Medora Rund	314-272-3303
Pennsylvania Division	Linda Kalbaugh	800-284-6462
NORTHEAST REGION	*Kevin McMahon* *	609-443-2800
Massachusetts Division	Jennifer Tremblay	800-242-4644
New Jersey Division	Elizabeth O'Connor	609-443-2800
New York Division	Barb Golas	800-457-4412
Virginia Division	Martha Nuckols	800-426-0127
Northeast Region (Princeton)	Sharon Zelis	609-987-0010
SOUTHEAST REGION	*Angelo Liberatore* *	800-327-9942
Alabama Division	Charlie Hunt	404-787-3836
Florida Division	Janet Bayes	800-552-2038
Caribbean Division	Evelyn Casillas	407-241-8903
Georgia Division	Sue Cagle	404-787-3834
North Carolina Division	Kathryn Wessell	800-275-8887
Southeast Region (Norcross)	Jennifer Boschert	800-327-9942
SOUTHWEST REGION	*Franklin Poston* *	713-875-3600
Austin Division	Marty Jones	512-327-9212
Louisiana Division	Jill Edwards	504-389-9596
Texas Division	Richard Hernandez	713-875-3600
Southwest Region (Houston)	Gayla George	713-875-0000
WESTERN REGION	*Rich Bohrer* *	800-882-8582
San Leandro Division	Ginger Biela	800-522-6462
Sacramento Division	Cheri Rieg	800-334-2417
Anaheim Division	Linda Vadura	800-255-2298
Washington Division	Stacie Siegfried	206-861-4617
Western Region (Walnut Creek)	JoAnne Barron	800-882-8582
TAC Group (Walnut Creek)	Bobbie Meehan	510-256-7187

* Regional Health & Safety Managers

APPENDIX J

OHM SAFETY INSPECTION PROJECT SITE FORM

OHM Corporation

OHM Corporation
Project Site Inspection Checklist

Project Name: _____
Project Number: _____
Project Location: _____
Site Supervisor: _____
Inspector's Name: _____

MEDICAL AND FIRST AID	YES	NO
1. Are First Aid Kits accessible and identified?	___	___
2. Are emergency eye wash and safety showers available?	___	___
3. Are daily logs for first aid present and up to date?	___	___
4. Are First Aid Kits inspected weekly?	___	___
PERSONAL PROTECTIVE EQUIPMENT		
1. Have levels of personnel protection been established?	___	___
2. Do all employees know their level of protection?	___	___
3. Are respirators used decontaminated, inspected, and stored according to standard procedures?	___	___
4. Have employees been fit-tested?	___	___
5. Is defective personal protective equipment tagged?	___	___
6. Does compressed breathing air meet CGA Grade "D" minimum?	___	___
7. Are there sufficient quantities of safety equipment and repair parts?	___	___
8. Does Level D protection consist of safety glasses, hard hats, and steel toe boots?	___	___
FIRE PREVENTION		
1. Is smoking prohibited in flammable storage areas?	___	___
2. Are fire lanes established and maintained?	___	___
3. Are flammable dispensing systems grounded and bonded?	___	___
4. Are approved safety cans available for storage of flammable liquids?	___	___
5. Has the local fire department been contacted?	___	___
6. Are fire extinguishers available near refueling areas?	___	___
AIR MONITORING		
1. Is air monitoring being conducted as required by the site safety plan?	___	___
2. Are air monitoring instruments calibrated daily?	___	___
3. Is the air monitoring logbooks up to date?	___	___
4. Are user manuals available?	___	___
5. Are instruments clean and charged?	___	___

WELDING AND CUTTING (29 CFR 1926 Subpart J)

1. Are fire extinguishers present at welding and cutting operations? ____ ____
2. Are confined spaces; such as, tanks, pipelines, and trenches; tested prior to cutting and welding operations? ____ ____
3. Are Hot Work Permits available? ____ ____
4. Are proper helmets, goggles, aprons, and gloves available for welding and cutting operations? ____ ____
5. Are welding machines properly grounded? ____ ____
6. Are oxygen and fuel gas cylinders stored a minimum of 20 feet apart? ____ ____
7. Are only trained personnel permitted to operate welding and cutting equipment? ____ ____

HAND AND POWER TOOLS (29 CFR 1926 Subpart I)

1. Are defective hand and power tools tagged and taken out of service? ____ ____
2. Is eye protection available and used when operating power tools? ____ ____
3. Are guards and safety devices in place on power tools? ____ ____
4. Are power tools inspected before each use? ____ ____
5. Are non-sparking tools available? ____ ____

MOTOR VEHICLES

1. Are vehicles inspected daily? ____ ____
2. Are personnel licensed for the equipment they operate? ____ ____
3. Are unsafe vehicles tagged and reported to supervision? ____ ____
4. Are vehicles shut down before fueling? ____ ____
5. When backing vehicles, are spotters provided? ____ ____
6. Is safety equipment on vehicles? ____ ____
7. Are loads secure on vehicles? ____ ____
8. Are vehicle occupants using safety belts if provided? ____ ____

EMERGENCY PLANS

1. Are emergency telephone numbers posted? ____ ____
2. Have emergency escape routes been designated? ____ ____
3. Are employees familiar with the emergency signal? ____ ____
4. Has the emergency route to the hospital been established and posted? ____ ____

MATERIALS HANDLING

1. Are materials stacked and stored as to prevent sliding or collapsing? ____ ____
2. Are flammables and combustibles stored in non-smoking areas? ____ ____
3. Is machinery braced when personnel are performing maintenance? ____ ____
4. Are tripping hazards labeled? ____ ____
5. Are semi-trailers chocked? ____ ____
6. Are fixed jacks used under semi-trailers? ____ ____
7. Are riders prohibited on materials handling equipment? ____ ____
8. Are cranes inspected as prescribed and logged? ____ ____
9. Are OSHA approved manlifts provided for the lifting of personnel? ____ ____
10. Are personnel in manlifts wearing approved fall protection devices? ____ ____

FIRE PROTECTION

1. Has a fire alarm been established? ____ ____
2. Do employees know the location and use of all fire extinguishers? ____ ____
3. Are fire extinguisher locations marked? ____ ____
4. Are combustible materials segregated from open flames? ____ ____
5. Have fire extinguishers been professionally inspected during the last year? ____ ____
6. Are fire extinguishers visually inspected monthly? ____ ____

ELECTRICAL (29 CFR 1926 Subpart K)

1. Is electrical equipment and wiring properly guarded? ____ ____
2. Are electrical lines, extension cords, and cables guarded and maintained in good conditions? ____ ____
3. Are extension cords kept out of wet areas? ____ ____
4. Is damaged electrical equipment tagged and taken out of service? ____ ____
5. Have underground electrical lines been identified by proper authorities? ____ ____
6. Has positive lock-out system been established by a certified project electrician? ____ ____
7. Are GFCI's being used as needed? ____ ____
8. Are extension cords being inspected daily for ground continuity and structural integrity? (i.e., group pin in place, no unapproved splices) ____ ____
9. Are warning signs exhibited on high voltae equipment (250V or greater)? ____ ____
10. Is extension cord inspection documented? ____ ____

CRANES AND RIGGING (29 CFR 1926.550)

1. Are cranes inspected daily? ____ ____
2. Are crane swing areas barricaded or demarked? ____ ____
3. Is all rigging equipment tagged with an identification number and rated capacity? ____ ____
4. Is rigging equipment inspection documented? ____ ____
5. Are slings, chains, and rigging inspected before each use? ____ ____
6. Are damaged slings, chains, and rigging tagged and taken out of service? ____ ____
7. Are slings padded or protected from sharp corners? ____ ____
8. Do employees keep clear of suspended loads? ____ ____
9. Are employees in the lift area wearing hard hats? ____ ____

COMPRESSED GAS CYLINDERS

1. Are breathing air cylinders charged only to prescribed pressures? ____ ____
2. Are like cylinders segregated in well ventilated areas? ____ ____
3. Is smoking prohibited in cylinder storage areas? ____ ____
4. Are cylinders stored secure and upright? ____ ____
5. Are cylinders protected from snow, rain, etc.? ____ ____
6. Are cylinder caps in place before cylinders are moved? ____ ____
7. Are fuel gas and 02 cylinders stored a minimum of 20 feet apart? ____ ____
8. Are propane cylinders stored and used outside the structure? ____ ____

SCAFFOLDING (29 CFR 1926.451)

1. Is scaffolding placed on a flat, firm surface? ____ ____
2. Are scaffold planks free of mud, ice, grease, etc.? ____ ____
3. Is scaffolding inspected before each use? ____ ____
4. Are defective scaffold parts taken out of service? ____ ____
5. Does mobile scaffold height exceed 4 times the width or base dimension? ____ ____
6. Does scaffold planking overlap a minimum of 12 inches? ____ ____
7. Does scaffold planking extend over end supports between 6 to 18 inches? ____ ____

8. Are employees restricted from working on scaffolds during storms and high winds? ____ ____
9. Are all pins in place and wheels locked? ____ ____
10. Is perimeter guarding (top rail, mid rail, and toe board) present? ____ ____

WALKING AND WORKING SURFACES

1. Are ladders a Type I or Type II? ____ ____
2. Are accessways, stairways, ramps, and ladders clean of ice, mud, snow, or debris? ____ ____
3. Are ladders being used in a safe manner? ____ ____
4. Are ladders kept out of passageways, doors, or driveways? ____ ____
5. Are broken or damaged ladders tagged and taken out of service? ____ ____
6. Are metal ladders prohibited in electrical service? ____ ____
7. Are stairways and floor openings guarded? ____ ____
8. Are safety feet installed on straight and extension ladders? ____ ____
9. Is general housekeeping up to OHM standards? ____ ____
10. Are ladders tied off? ____ ____

SITE SAFETY PLAN

1. Is a site safety plan available on site or accessible to all employees? ____ ____
2. Does the safety plan accurately reflect site conditions and tasks? ____ ____
3. Have potential hazards been described to employees on site? ____ ____
4. Is there a designated safety official on site? ____ ____
5. Have all employees signed the acknowledgement form? ____ ____

SITE POSTERS

1. Are the following documents posted in a prominent and accessible area?

   A. Minimum Wage ____ ____
   B. OSHA Health and Safety ____ ____
   C. Equal Employment Opportunity ____ ____

SITE CONTROL

1. Are work zones clearly defined? ____ ____
2. Are support trailers located to minimize exposure from a potential release? ____ ____
3. Are support trailers accessible for approach by emergency vehicles? ____ ____
4. Is the site properly secured during and after work hours? ____ ____

HEAVY EQUIPMENT (29 CFR 1926 Subpart O)

1. Is heavy equipment inspected as prescribed by the manufacturer? ____ ____
2. Is defective heavy equipment tagged and taken out of service? ____ ____
3. Are project roads and structures inspected for load capacities and proper clearances? ____ ____
4. Is heavy equipment shut down for fueling and maintenance? ____ ____
5. Are back-up alarms installed and working on equipment? ____ ____
6. Are designated operators only operating equipment? ____ ____
7. Are riders prohibited on heavy equipment? ____ ____
8. Are guards and safety appliances in place and used? ____ ____

EXCAVATION (29 CFR 1926 Subpart P)

1. Has a "competent person" been designated to supervise this excavation activity? ____ ____
2. Have utility companies been advised of excavation activities? ____ ____
3. Prior to opening excavations, are utilities located and marked? ____ ____

Has a professional engineer evaluated all excavations greater than 20 feet deep? ____ ____

5. Is there rescue equipment on-site and accessible to excavation? ____ ____
6. Is excavated material placed a minimum of 24 inches from the excavations? ____ ____
7. Are the sides of excavations sloped or shored to prevent caving in on employees? ____ ____
8. Has excavation greater than 4-feet deep been monitored for hazardous atmospheres (i.e. LEL/02 deficiency)? ____ ____
9. Are ladders used in excavations over 4-feet deep? ____ ____
10. Are ladders present every 25 feet? ____ ____
11. Are barriers, i.e. guardrails or fences placed around excavations near pedestrian or vehicle thoroughfares? ____ ____
12. Is excavation inspected daily by competent persons and documented? ____ ____

CONFINED SPACES (Proposed Regulation 29 CFR 1910.146)

1. Have employees been trained in the hazards of confined spaces? ____ ____
2. Are confined space permits available on project site? ____ ____
3. Is the contractors confined space safety procedure on the project? ____ ____
4. Has a rescue plan been established? ____ ____

PERSONNEL DECONTAMINATION

1. Are decontamination stations set up on site? ____ ____
2. Are waste receptacles available for contaminated clothing? ____ ____
3. Are steps taken to contain liquids used for decontamination? ____ ____
4. Have decontamination steps and procedures been covered by the site supervisor or safety official? ____ ____
5. Is all personal protective equipment and respiratory equipment being cleaned on a daily basis? ____ ____

EQUIPMENT DECONTAMINATION

1. Has equipment decontamination been established? ____ ____
2. Is contamination wash water properly contained and disposed of? ____ ____
3. Are all pieces of equipment inspected for proper decontamination before leaving the site? ____ ____
4. Is all equipment being cleaned on a daily basis? ____ ____

HAZARD COMMUNICATION (29 CFR 1926.59)

1. Is there a written program on-site? ____ ____
2. Is there a MSDS FOR EACH CHEMICAL present on-site? ____ ____
3. Are all containers properly labeled, as to content, hazard? ____ ____
4. Have employees been trained on chemical hazards? ____ ____
5. Are employee's trained on chemical hazards while doing non-routine tasks? ____ ____
6. Do employees (including subcontractors) know and understand the acute and chemical effects of exposure from the chemicals on-site? ____ ____
7. Have all subcontractors signed the Haz-Comm acknowledgement form? ____ ____

I have reviewed this inspection checklist with the safety inspector and fully understand the recommendations and will make every attempt to correct them immediately.

	Signature	Date
Site Contractor Supervisor:	_____	_____
Project Manager:	_____	_____
OHM Compliance Inspector:	_____	_____

APPENDIX K

SUMMARY OF SAMPLE RESULTS

TABLE 22

REMOTE FILL REMEDIAL VOLUME ESTIMATES
NL/TARACORP SUPERFUND SITE

LOCATION	HAZARDOUS TCLP Lead > 5 MG/L (Y/N)	ESTIMATED NON-HAZARDOUS VOLUME (YD^3)	ESTIMATED HAZARDOUS VOLUME (YD^3)
2230 CLEVELAND	YES	0	51
3108 COLGATE	YES	0	6
1628 DELMAR	NO	7	0
EAGLE PARK ACRES			
108 CARVER	NO	56	0
111 CARVER	NO	0	0
202A HARRISON	YES/NO	29	310
203/205 HARRISON	NO	1,274	0
100/201 HILL	NO/YES	24	59
128 ROOSEVELT	NO	417	0
203/205 TERRY	YES	0	438
208 TERRY	NO	511	0
EAGLE PARK ACRES TOTAL (YD^3)		2,311	807

PRELIMINARY

TABLE 22

REMOTE FILL REMEDIAL VOLUME ESTIMATES
NL/TARACORP SUPERFUND SITE

LOCATION	HAZARDOUS TCLP Lead > 5 MG/L (Y/N)	ESTIMATED NON-HAZARDOUS VOLUME (YD^3)	ESTIMATED HAZARDOUS VOLUME (YD^3)
MISSOURI AVENUE	YES/NO	80	1,790
SAND ROAD	NO	1,415	0
SCHAEFFER ROAD	YES	0	918
VENICE ALLEYS			
ABBOTT AVENUE	YES	0	1,363
KLEIN AVENUE	NO	389	0
LINCOLN AVENUE	NO	227	0
SLOUGH ROAD	YES*	0	790
WEBER AVENUE	NO/YES	589	109
VENICE ALLEYS TOTAL (YD^3)		1,205	2,262
REMOTE FILL TOTAL VOLUMES (YD^3)		5,018	5,834
COMBINED TOTAL FILL VOLUME (YD^3)			10,851

LEGEND

* A majority of the area contains TCLP-Lead concentrations > 5 mg/l.

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TABLE 24
EAGLE PARK DATA SUMMARY

NI/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 02, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SCA0108100C00L	Total Lead	05/19/1992	07/29/1992	154	U	MG/KG	5.1	Moisture Content	07/08/1992	19.7	%WET W
SCA0108100A00T	TCLP Lead	05/19/1992		4		MG/L					
SCA0108200C00L	Total Lead	05/19/1992	07/29/1992	1810	U	MG/KG	5.3	Moisture Content	07/08/1992	9.9	%WET W
SCA010820AB00L	Total Lead	05/19/1992	07/29/1992	4350	U	MG/KG	29.0	Moisture Content	07/08/1992	14.5	%WET W
SCA011110AB00L	Total Lead	05/19/1992	07/29/1992	471	U	MG/KG	5.4	Moisture Content	07/08/1992	9.1	%WET W
SCA011120AB00L	Total Lead	05/19/1992	07/29/1992	445	U	MG/KG	5.2	Moisture Content	07/08/1992	9.2	%WET W
SHA0202100C00L	Total Lead	05/27/1992	07/30/1992	2320		MG/KG	6.1	Moisture Content	07/10/1992	23.3	%WET W
SHA0202100C00T	TCLP Lead	05/27/1992		11.7		MG/L	0.2				
SHA0202100D00L	Total Lead	05/27/1992	07/30/1992	103		MG/KG	5.9	Moisture Content	07/10/1992	22.1	%WET W
SHA0202100E00L	Total Lead	05/27/1992	07/30/1992	198		MG/KG	6.0	Moisture Content	07/10/1992	21.1	%WET W
SHA020210AB00L	Total Lead	05/27/1992	07/30/1992	68400		MG/KG	261	Moisture Content	07/10/1992	10.2	%WET W
SHA020210AB00T	TCLP Lead	05/27/1992	09/15/1992	440		MG/L	0.18				
SHA0202200C00T	TCLP Lead	05/27/1992	09/15/1992	2.34		MG/L	0.18				
SHA0202200F00L	Total Lead	05/27/1992	07/30/1992	19.4		MG/KG	6.1	Moisture Content	07/10/1992	22.9	%WET W
SHA020220AB00L	Total Lead	05/27/1992	07/30/1992	1240		MG/KG	5.1	Moisture Content	07/10/1992	10.0	%WET W
SHA020220AB00T	TCLP Lead	05/27/1992	09/15/1992	1.47		MG/L	0.18				
SHA0202300C00L	Total Lead	05/27/1992	07/30/1992	752		MG/KG	6.1	Moisture Content	07/10/1992	22.7	%WET W
SHA0202300E00L	Total Lead	05/27/1992	07/30/1992	622		MG/KG	6.6	Moisture Content	07/10/1992	28.3	%WET W
SHA0202300F00T	TCLP Lead	05/27/1992	09/15/1992	0.93		MG/L	0.18				
SHA0202300F0TD	TCLP Lead	05/27/1992	09/15/1992	1.13		MG/L	0.18				
SHA0202300G00L	Total Lead	05/27/1992	07/30/1992	177		MG/KG	5.9	Moisture Content	07/10/1992	28.3	%WET W
SHA020230AB0L	Total Lead	05/27/1992	07/30/1992	937		MG/KG	5.5	Moisture Content	07/10/1992	9.1	%WET W
SHA020230AB0LD	Total Lead	05/27/1992	07/30/1992	536		MG/KG	5.3	Moisture Content	07/10/1992	11.6	%WET W
SHA0202400C00L	Total Lead	05/27/1992	07/30/1992	151		MG/KG	5.8	Moisture Content	07/10/1992	19.1	%WET W
SHA020240AB00L	Total Lead	05/27/1992	07/30/1992	106		MG/KG	5.6	Moisture Content	07/10/1992	15.2	%WET W
SHA0203100D00L	Total Lead	05/22/1992	07/29/1992	49.8	U	MG/KG	6.6	Moisture Content	07/09/1992	27.9	%WET W
SHA020310AC00L	Total Lead	05/22/1992	07/29/1992	92.9	U	MG/KG	5.1	Moisture Content	07/09/1992	20.9	%WET W

5.6 Thirst is not an adequate indicator of body water loss. Workers are to drink at least small amounts of water on each break.

5.7 Workers are to rest when any of the symptoms described above are present. The buddy system is mandatory, as most often the potential victim will not be aware of any symptoms. Watch out for each other.

1. OBJECTIVE

OHM Remediation Services Corp. (OHM) recognizes that work must be performed in various weather conditions, including cold climates. In order to minimize cold related illnesses, site supervisors are to be aware of the symptoms of and environmental conditions that lead to cold-related illnesses the appropriate steps to take to prevent their occurrence.

2. PURPOSE

This procedure describes the causes, symptoms, treatment and/or prevention of cold-related illness.

3. GENERAL INFORMATION

3.1 When the temperature of the surrounding air or water are much colder than the worker, the body's physical processes must increase to maintain thermal balance. Shivering is the body's attempt to generate increased heat.

3.2 The lower limit of efficiency for prolonged outdoor work is -24 degrees F.

3.3 Shivering, pain and numbness are not trustworthy indicators to cold exposures, because prolonged cold exposure numbs all body sensations.

3.4 Wind-chill temperature is a better means of evaluation as it takes into account the wind's ability to strip heat from the body through convection.

3.5 Protective clothing that is wet with sweat or from rain will cause heat loss through conduction.

4. COLD INJURY

4.1 **TRENCH FOOT** occurs as a result of extended exposure of the feet to cold and moisture. Capillary walls of the feet are injured, resulting in tingling, itching and pain. Blisters may form followed by ulceration of the skin.

4.2 **FROST-NIP** is localized superficial freezing of extremities such as ears, nose, toes, and fingers. Initially there is a dark bluish color due to bleeding under the skin which at times can become gangrenous. Worker experiencing frost nip are susceptible to future injury and should avoid chilling.

4.3 **FROSTBITE** occurs when the moisture in the skin actually freezes, forming ice crystals, resulting in the damage of skin cells. The injured area becomes red, then blue/red. A burning pain is noted initially, then pain decreases and numbness sets in. The skin becomes waxy pale in appearance because of lack of oxygen. The ears, nose, toes and fingers are most susceptible. Damaged area can become gangrenous resulting in the loss of tissue, finger tips and toes.

4.4 **HYPOTHERMIA** occurs when heat production of the body is not sufficient to replace heat lost to the environment. The results are a lowering of the core body temperature, the pulse rate slows, muscular weakness occurs, mental abilities dull and the worker becomes uncoordinated. Signs of hypothermia are evident at 95 degrees Fahrenheit body core temperature and consciousness is lost between 89.6 - 86.0 degrees Fahrenheit. At lower core temperatures, cardiac arrest is possible.

Exposure to cold water decreases the body core temperature rapidly and consciousness is quickly lost. Workers on or over water should be acutely aware of the danger of immersion during cold weather.

It has been known for years that hypothermia results in dulling of the senses and could result in poor decision making. Workers that are exposed to extreme cold should not be given tasks that are critical to their health and safety and that of others.

5. PREVENTION

Prevention of hypothermia and other cold injuries is best accomplished by protecting workers from cold and moisture. Clothing is the most important factor in prevention of injury. Personnel working on land should layer clothing with outer layer being wind and water resistant. The layers should be capable of being vented at wrist, neck and waist to reduce wetting by perspiration. Feet should be kept dry and socks should be changed when they become wet. Gloves which protect the hands from cold but allow freedom of movement are necessary. Never allow bare skin to contact metal surfaces at sub-zero temperatures.

APPENDIX G

EXCAVATION SAFETY PROCEDURES

1. OBJECTIVE

All excavations opened at OHM Remediation Services Corp. (OHM) facilities and project sites must comply with the requirements of this procedure.

2. SCOPE, APPLICATION AND PURPOSE

This procedure outlines requirements for all open excavations made in the earth's surface. Excavations are defined to include trenches. This policy is intended to protect personnel from the hazards of collapse.

3. REGULATORY REQUIREMENTS

This procedure will follow the guidelines of 29 CFR 1926, Subpart P - Excavations. In the case of United States Army Corp of Engineers projects, the requirements of EM 385-1-1, Section 23 will be observed. In the event of a conflict between these referenced standards, the more stringent will prevail.

4. GENERAL REQUIREMENTS

Safety operations while working in and around excavations involve many factors. Factors to be evaluated and discussed before starting work at daily safety meetings include:

4.1 Surface Encumbrances

All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary to safeguard employees.

4.2 Underground Installations

The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked

to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the excavation may proceed with caution, provided detection equipment or other acceptable means to locate utility installations are used.

When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

4.3 ACCESS AND EGRESS

4.3.1 Structural Ramps

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

Structural members used for ramps and runways shall be of uniform thickness.

Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

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TABLE 24
EAGLE PARK DATA SUMMARY

NI/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 02, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SHA0203200D00L	Total Lead	05/22/1992	07/29/1992	101	U	MG/KG	6.1	Moisture Content	07/09/1992	23	%WET W
SHA020320AC00L	Total Lead	05/22/1992	07/29/1992	848	U	MG/KG	6.2	Moisture Content	07/09/1992	22 1	%WET W
SHA0203300D00L	Total Lead	05/22/1992	07/29/1992	1540	U	MG/KG	6 3	Moisture Content	07/09/1992	24 7	%WET W
SHA0203300D0LD	Total Lead	05/22/1992	07/29/1992	1220	U	MG/KG	6 3	Moisture Content	07/09/1992	23 7	%WET W
SHA0203300D00T	TCLP Lead	05/22/1992		0.54		MG/L	0.2				
SHA0203300E00L	Total Lead	05/22/1992	07/29/1992	507	U	MG/KG	6 9	Moisture Content	07/09/1992	29 8	%WET W
SHA0203300E00T	TCLP Lead	05/22/1992		0.31		MG/L	0.2				
SHA0203300F00L	Total Lead	05/22/1992	07/29/1992	95.9	U	MG/KG	6.6	Moisture Content	07/09/1992	30 8	%WET W
SHA0203400D00L	Total Lead	05/22/1992	07/29/1992	1800	U	MG/KG	7.1	Moisture Content	07/09/1992	34	%WET W
SHA0203400D00T	TCLP Lead	05/22/1992		< 0.20		MG/L	0.2				
SHA0203400E00L	Total Lead	05/22/1992	07/29/1992	148	U	MG/KG	7.1	Moisture Content	07/09/1992	30 8	%WET W
SHA0203400F00L	Total Lead	05/22/1992	07/29/1992	178	U	MG/KG	7.0	Moisture Content	07/09/1992	30 6	%WET W
SHA020340AC00L	Total Lead	05/22/1992	07/29/1992	186	U	MG/KG	5 9	Moisture Content	07/09/1992	21 8	%WET W
SHA0205100D00L	Total Lead	05/21/1992	07/29/1992	1030	U	MG/KG	6 5	Moisture Content	07/09/1992	24 8	%WET W
SHA0205100E00L	Total Lead	05/21/1992	07/29/1992	223	U	MG/KG	7.2	Moisture Content	07/09/1992	30 2	%WET W
SHA0205200D00L	Total Lead	05/21/1992	07/29/1992	529	U	MG/KG	5.9	Moisture Content	07/09/1992	18 4	%WET W
SHA0205200D0LD	Total Lead	05/21/1992	07/29/1992	832	U	MG/KG	6.1	Moisture Content	07/09/1992	21 3	%WET W
SHA0205200E00L	Total Lead	05/21/1992	07/29/1992	216	U	MG/KG	6.9	Moisture Content	07/09/1992	28 4	%WET W
SHA0205200F00L	Total Lead	05/21/1992	07/29/1992	20.4	U	MG/KG	6.4	Moisture Content	07/09/1992	25 9	%WET W
SHA0205300D00L	Total Lead	05/21/1992	07/29/1992	782	U	MG/KG	5.8	Moisture Content	07/09/1992	19 1	%WET W
SHA0205300D00T	TCLP Lead	05/21/1992		0.22		MG/L	0.2				
SHA0205300D0TD	TCLP Lead	05/21/1992		0.32		MG/L	0 2				
SHA0205300E0L	Total Lead	05/21/1992	07/29/1992	500	U	MG/KG	6.6	Moisture Content	07/09/1992	29 4	%WET W
SHA0205300E0T	TCLP Lead	05/21/1992		<0.19		MG/L	0.19				
SHA020530AC00L	Total Lead	05/21/1992	07/29/1992	45	U	MG/KG	6.1	Moisture Content	07/09/1992	22 2	%WET W
SHI0100100C00L	Total Lead	05/20/1992	07/29/1992	1580	U	MG/KG	5.8	Moisture Content	07/08/1992	16 4	%WET W
SHI0100100D00L	Total Lead	05/20/1992	07/29/1992	843	U	MG/KG	6.1	Moisture Content	07/08/1992	18 8	%WET W
SHI010010AB00L	Total Lead	05/20/1992	07/29/1992	17900	U	MG/KG	51.1	Moisture Content	07/08/1992	7 9	%WET W
SHI010010AB00T	TCLP Lead	05/20/1992		152		MG/L	0 2				

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TABLE 24
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SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SHI0100200C00L	Total Lead	05/20/1992	07/29/1992	90.2	U	MG/KG	5.2	Moisture Content	07/08/1992	20.5	%WET W
SHI010020AB00L	Total Lead	05/20/1992	07/29/1992	360	J	MG/KG	5.8	Moisture Content	07/08/1992	21.3	%WET W
SHI010020AB00T	TCLP Lead	05/20/1992		1.36		MG/L	0.2				
SRS0128100C00L	Total Lead	05/27/1992	07/30/1992	197		MG/KG	5.3	Moisture Content	07/10/1992	10	%WET W
SRS0128100D00L	Total Lead	05/27/1992	07/30/1992	1670		MG/KG	6.0	Moisture Content	07/10/1992	21.7	%WET W
SRS012810AB00L	Total Lead	05/27/1992	07/30/1992	53.2		MG/KG	5.2	Moisture Content	07/10/1992	6.4	%WET W
SRS0128200C00L	Total Lead	05/27/1992	07/30/1992	474		MG/KG	5.9	Moisture Content	07/10/1992	19.5	%WET W
SRS0128200D00L	Total Lead	05/27/1992	07/30/1992	163		MG/KG	5.4	Moisture Content	07/10/1992	12.6	%WET W
SRS0128200D00T	TCLP Lead	05/27/1992	09/15/1992	0.3		MG/L	0.18				
SRS0128200E00L	Total Lead	05/27/1992	07/30/1992	60.9		MG/KG	6.0	Moisture Content	07/10/1992	22.9	%WET W
SRS0128300C00L	Total Lead	05/27/1992	07/30/1992	745		MG/KG	5.5	Moisture Content	07/10/1992	13.3	%WET W
SRS0128300C00T	TCLP Lead	05/27/1992	09/15/1992	< 0.18		MG/L	0.18				
SRS0128300D00L	Total Lead	05/27/1992	07/30/1992	117		MG/KG	5.9	Moisture Content	07/10/1992	22.6	%WET W
SRS0128300D00T	TCLP Lead	05/27/1992		0.37							
SRS0128300E00L	Total Lead	05/27/1992	07/30/1992	57.2		MG/KG	5.4	Moisture Content	07/10/1992	22.1	%WET W
STE0203100C00L	Total Lead	05/20/1992	07/29/1992	10100	J	MG/KG	59.7	Moisture Content	07/08/1992	21.6	%WET W
STE0203100C0LD	Total Lead	05/20/1992	07/29/1992	5930	J	MG/KG	31.5	Moisture Content	07/08/1992	20.7	%WET W
STE0203100C00T	TCLP Lead	05/20/1992		71.6		MG/L					
STE0203100D00L	Total Lead	05/20/1992	07/29/1992	292	J	MG/KG	6.3	Moisture Content	07/08/1992	24.6	%WET W
STE020310AB00L	Total Lead	05/20/1992	07/29/1992	45200	J	MG/KG	105	Moisture Content	07/08/1992	6.1	%WET W
STE020310AB0LD	Total Lead	05/20/1992	07/29/1992	37700	J	MG/KG	108	Moisture Content	07/08/1992	7.4	%WET W
STE020310AB00T	TCLP Lead	05/20/1992		156		MG/L					
STE0203200C00L	Total Lead	05/20/1992	07/29/1992	820	J	MG/KG	5.7	Moisture Content	07/08/1992	16.7	%WET W
STE0203200D00L	Total Lead	05/20/1992	07/29/1992	44.2	U	MG/KG	6.1	Moisture Content	07/08/1992	21.5	%WET W
STE020320AB00L	Total Lead	05/20/1992	07/29/1992	8060	J	MG/KG	26.1	Moisture Content	07/08/1992	5.3	%WET W
STE020320AB00T	TCLP Lead	05/20/1992		52.3		MG/L	0.2				
STE0203300C00L	Total Lead	05/20/1992	07/29/1992	126	U	MG/KG	6.1	Moisture Content	07/08/1992	21	%WET W
STE0203300D00L	Total Lead	05/20/1992	07/29/1992	41.5	U	MG/KG	6.1	Moisture Content	07/08/1992	23.5	%WET W
STE020330AB00L	Total Lead	05/20/1992	07/29/1992	5430	J	MG/KG	28.1	Moisture Content	07/08/1992	12.9	%WET W
STE020330AB0LD	Total Lead	05/20/1992	07/29/1992	9140	J	MG/KG	28.5	Moisture Content	07/08/1992	13.3	%WET W

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TABLE 24
EAGLE PARK DATA SUMMARY

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SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
STE020330AB05/20/	TCLP Lead	05/20/1992		32.2		MG/L	0.2				
STE0203400C00L	Total Lead	05/20/1992	07/29/1992	971	U	MG/KG	6.5	Moisture Content	07/08/1992	23.4	%WET W
STE0203400D00L	Total Lead	05/20/1992	07/29/1992	59.8	U	MG/KG	6.6	Moisture Content	07/08/1992	25.2	%WET W
STE020340AB00L	Total Lead	05/20/1992	07/29/1992	37500	J	MG/KG	101	Moisture Content	07/08/1992	7.5	%WET W
STE020340AB00T	TCLP Lead	05/20/1992		101		MG/L	0.2				
STE0208100C00L	Total Lead	05/21/1992	07/29/1992	52	U	MG/KG	6.1	Moisture Content	07/09/1992	21.3	%WET W
STE020810AB00L	Total Lead	05/21/1992	07/29/1992	2170	J	MG/KG	6.1	Moisture Content	07/08/1992	21.9	%WET W
STE020810AB00T	TCLP Lead	05/21/1992		1.79		MG/L	0.2				
STE0208200C00L	Total Lead	05/21/1992	07/29/1992	88.9	U	MG/KG	6.3	Moisture Content	07/09/1992	21.7	%WET W
STE020820AB00L	Total Lead	05/21/1992	07/29/1992	474	J	MG/KG	6.2	Moisture Content	07/09/1992	23.5	%WET W
STE020820AB00T	TCLP Lead	05/21/1992		0.88		MG/L	0.2				
STE0208300C00L	Total Lead	05/21/1992	07/29/1992	19.4	U	MG/KG	5.7	Moisture Content	07/09/1992	19.4	%WET W
STE020830AB00L	Total Lead	05/21/1992	07/29/1992	90.7	U	MG/KG	6.8	Moisture Content	07/09/1992	26.4	%WET W
STE0208400C00L	Total Lead	05/21/1992	07/29/1992	2100	J	MG/KG	6.1	Moisture Content	07/09/1992	20.6	%WET W
STE020840AB00L	Total Lead	05/21/1992	07/29/1992	2790	J	MG/KG	29.7	Moisture Content	07/09/1992	22.9	%WET W
STE020840AB00T	TCLP Lead	05/21/1992		0.51		MG/L	0.2				
STE0208500C00L	Total Lead	05/21/1992	07/29/1992	4070	J	MG/KG	27.3	Moisture Content	07/09/1992	16.9	%WET W
STE020850AB00L	Total Lead	05/21/1992	07/29/1992	1180	J	MG/KG	6.3	Moisture Content	07/09/1992	24.3	%WET W
STE020850AB00T	TCLP Lead	05/21/1992		0.53		MG/L	0.2				

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TABLE 28
2230 CLEVELAND DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SCL2230100A00L	Total Lead	04/22/1992	06/03/1992	525		MG/KG –	5.8	Moisture Content	06/10/1992	19.4	%WET W
SCL2230100B00L	Total Lead	04/22/1992	06/03/1992	422		MG/KG –	5.2	Moisture Content	06/10/1992	19.4	%WET W
SCL2230100C00L	Total Lead	04/22/1992	06/03/1992	148		MG/KG –	5.9	Moisture Content	06/10/1992	18.6	%WET W
SCL2230200A00L	Total Lead	04/22/1992	06/03/1992	1020		MG/KG –	6.2	Moisture Content	06/10/1992	20.9	%WET W
SCL2230200B00L	Total Lead	04/22/1992	06/03/1992	613		MG/KG –	6.1	Moisture Content	06/10/1992	19.1	%WET W
SCL2230200C00L	Total Lead	04/22/1992	06/03/1992	433		MG/KG –	6.0	Moisture Content	06/10/1992	18.7	%WET W
SOR0001100A00T	TCLP Lead	04/22/1992		10.3		MG/L					
SOR0001100A0TD	TCLP Lead	04/22/1992		11.2		MG/L					
SOR0002100A00T	TCLP Lead	04/22/1992		72.8		MG/L					
SOR0003100A00T	TCLP Lead	04/22/1992		15.6		MG/L					

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TABLE 29
3108 COLGATE DATA SUMMARY

NL/TARACORP 89MCANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SOR0026100A00L	Total Lead	05/13/1992	07/28/1992	3390	J	MG/KG –	26.5	Moisture Content	07/05/1992	9.3	%WET W
SOR0026100B00L	Total Lead	05/13/1992	06/26/1992	11900		MG/KG –	53.4	Moisture Content	07/05/1992	13.3	%WET W
SOR0026100C00T	TCLP Lead	05/13/1992		10.9		MG/L					
SOR0026200A00L	Total Lead	05/13/1992	06/26/1992	81.1		MG/KG –	5.2	Moisture Content	07/05/1992	9.6	%WET W
SOR0026200B00L	Total Lead	05/13/1992	06/26/1992	70.1		MG/KG –	5.5	Moisture Content	07/05/1992	11.5	%WET W
SOR0026200C00L	Total Lead	05/13/1992	06/26/1992	64.9		MG/KG –	5.5	Moisture Content	07/05/1992	12.9	%WET W

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TABLE 30
1628 DELMAR AVENUE DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 10, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT	QUALIFIER	UNITS	REPORTING DETECTION LIMIT	PARAMETER	ANALYSIS DATE	RESULT	UNITS
SDE1628100A00L	Total Lead	03/03/1992	03/18/1992	1620		MG/KG -	5.9	Moisture Content	03/05/1992	18.4	%WET W
SDE1628100A0LD	Total Lead	03/03/1992	03/18/1992	1730		MG/KG -	6.0	Moisture Content	03/05/1992	18	%WET W
SDE1628100B00L	Total Lead	03/03/1992	03/18/1992	722		MG/KG -	5.7	Moisture Content	03/05/1992	17	%WET W
SDE1628100B0LD	Total Lead	03/03/1992	03/18/1992	680		MG/KG -	5.8	Moisture Content	03/05/1992	17.5	%WET W
SDE1628100C00L	Total Lead	03/03/1992	03/18/1992	278		MG/KG -	5.7	Moisture Content	03/05/1992	16.5	%WET W
SDE1628100C0LD	Total Lead	03/03/1992	03/18/1992	280		MG/KG -	5.5	Moisture Content	03/05/1992	16.7	%WET W
SDE1628200A00L	Total Lead	03/03/1992	03/18/1992	1250		MG/KG -	6.2	Moisture Content	03/05/1992	22.7	%WET W
SDE1628200B00L	Total Lead	03/03/1992	03/18/1992	833		MG/KG -	6.3	Moisture Content	03/05/1992	22.4	%WET W
SDE1628200C00L	Total Lead	03/03/1992	03/18/1992	107		MG/KG -	6.4	Moisture Content	03/05/1992	22.5	%WET W
SOR0025300A00T	TCLP Lead	05/13/1992		0.47		MG/L					
SOR0025400A00T	TCLP Lead	05/13/1992		0.11		MG/L					

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TABLE 25

MISSOURI AVENUE DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SOR000710AB00T	TCLP Lead	12/10/1991	01/07/1992	180		MG/L	0.65
SOR000810AB00T	TCLP Lead	12/10/1991	01/07/1992	<0.65		MG/L	0.65
SOR000910AB00T	TCLP Lead	12/10/1991	01/07/1992	235		MG/L	0.65
SOR001010AB00T	TCLP Lead	12/10/1991	01/07/1992	82.5		MG/L	0.65
SOR0013100K00T	TCLP Lead	06/29/1992		3.94		MG/L	
SOR0014100K00T	TCLP Lead	06/29/1992		< 0.17		MG/L	
SOR0015100J00T	TCLP Lead	06/29/1992		< 0.19		MG/L	
SOR0015100K00T	TCLP Lead	06/29/1992		0.68		MG/L	

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TABLE

SAND ROAD DATA SUMMARY

NL/TARACORP 89MANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SOR0022100C00L	Total Lead	05/20/1992	07/29/1992	318	J	MG/KG	6.0
SOR002210AB00L	Total Lead	05/20/1992	07/29/1992	1030	J	MG/KG	5.8
SOR0023100C00L	Total Lead	05/20/1992	07/29/1992	98	U	MG/KG	6.6
SOR002310AB00L	Total Lead	05/20/1992	07/29/1992	712	J	MG/KG	6.5
SOR0024100C00L	Total Lead	05/20/1992	07/29/1992	3490	J	MG/KG	32.1
SOR0024100D00L	Total Lead	05/20/1992	07/29/1992	141	J	MG/KG	6.8
SOR002410AB00L	Total Lead	05/20/1992	07/29/1992	7130	J	MG/KG	31.3
SOR002410AB0LD	Total Lead	05/20/1992	07/29/1992	4200	J	MG/KG	29.6

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TABLE

SCHAEFFER ROAD DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SOR000410AB00T	TCLP Lead	12/10/1991	01/07/1992	13		MG/L	0.65
SOR000510AB00T	TCLP Lead	12/10/1991	01/07/1992	1.41		MG/L	0.65
SOR000610AB00T	TCLP Lead	12/10/1991	01/07/1992	4.86		MG/L	0.65

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TABLE

VENICE ALLEYS DATA SUMMARY

NL/TARACORP 89MC114V ANALYTICAL REPORT GENERATED: Sep 09, 1992

SAMPLE ID	PARAMETER	SAMPLE COLLECTION DATE	ANALYSIS DATE	RESULT (ppm)	QUALIFIER	UNITS	REPORTING DETECTION LIMIT
SVE0002100J00T	TCLP Lead	12/02/1991	01/07/1992	<0.65		MG/L	0.65
SVE0004100J00T	TCLP Lead	12/02/1991	01/07/1992	6.8		MG/L	0.65
SVE0005100L00T	TCLP Lead	12/02/1991	01/07/1992	7.52		MG/L	0.65
SVE0008100L00T	TCLP Lead	12/03/1991	01/07/1992	<0.65		MG/L	0.65
SVE0009100J00T	TCLP Lead	12/03/1991	01/07/1992	1.53		MG/L	0.65
SVE0009100J0TD	TCLP Lead	12/03/1991	01/07/1992	0.92		MG/L	0.65
SVE0011100J00T	TCLP Lead	12/03/1991	01/07/1992	5.64		MG/L	0.65
SVE0013100J00T	TCLP Lead	12/03/1991	01/07/1992	<0.65		MG/L	0.65
SVE0015100K00T	TCLP Lead	12/03/1991	01/07/1992	<0.65		MG/L	0.65
SVE0017100J00T	TCLP Lead	12/03/1991	01/07/1992	93.4		MG/L	0.65
SVE0020100J00T	TCLP Lead	12/04/1991	01/07/1992	2.59		MG/L	0.65

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

Each sample has a unique sample identification. The identification consists of sample matrix code, street code, lot number, boring number, sample depth code, and sample type. All of the codes are listed in the following tables with their appropriate description. An example follows to demonstrate the operation of the sample identification.

SMP1629200B00L

S	Sample Matrix (In this case, the sample matrix is soil, see **SAMPLE MATRICES** table.)
MP	Street Code (In this case, the sample location is on Maple Street, see **STREET CODE** table.)
1629	Lot Number (In this case, the sample was taken at lot/house number 1629.)
2	Boring Number (In this case, the sample was taken from the 2nd boring on the property.)
00B	Sample Depth (In this case, the sample was taken between 3 - 6 inches from the boring indicated, see **SAMPLE DEPTHS** table.)
00L	Sample Type (In this case, the sample was analyzed for Total Lead, see **SAMPLE TYPES** table.)

SAMPLE MATRICES

S	Soil Sampled for Chemical Analysis &/or Geotechnical
W	Groundwater Sampled from Monitoring Wells

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

STREET CODES

RESIDENTIAL

AD	ADAMS	OH	OHIO
AL	ALTON	OL	OLIVE
BE	BENTON	RE	REYNOLDS
BR	BRYAN	RR	ROCK ROAD
CH	CHESTNUT	SA	SALVETER
CL	CLEVELAND	SP	SPRUCE
DE	DELMAR	ST	STATE
DV	DENVER	WA	WALNUT
ED	EDISON	WS	WASHINGTON
EL	ELIZABETH		
ER	EDWARDSVILLE ROAD	ET	18th
GR	GRAND	FI	5th
GW	GREENWOOD	NT	19th
IO	IOWA	TL	12th
KE	KENNEDY	SN	2nd
LE	LEE	TW	20th
MA	MADISON	TS	22nd
MP	MAPLE	WT	W. 20th
MC	McCAMBRIDGE		
ME	MEREDOCIA		
NI	NIEDRINGHAUS		

INDUSTRIAL AND REMOTE FILL AREAS

BV	BV & G TRANSPORT	CA	CARVER
OR	OTHER REMOTE FILL AREAS	CO	COLGATE
		HA	HARRISON
RO	RICH OIL	HI	HILL
TA	TARACORP	RS	ROOSEVELT
TR	TRUST 454	TE	TERRY
VE	VENICE ALLEYS		

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

SAMPLE DEPTH

CODE	DEPTH
00A	0-3 inches
00B	3-6 inches
00C	6-12 inches
00D	1-2 feet
00E	2-3 feet
00F	3-4 feet
00G	4-5 feet
00H	5-6 feet
00I	6-7 feet
00J	0-2 feet
00K	2-4 feet
00L	4-6 feet
00M	6-8 feet
00N	8-10 feet
00P	10-12 feet
00R	12-14 feet
00S	14-15 feet
00T	13-15 feet
00U	10-11 feet
00V	15-16 feet
00W	20-21 feet
00X	25-26 feet
0AB	0-6 inches
0AC	0-1 feet
0GG	Top of Groundwater

TABLE 8

SAMPLE IDENTIFICATION CODE DESCRIPTION
NL/TARACORP SUPERFUND SITE

SAMPLE TYPE

00G	Geotechnical Sample
0GD	Geotechnical Duplicate
0GQ	Geotechnical QA Sample
00L	Total Lead Sample
0LD	Total Lead Duplicate Sample - Boring 1
0LQ	Total Lead Quality Assurance
0XM	Total Lead, Boring 2, Duplicate - # 1
0XX	Total Lead, Boring 2, Duplicate - # 2
00T	TCLP Lead Sample
0TD	TCLP Lead Duplicate
0TQ	TCLP Lead Quality Assurance
0TM	TCLP Lead Matrix Spike
0TX	TCLP Lead Matrix Spike Duplicate
00W	Groundwater Sample
0WD	Groundwater Duplicate
0WB	Groundwater Rinsate Blank
0WM	Groundwater Matrix Spike
0WX	Groundwater Matrix Spike Duplicate
0WQ	Groundwater QA Sample
0WR	Groundwater QA Matrix Spike
0WS	Groundwater QA Matrix Spike Duplicate
0WT	Groundwater QA Rinsate Blank
0TB	Trip Blank
0RS	Re-Sample

APPENDIX L

SAFETY EQUIPMENT AVAILABLE ON-LOCATION

MINI DECON TRAILER INVENTORY
REVISED 12/20/90
PAGE -1-

FROM JOB #_____
UNIT # _____
DATE_____ SEAL#_____
STOCKED BY _____

BREATHING AIR EQUIPMENT

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	3	EA	___	___	400176	L.P. SCBA UNIT UNIT #_____
_____	2	EA	___	___	400797	EXTRA L.P. SCBA
_____	3	EA	___	___	400185	EGRESS COMPLETE
____	3	EA	___	___	400186	EXTRA EGRESS CYL
_____	1	EA	___	___	400088	100FT BREATH/AIR HOSE
_____	1	EA	___	___	400087	50FT BREATH/AIR HOSE
_____	3	EA	___	___	400086	25FT BREATH/AIR HOSE
_____	1	EA	___	___	400048	CASCADE SYSTEM
_____	1	EA	___	___	400123	VICTOR REGULATOR
_____	1	EA	___	___	400478	3-WAY MANIFOLD
_____	1	EA	___	___	400165	SURVIVAIR ADAPTER
_____	3	EA	___	___	400322	SURVIVAIR LENS
_____	4	EA	___	___	400015	ANTI-FOG

RESPIRATORY PROTECTION

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	3	EA	___	___	400816	MSA FULL FACE RESP
_____	36	PR	___	___	400815	MSA GMC-HS CARTRID
_____	1	EA	___	___	400189	EMERGENCY OXYGEN
_____	10	EA	___	___	400142	MSA INHAL FLAPS
_____	5	EA	___	___	400388	MSA EXHAL FLAPS
_____	10	EA	___	___	400393	MSA CART GASKET
_____	2	EA	___	___	400394	MSA HEAD STRAP
_____	2	EA	___	___	400383	MSA FACE LENSE
_____	2	EA	___	____	400391	EXHAL/VALVE FLAP

PROTECTIVE CLOTHING

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	1	PR	___	___	400022	ACID GLOVES
_____	12	PR	___	___	400341	PVC GLOVES
_____	12	PR	___	___	400100	CLOTH GLOVES
_____	1	EA	___	___	400366	WHITE HARD HAT
_____	2	EA	___	___	400367	BLUE HARD HAT
_____	5	EA	___	___	400348	GRAY HARD HAT
_____	6	EA	___	___	400021	HEADGEAR BRACKETS
_____	6	EA	___	___	400110	CLEAR FACE SHIELDS
_____	1000	EA	___	___	400114	SAMPLE GLOVES
_____	25	EA	___	___	400806	XLG SARAN SUITS
_____	25	EA	___	___	400805	XXLG SARAN SUITS
_____	25	EA	___	___	400062	XLG TYVEK SUITS
_____	25	EA	___	___	400061	XXLG TYVEK SUITS
_____	200	EA	___	___	400063	TYVEK HOODS
_____	2	EA	___	___	400334	XLG ACID BIBS
_____	2	EA	___	___	400333	XLG ACID COAT
_____	2	EA	___	___	400332	LG ACID BIBS

PROTECTIVE CLOTHING CONTINUE

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	2	EA	___	___	400331	LG ACID COAT
_____	2	EA	___	___	400001	MD ACID COAT
_____	2	EA	___	___	400000	MD ACID BIB
_____	12	EA	___	___	400019	PLASTIC ACID RING
_____	12	EA	___	___	400020	RUBBER ACID RING
_____	6	EA	___	___	400098	DUST PROOF GOGGLES
_____	6	PR	___	___	400042	XLG TINGLEY BOOTS
_____	2	PR	___	___	400291	PVC BOOTS SIZE 13
_____	2	PR	___	___	400290	PVC BOOTS SIZE 12
_____	2	PR	___	___	400289	PVC BOOTS SIZE 11
_____	1	PR	___	___	400286	CHEST WADERS SZ 13
_____	1	PR	___	___	400285	CHEST WADERS SZ 12
_____	2	PR	___	___	400206	WADER SUSPENDERS
_____	2	EA	___	___	400801	XLG RAIN GEAR
_____	2	EA	___	___	400800	LG RAIN GEAR
_____	2	EA	___	___	400799	MD RAIN GEAR
_____	200	PR	___	___	400820	VINYL BOOTIES

HAND TOOLS

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	1	EA	___	___	400646	COMPLETE TOOL BOX
_____	1	EA	___	___	400877	18" BOLT CUTTER
_____	2	EA	___	___	400170	6" LH SCRAPER
_____	2	EA	___	___	400171	LH POINTED SHOVEL
_____	2	EA	___	___	400509	LH FLAT SHOVEL
_____	1	EA	___	___	400160	SH POINTED SHOVEL
_____	1	EA	___	___	400196	SH FLAT SHOVEL
_____	1	EA	___	___	400164	SPADE
_____	1	EA	___	___	400151	GARDEN RAKE
_____	1	EA	___	___	400093	SLEDGE HAMMER
_____	1	EA	___	___	400132	R.R. PICK
_____	1	EA	___	___	400623	3/8" DRILL
_____	1	EA	___	___	400837	DRILL INDEX
_____	1	EA	___	___	400652	PIPE WRENCH 36"
_____	1	EA	___	___	400633	COME-A-LONG

HAND TOOLS CONTINUE

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	1	EA	___	___	400135	MATTOCK AXE
_____	1	EA	___	___	400013	SINGLE BLADE AXE
_____	1	EA	___	___	400431	36" CROWBAR
_____	1	EA	___	___	400159	SPUD BAR
_____	1	EA	___	___	400097	18" PIPE WRENCH
_____	1	EA	___	___	400607	24" PIP WRENCH
_____	1	EA	___	___	400632	HAND SAW
_____	1	EA	___	___	400108	PITCH FORK
_____	1	EA	___	___	#_____	PARTNER SAW
_____	3	EA	___	___	400594	BLADE METAL
_____	3	EA	___	___	400593	BLADE CONCRETE
_____	1	EA	___	___	400654	SKILL SAW
_____	1	EA	___	___	400851	BLADES FOR SKILL
_____	1	EA	___	___	400863	20FT. LOG CHAIN

SAMPLE EQUIPMENT

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	1	RL	___	___	400119	SAMPLES LABELS
_____	24	EA	___	___	400157	QUART SAMPLE JAR
_____	24	EA	___	___	400158	8OZ JAR W/LID
_____	1	EA	___	___	400207	WATER FINDER PASTE
_____	2	PK	___	___	7400035	PH STRIPS 0-14

PUMP

_____	2	EA	___	___	#_____	1 1/2" HOMELITE PUMP
_____	2	EA	___	___	400808	1 1/2" SUCTION HOSE
_____	4	EA	___	___	400456	1 1/2" DISCHARGE HOSE
_____	1	EA	___	___	400874	1 1/2" BRASS FIRE NOZZLE
_____	1	EA	___	___	400499	3/4" PORT/PUMP W/ GARDEN HOSE
_____	2	EA	___	___	400363	1 1/2" SUCTION SCREEN

MISCELLANEOUS

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	1	EA	___	___	400867	50FT GARDEN HOSE
_____	10	RL	___	___	400066	DUCT TAPE
_____	2	EA	___	___	400046	SH SCRUB BRUSH
_____	2	EA	___	___	400047	LH SCRUB BRUSH
_____	2	EA	___	___	400082	PLASTIC 5GAL BUCK
_____	1	EA	___	___	400203	TRASH CAN
_____	1	EA	___	___	400067	LARGE FUNNEL
_____	6	RL	___	___	400557	PAPER TOWELS
_____	1	EA	___	___	400871	5GAL SAFETY CAN
_____	1	EA	___	___	400842	2 1/2 GAL SAFE CAN
_____	2	EA	___	___	400111	FLASHLIGHT
_____	12	EA	___	___	400373	BATTERIES SZ D
_____	2	RL	___	___	400543	TRASH BAGS
_____	2	EA	___	___	400037	UPRIGHT BROOM
_____	1	EA	___	___	400052	WATER COOLER
_____	1	EA	___	___	400117	ICE CHEST
_____	2	RL	___	___	400204	VISQUEEN
_____	2	RL	___	___	400202	FLAGGING TAPE

MISCELLANEOUS CONTINUE

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	3	QT	___	___		2-CYCLE OIL
_____	1	RL	___	___	400590	TIE WIRE
_____	3	EA	___	___	400116	INSECT
_____	1	RL	___	___	400888	CAUTION TAPE
_____	1	EA	___	___	400121	MOP FLOOR

GENERAL SAFETY

_____	1	EA	___	___	400106	LG FIRST AID KITS
_____	2	EA	___	___	400315	FIRE EXTINGUISHER
_____	2	EA	___	___	400343	SAFETY HARNESS
_____	2	EA	___	___	400081	SM EYE WASH BOT
_____	1	EA	___	___	400078	LG EYE WASH STA

BARREL HANDLING EQUIPMENT

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	1	EA	___	___	400129	STEEL BUNG WRENCH
_____	1	EA	___	___		BARREL FILLER
_____	1	EA	___	___		BARREL SUCKER
_____	1	EA	___	___	400625	1/2"IMPACT WRENCH
_____	2	EA	___	___	400644	15/16" D/W SOCKET
_____	2	EA	___	___	400618	1/2"DRIVE RATCHET
_____	1	EA	___	___	400380	NYLON CHOKERS
_____	12	EA	___	___	400835	MEAN STREAK
_____	1	RL	___	___	400137	3/8" POLY ROPE

EXPLOSION PROOF EQUIPMENT

_____	1	EA	___	___	400523	BRASS TOOL BOX
_____	2	EA	___	___	400080	EXPLO/ PROOF FLASHLIGHT
_____	1	EA	___	___	400230	BRASS LH POINT SHOVEL
_____	1	EA	___	___	400231	BRASS LH FLAT SHOVEL
_____	1	EA	___	___	400253	BRASS RR PICK

ELECTRICAL EQUIPMENT

ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	INV. NUMBER	DESCRIPTION
_____	2	EA	___	___	400792	SATELLITES
_____	2	EA	___	___	400795	SATELLIT STAND
_____	2	EA	___	___	400518	50FT 110 EXT CORD

INTERIOR DAMAGE INSPECTION SHEET
MINI DECON TRAILER
#_____

Based on your visible inspection of this unit, what is the condition of the below noted items:

1. CABINETS

   a. SCRATCHES

   _____

   b. HINGES

   _____

   c. HANDLES

   _____

   d. SHELVING

   _____

2. LOCKERS

   a. DENTS

   _____

   b. HINGES

   _____

   c. HANDLES

   _____

3. ELECTRICAL

   a. LIGHTS

   _____

   b. RECEPTACLES/COVERS

   _____

   c. SWITCHES/COVERS

   _____

4. PLUMBING

   a. FIXTURES

   _____

   b. LEAKS

   _____

5. BENCHES

   _____

6. FLOOR _____

7. DOORS _____

8. OTHER (Please Specify)

_____

_____

_____

DAILY EQUIPMENT LIST

CARS	PICKUPS	VANS	1-TON BOX	2-TON BOX
1-TON STAK	2-TON STAKE	TRACTORS	BOOM TRUCK	DUMP TRUCK
VAC TRUCK	SKID UNIT	SHOWERS	DECONS	DROP DECK

_____
DATE
*- Out of Service

DISC TRLS	BOX TRLS	UTILITY TRL	LAB TRLS	COOK TRLS
CAT D-3	CAT D-6	CAT 950	CAT 963	CAT 930
CAT 936	CAT 215	CAT 225	BACKHOES	GUZZLERS

_____
DATE
* - Out of Service

GRAPPLERS	J.Y. GRAPP	SHEARS	TANKERS	DRILL RIGS
OTHERS				

DATE

* - Out of Service

VAC TRUCK INVENTORY
REVISED 12/16/91

FROM JOB #_____
UNIT #_____
DATE_____SEAL #_____
STOCKED BY _____

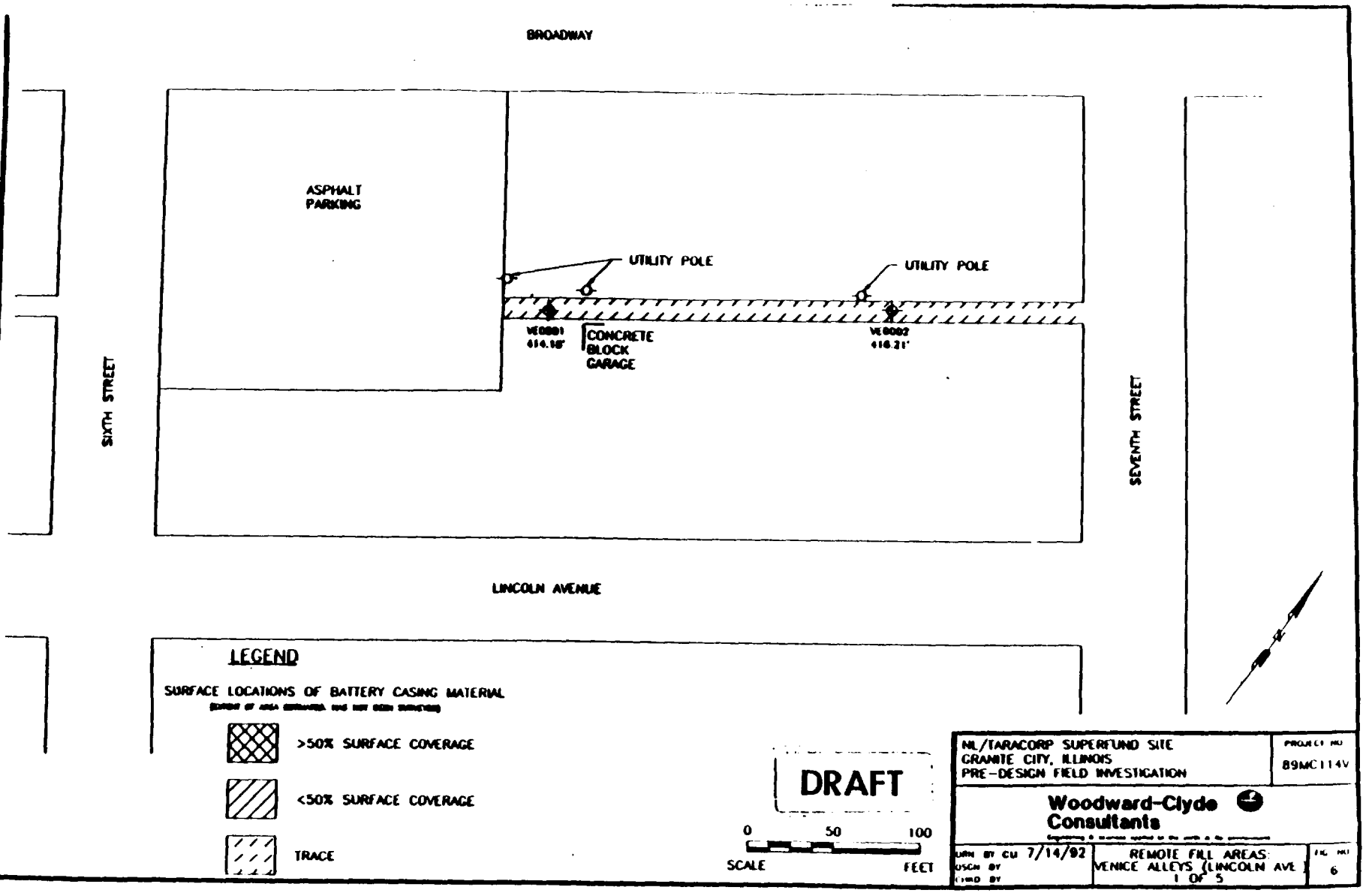
ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	DESCRIPTION
____	1	EA	____	____	1 1/2" DOUBLE MALE OPW
____	1	EA	____	____	1 1/2" DOUBLE FEMALE OPW
____	1	EA	____	____	1 1/2" CAP
____	1	EA	____	____	2" DOUBLE MALE OPW
____	1	EA	____	____	2" DOUBLE FEMALE OPW
____	1	EA	____	____	2" FEMALE TO 1 1/2" MALE OPW
____	1	EA	____	____	3" DOUBLE MALE OPW
____	1	EA	____	____	3" DOUBLE FEMALE OPW
____	1	EA	____	____	3" FEMALE TO 2" MALE OPW
____	1	EA	____	____	3" FEMALE TO 1 1/2" MALE OPW
____	2	EA	____	____	3" SCROPPER CAPS
____	1	EA	____	____	1 1/2" NOZZLE W/MALE OPW
____	1	EA	____	____	6" CAP OPW
____	1	EA	____	____	4" FEMALE TO 3" MALE OPW
____	1	EA	____	____	6" FEMALE TO 3" MALE OPW
____	1	EA	____	____	3" CAP
____	1	EA	____	____	6" FEMALE TO 4" MALE OPW
____	1	EA	____	____	12 TON JACK

VAC TRUCK INVENTORY
REVISED 12/16/91

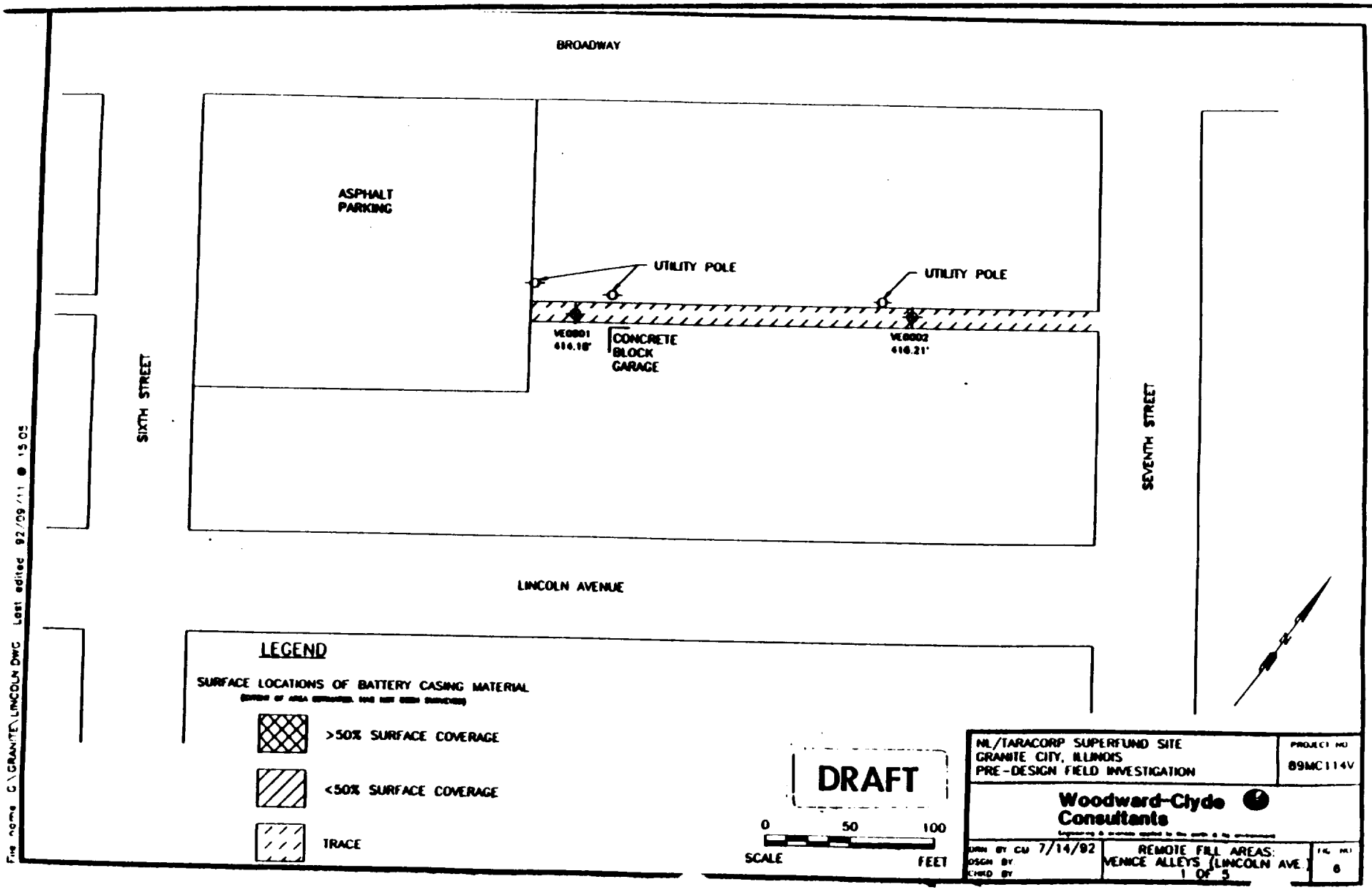
ACTUAL COUNT	STD STOCK	QTY	ADD TO	TAKE OUT	DESCRIPTION
____	4	EA	____	____	QT PUMP OIL 20WT NON-DETG)
____	6	EA	____	____	20'X3" SUCTION HOSE
____	2	EA	____	____	24" PIPE WRENCHES
____	1	EA	____	____	20' ROPE
____	4	EA	____	____	1 1/2" GASKETS OPW
____	4	EA	____	____	2" GASKETS OPW
____	4	EA	____	____	3" GASKETS OPW
____	4	EA	____	____	4" GASKETS OPW
____	1	EA	____	____	FIRE EXTINGUSIHER 2 1/2 LB
____	4	EA	____	____	6" GASKETS OPW
____	1	EA	____	____	3/4" CHOCKER CABLE
____	1	EA	____	____	ROLL OF TIRE WIRE
____	1	EA	____	____	JUMPER CABLE
____	1	EA	____	____	LINEMANS PLIERS
____	1	SET	____	____	SET HIDE-A-WAY KEYS
____	1	EA	____	____	LOG BOOK (MILEAGE)
____	1	EA	____	____	FLASHLIGHT W/BATTERIES
____	1	EA	____	____	VEHICLE INSPECTION BOOK
____	1	EA	____	____	FIRST AID KIT
FUEL PERMITS			REGISTRATION		SHOP CLOTHS

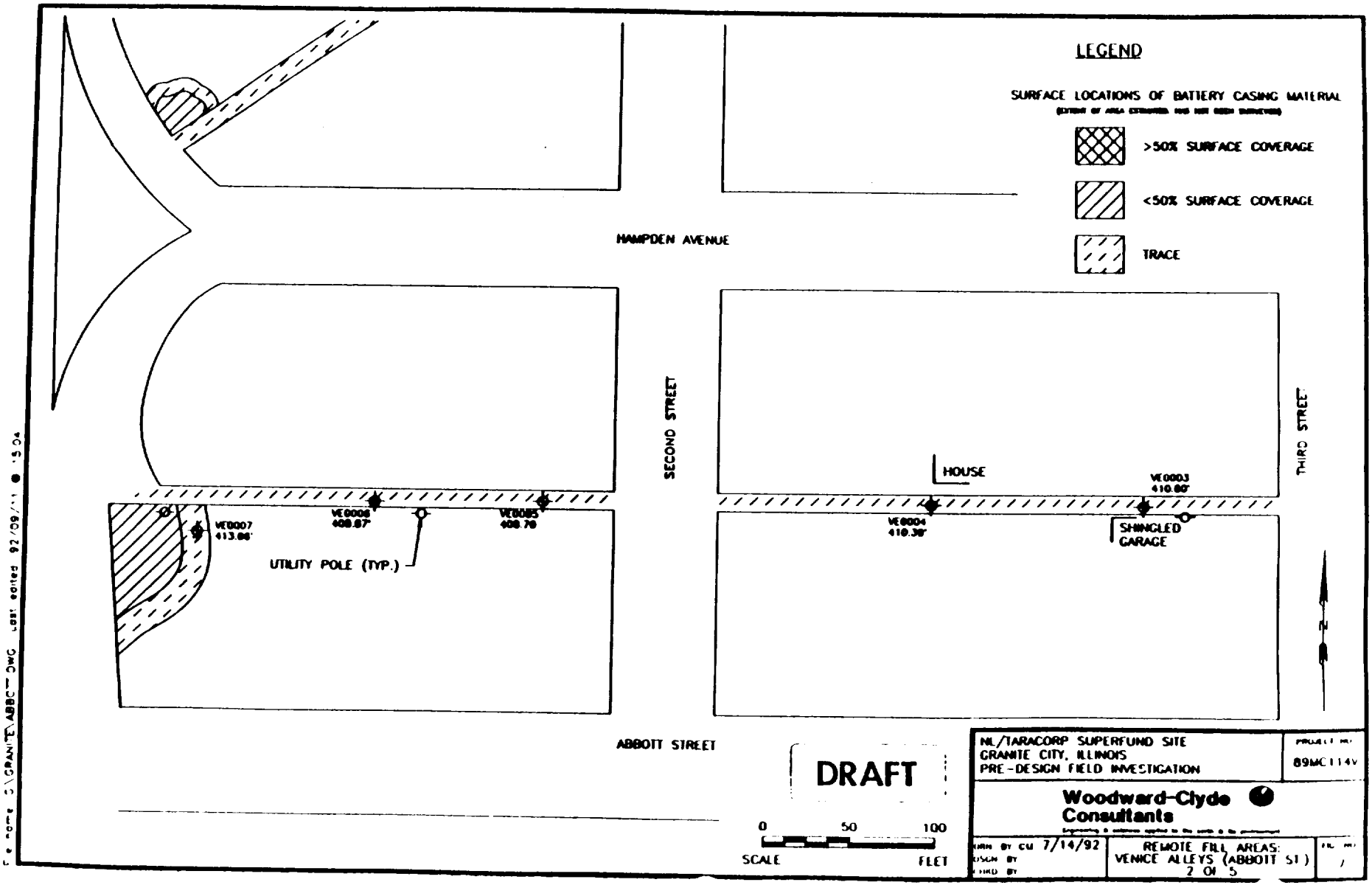
APPENDIX M

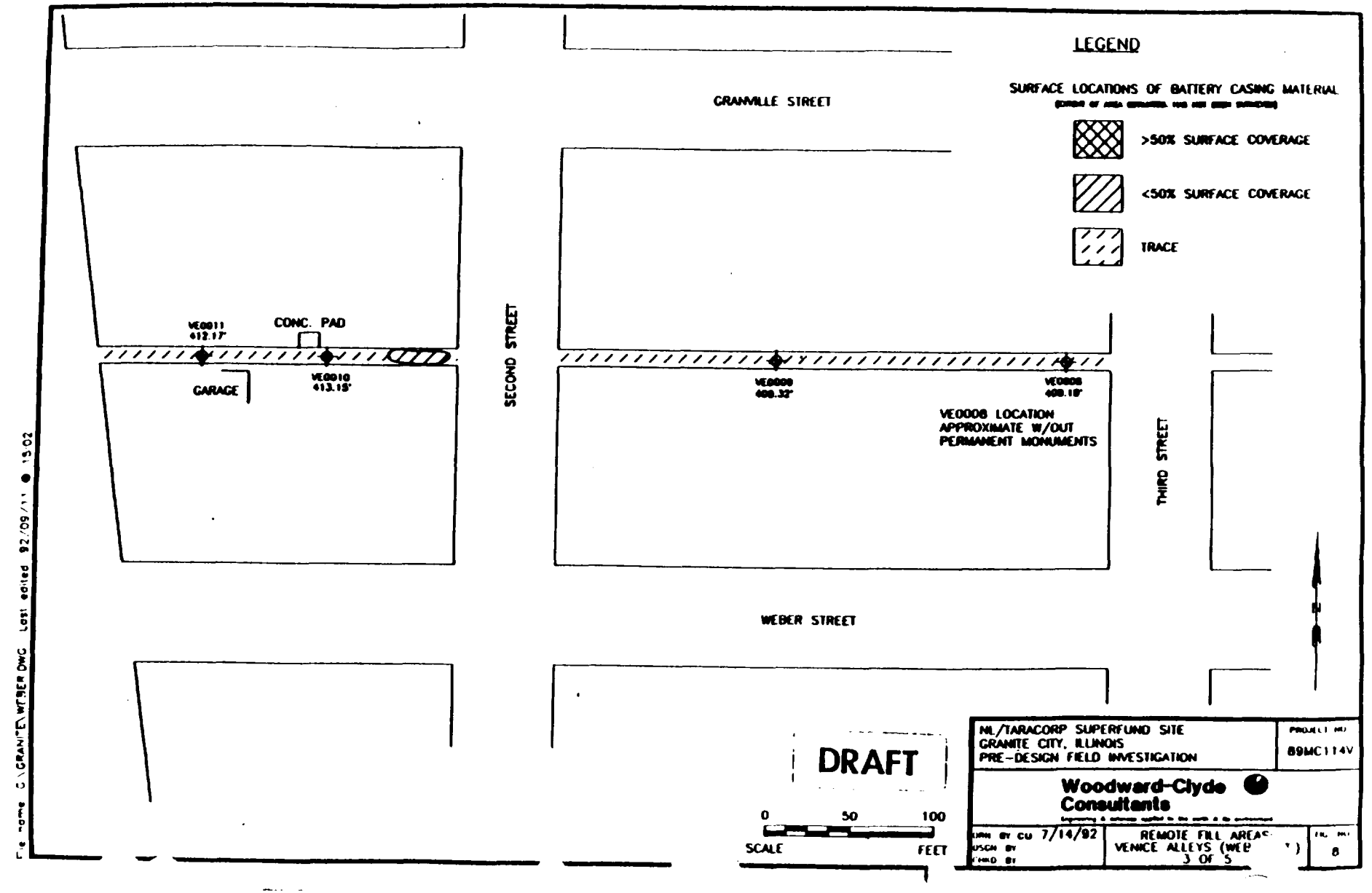
WORK ZONES

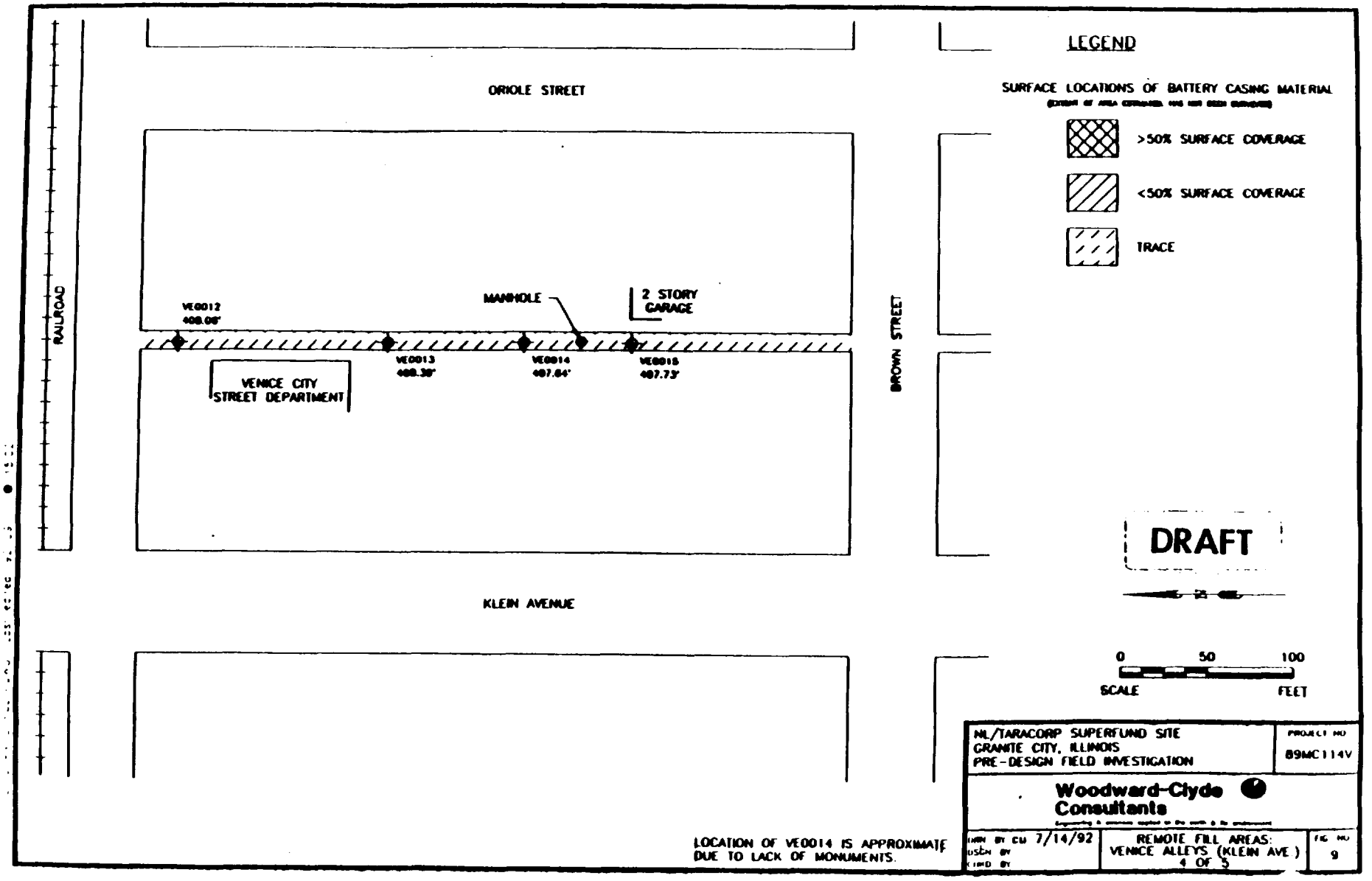


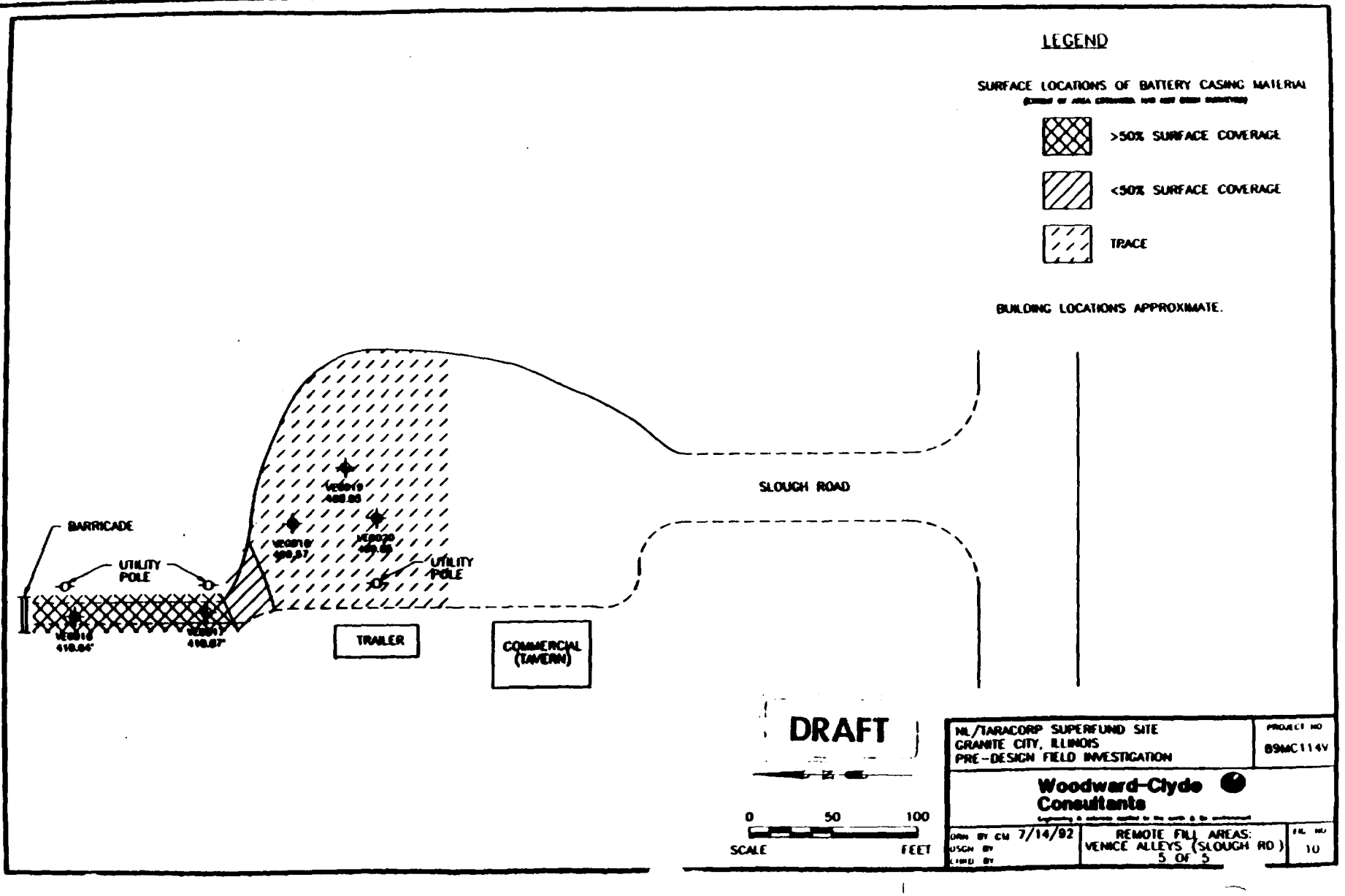
File name C:\GRANITE\LINCOLN.DWG Last edited 92/09/11 @ 15:05

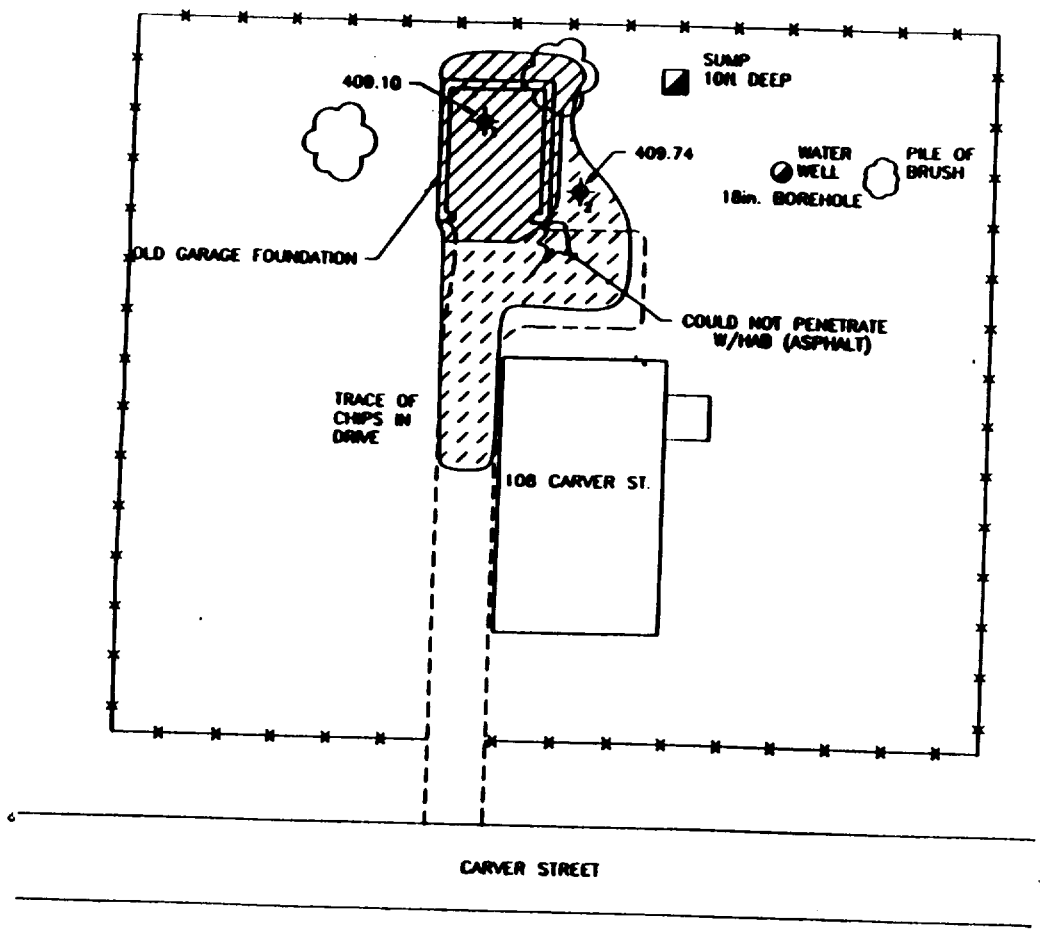

BROADWAY
ASPHALT PARKING
UTILITY POLE
UTILITY POLE
VE0001
414.18'
CONCRETE BLOCK GARAGE
VE0002
416.21'
SIXTH STREET
SEVENTH STREET
LINCOLN AVENUE
LEGEND
SURFACE LOCATIONS OF BATTERY CASING MATERIAL
>50% SURFACE COVERAGE
<50% SURFACE COVERAGE
TRACE
DRAFT
0
50
100
SCALE
FEET
NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION
PROJECT NO
89MC114V
Woodward-Clyde Consultants
DRN BY CM 7/14/92
DSGN BY
CHKD BY
REMOTE FILL AREAS:
VENICE ALLEYS (LINCOLN AVE.)
1 OF 5
FIG NO
6
File name C:\GRANITE\LINCOLN.DWG Last edited 92/09/11 @ 15:05


LEGEND
SURFACE LOCATIONS OF BATTERY CASING MATERIAL
>50% SURFACE COVERAGE
<50% SURFACE COVERAGE
TRACE
HAMPDEN AVENUE
SECOND STREET
THIRD STREET
ABBOTT STREET
HOUSE
SHINGLED GARAGE
UTILITY POLE (TYP.)
VE0007 413.06'
VE0006 408.87'
VE0005 408.70
VE0004 410.30'
VE0003 410.80'
DRAFT
0 50 100
SCALE FEET
NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION
PROJECT NO. 89MC114V
Woodward-Clyde Consultants
DRAWN BY CW 7/14/92
DESIGN BY
CHKD BY
REMOTE FILL AREAS: VENICE ALLEYS (ABBOTT ST.)
2 OF 5
FIG. NO. 1


LEGEND
SURFACE LOCATIONS OF BATTERY CASING MATERIAL
>50% SURFACE COVERAGE
<50% SURFACE COVERAGE
TRACE
GRANVILLE STREET
SECOND STREET
THIRD STREET
WEBER STREET
CONC. PAD
GARAGE
VE0011
412.17'
VE0010
413.15'
VE0009
409.32'
VE0008
409.18'
VE0008 LOCATION
APPROXIMATE W/OUT
PERMANENT MONUMENTS
DRAFT
0
50
100
SCALE
FEET
NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION
PROJECT NO
89MC114V
Woodward-Clyde Consultants
DRN BY CU 7/14/92
DSGN BY
CHKD BY
REMOTE FILL AREAS
VENICE ALLEYS (WEB
3 OF 5
FIG. NO
8
File name C:\GRANITE\WEBER.DWG Last edited 92/09/11 @ 15:02


ORIOLE STREET
RAILROAD
VE0012
408.08'
MANHOLE
2 STORY GARAGE
VE0013
408.30'
VE0014
407.84'
VE0015
407.73'
VENICE CITY STREET DEPARTMENT
BROWN STREET
KLEIN AVENUE
LEGEND
SURFACE LOCATIONS OF BATTERY CASING MATERIAL
>50% SURFACE COVERAGE
<50% SURFACE COVERAGE
TRACE
DRAFT
0
50
100
SCALE
FEET
NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION
PROJECT NO
89MC114V
Woodward-Clyde Consultants
DRN BY CU 7/14/92
DSGN BY
CHKD BY
REMOTE FILL AREAS:
VENICE ALLEYS (KLEIN AVE.)
4 OF 5
FIG NO
9
LOCATION OF VE0014 IS APPROXIMATE DUE TO LACK OF MONUMENTS.


LEGEND
SURFACE LOCATIONS OF BATTERY CASING MATERIAL
>50% SURFACE COVERAGE
<50% SURFACE COVERAGE
TRACE
BUILDING LOCATIONS APPROXIMATE.
SLOUGH ROAD
BARRICADE
UTILITY POLE
UTILITY POLE
TRAILER
COMMERCIAL (TAVERN)
DRAFT
0
50
100
SCALE
FEET
NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION
PROJECT NO
89MC114V
Woodward-Clyde Consultants
DRN BY CM 7/14/92
DSGN BY
CHKD BY
REMOTE FILL AREAS:
VENICE ALLEYS (SLOUGH RD)
5 OF 5
FIG NO
10



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL

- >50% SURFACE COVERAGE
- <50% SURFACE COVERAGE
- TRACE

0 20 40
SCALE FEET

NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION

PROJECT NO
89MC114V

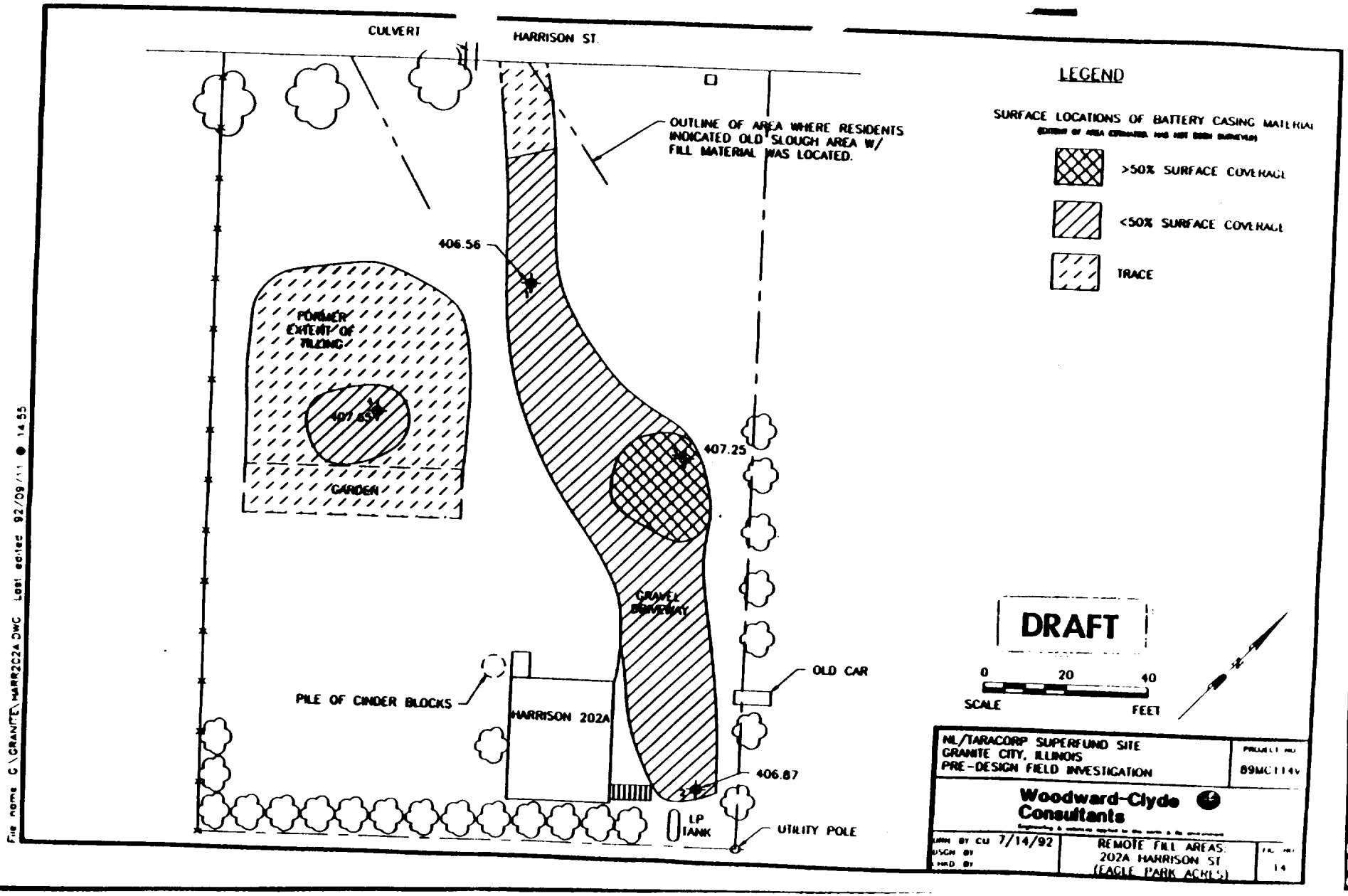
Woodward-Clyde Consultants

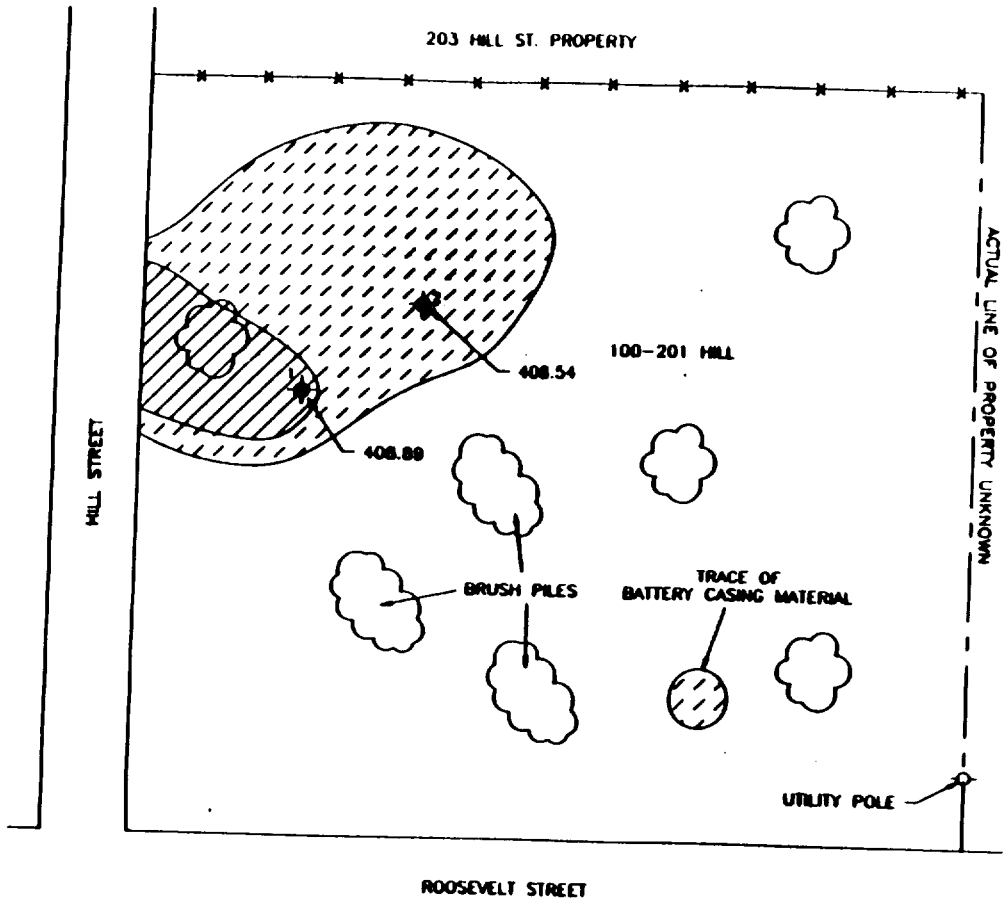
DRAWN BY CU 7/14/92
DESIGN BY
CHKD BY

REMOTE FILL AREAS:
108 CARVER ST.
(EAGLE PARK ACRES)

FIG NO
12

DRAFT


CULVERT
HARRISON ST.
OUTLINE OF AREA WHERE RESIDENTS INDICATED OLD SLOUGH AREA W/ FILL MATERIAL WAS LOCATED.
406.56
FORMER EXTENT OF FILLING
407.65
GARDEN
407.25
GRAVEL DRIVEWAY
OLD CAR
PILE OF CINDER BLOCKS
HARRISON 202A
406.87
LP TANK
UTILITY POLE
LEGEND
SURFACE LOCATIONS OF BATTERY CASING MATERIAL
>50% SURFACE COVERAGE
<50% SURFACE COVERAGE
TRACE
DRAFT
0 20 40
SCALE FEET
NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION
89MC114V
Woodward-Clyde Consultants
DRAWN BY CU 7/14/92
REMOTE FILL AREAS
202A HARRISON ST
(EAGLE PARK ACRES)
14
File name G:\GRANITE\HARR202A.DWG Last edited 92/09/11 @ 14:55



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL
(EXTENT OF AREA ESTIMATED THIS HAS NOT BEEN SURVEYED)

- >50% SURFACE COVERAGE
- <50% SURFACE COVERAGE
- TRACE

COMMENT: TALL GRASS AND UNDERBRUSH OVER MAJORITY OF PARCEL

0 20 40
SCALE FEET

DRAFT

NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION

PROJECT NO 89MC114V

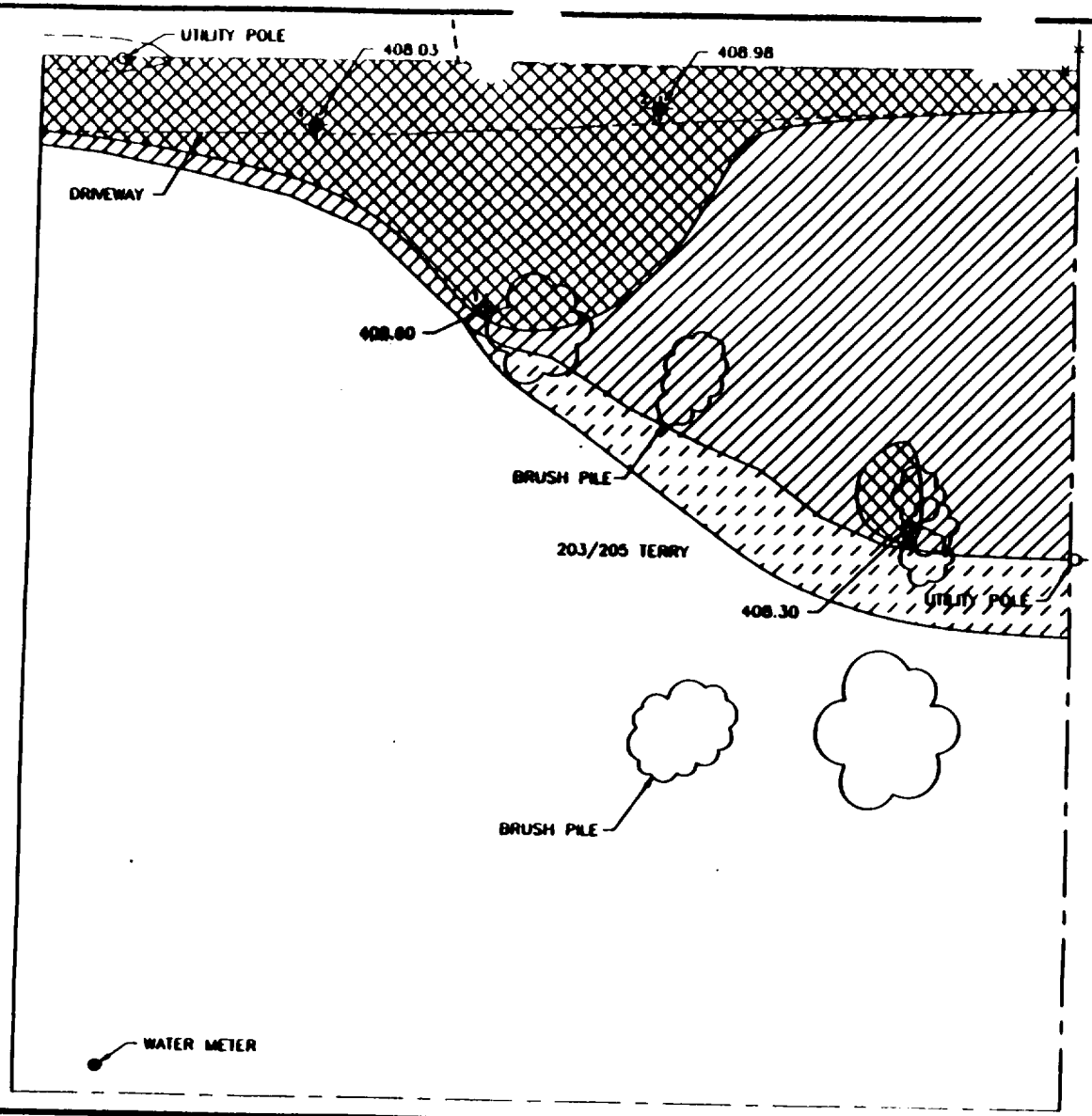
Woodward-Clyde Consultants

DRAWN BY CM 7/14/92
DSGN BY
CHKD BY

REMOTE FILL AREAS:
100-201 HILL ST.
(EAGLE PARK ACRES)

FIG NO 16

File name C:\GRANITE\HILL201.DWG Last edited 92/09/11 @ 14:54



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL

(EXTENT OF AREA ESTIMATED, HAS NOT BEEN SURVEYED)

- >50% SURFACE COVERAGE
- <50% SURFACE COVERAGE
- TRACE

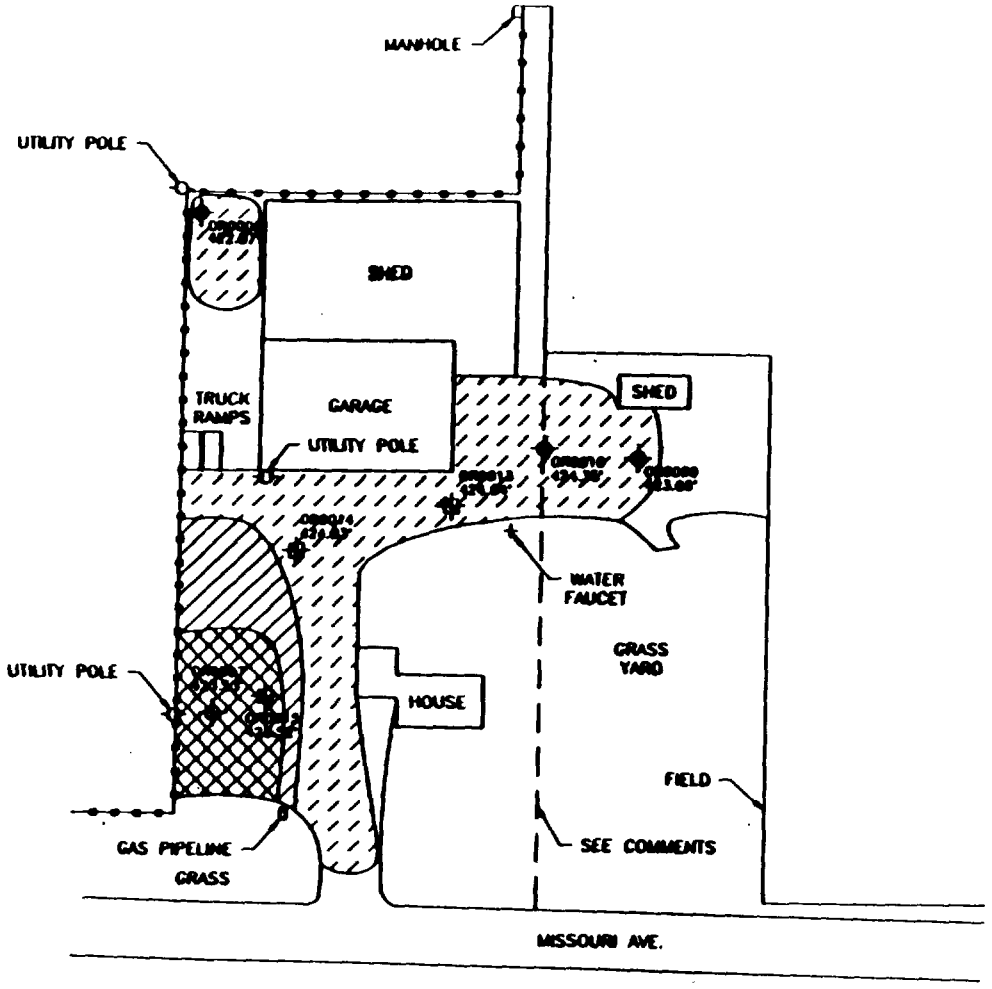
DRAFT

0 20 40

SCALE FEET

NL/TARACORP SUPERFUND SITE GRANITE CITY, ILLINOIS PRE-DESIGN FIELD INVESTIGATION	PROJECT NO 89MC114V
Woodward-Clyde Consultants	
DRN BY CW 7/14/92 DSGN BY CHKD BY	REMOTE FILL AREAS: 203/205 TERRY ST. (EAGLE PARK ACRES)
	FIG. NO 1/

File name C:\GRANITE\TERRY-ST.DWG Last edited 92/08/11 @ 14:46



LEGEND

SURFACE LOCATIONS OF BATTERY CASING AND SLAG MATERIAL

- >50% SURFACE COVERAGE
- <50% SURFACE COVERAGE
- TRACE
- HAND AUGER BORING LOCATION
- DRILLING RIG BORING LOCATION

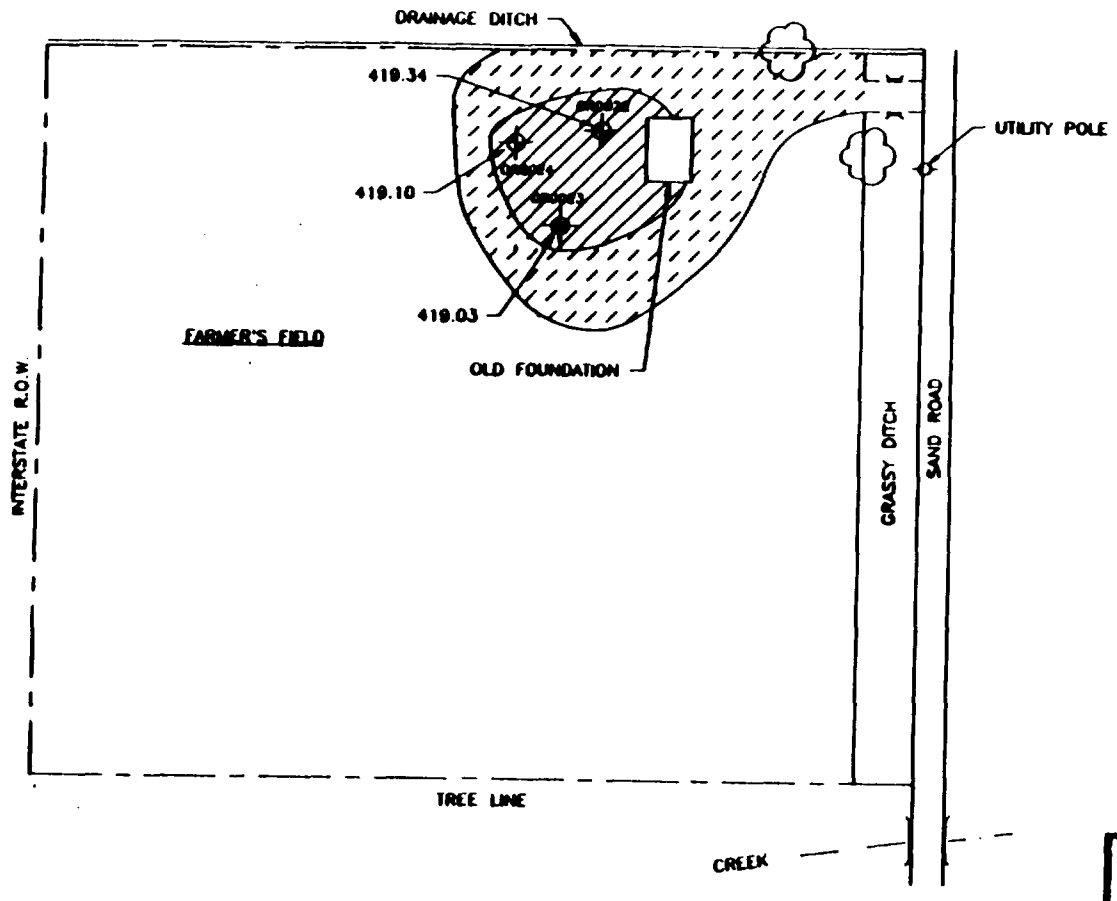
COMMENTS:
RESIDENT INDICATED THAT LAND NORTH OF DASHED LINE IS LEASED RR PROPERTY

0 60 120
SCALE FEET

DRAFT

NL/TARACORP SUPERFUND SITE GRANITE CITY, ILLINOIS PRE-DESIGN FIELD INVESTIGATION	PROJECT NO 89MC114V
Woodward-Clyde Consultants	
DRAWN BY CM 7/14/92 DESIGN BY CHKD BY	REMOTE FILL AREAS: MISSOURI AVENUE
	FIG. NO 20

File name C:\GRANITE\MISSOURI.DWG Last edited 92/09/11 @ 15:00



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL

(EXTENT OF AREA COVERED HAS NOT BEEN SURVEYED)

- >50% SURFACE COVERAGE
- <50% SURFACE COVERAGE
- TRACE

0 100 200

SCALE FEET

DRAFT

NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION

PROJECT NO. 89MC114V

Woodward-Clyde Consultants

DRN BY CU 7/14/92
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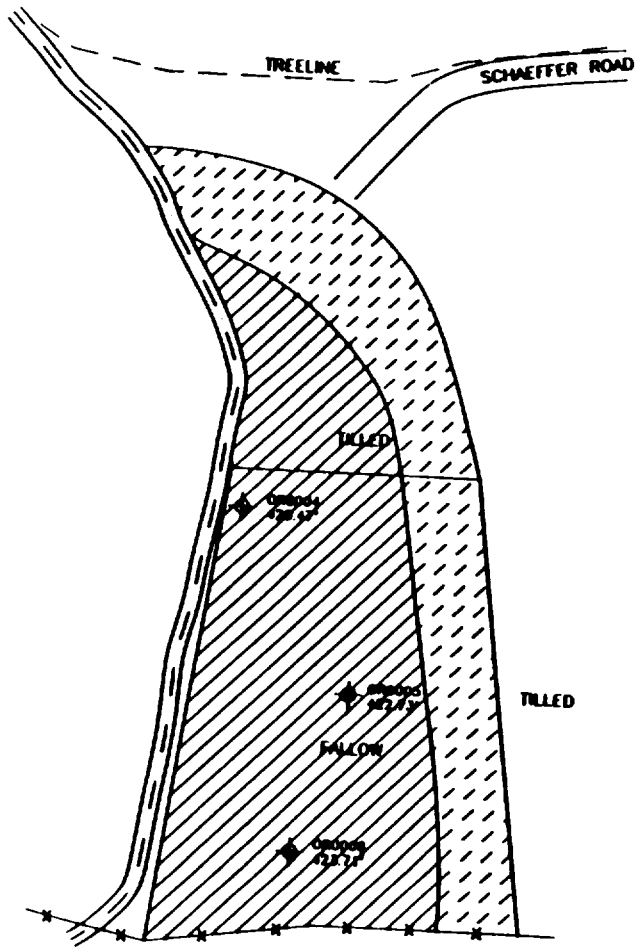
CHKD BY

REMOTE FILL AREAS:
SAND ROAD (FARMER'S FIELD)

FIG. NO. 21

File name: C:\GRANITE\FIELD.DWG Last edited 92/09/11 @ 14:56



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL

- >50% SURFACE COVERAGE
- <50% SURFACE COVERAGE
- TRACE

0 40 80
SCALE FEET

NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION

PROJECT NO 89MC114V

Woodward-Clyde Consultants

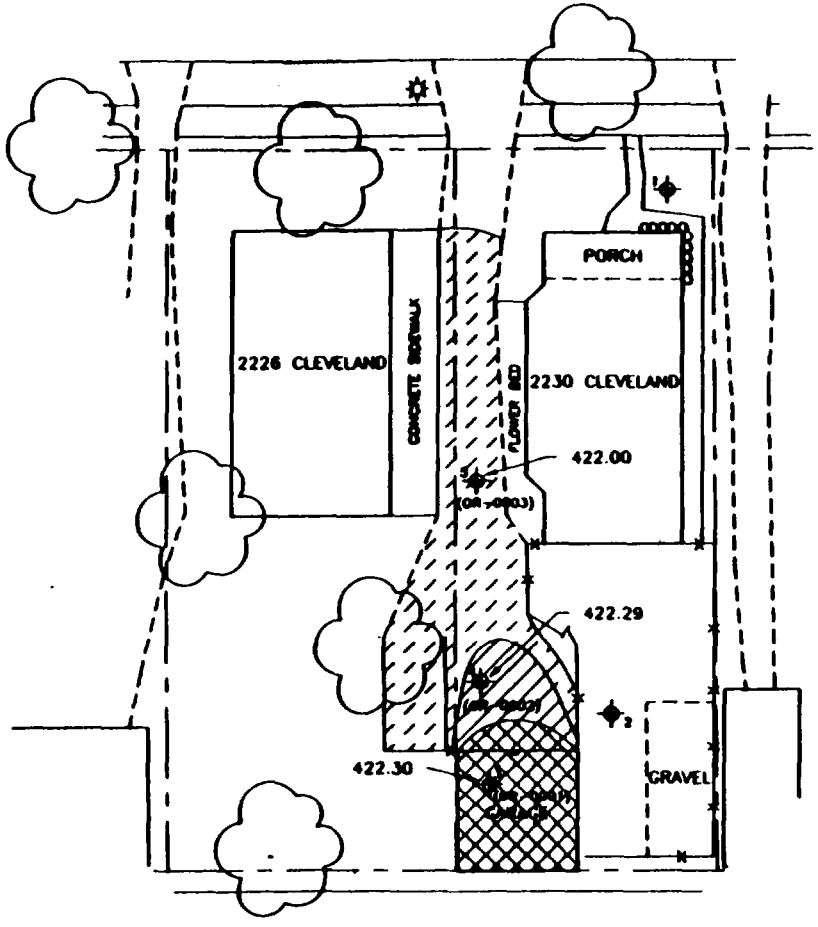
DRN BY CU 7/14/92
DSGN BY
CHKD BY

REMOTE FILL AREA
SCHAEFFER ROAD

FIG NO 22

DRAFT

File name G:\GRANITE\SCHAEFER.DWG Last edited 92/09/11 @ 10:36



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL

>50% SURFACE COVERAGE

<50% SURFACE COVERAGE

TRACE

0 20 40
SCALE FEET

NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION

PROJECT NO 89MC114V

Woodward-Clyde Consultants

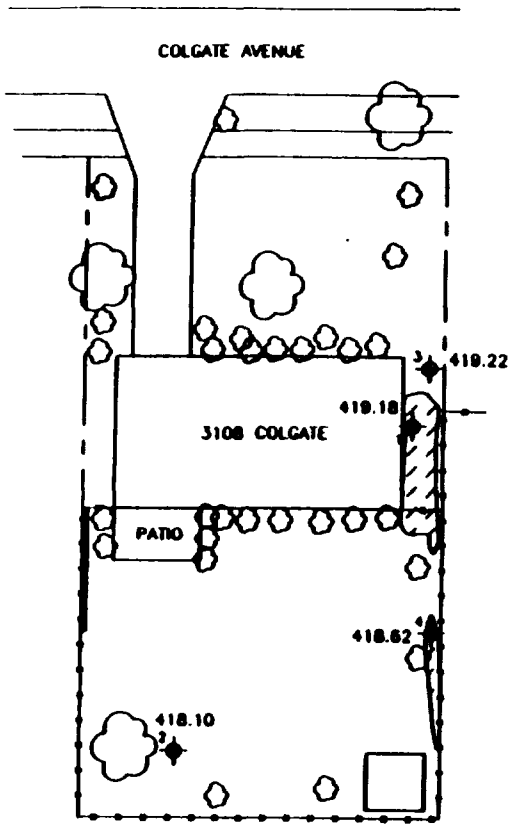
DRAWN BY CW 7/14/92
DESIGN BY
CHKD BY

REMOTE FILL AREAS:
2230 CLEVELAND

FIG. NO 23

DRAFT

File name C:\GRANITE\CLEVELAND.DWG Last edited: 92/09/16 @ 15:53



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL

(EXTENT OF AREA ESTIMATED HAS NOT BEEN SURVEYED)

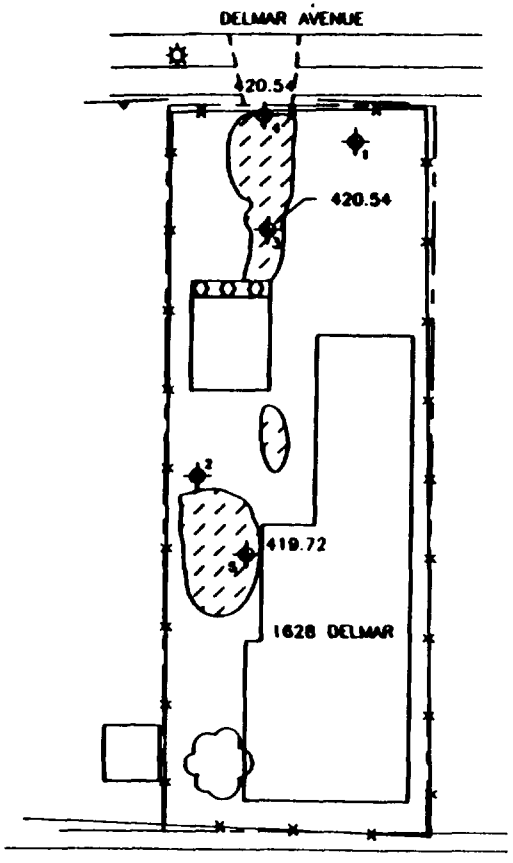
- >50% SURFACE COVERAGE
- <50% SURFACE COVERAGE
- TRACE

0 20 40
SCALE FEET

DRAFT

NL/TARACORP SUPERFUND SITE GRANITE CITY, ILLINOIS PRE-DESIGN FIELD INVESTIGATION	PROJECT NO 89MC114V
Woodward-Clyde Consultants	
DRN BY CU 7/14/92 DSGN BY CHKD BY	ADDITIONAL REMOTE FILL AREAS 3108 COLGATE
	FIG NO 25

File name G:\GRANITE\COLGATE DW... edited 92/09/11 @ 14:58



LEGEND

SURFACE LOCATIONS OF BATTERY CASING MATERIAL

>50% SURFACE COVERAGE

<50% SURFACE COVERAGE

TRACE

0 20 40

SCALE FEET

NL/TARACORP SUPERFUND SITE
GRANITE CITY, ILLINOIS
PRE-DESIGN FIELD INVESTIGATION

PROJECT NO 89MC114V

Woodward-Clyde Consultants

DRAWN BY CU 7/14/92
DESIGN BY
CHKD BY

ADDITIONAL REMOTE FILL 1628 DE

FIG NO 24

DRAFT

File name C:\GRANITE\DELMAR.DWG Last edited 92/09/11 @ 14:53