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**Final
Interim Action Plan**

**American Plating Site
Tacoma, Washington**

April 25, 2003

Conducted for:

**Washington State Department of Ecology
Toxics Cleanup Program
Olympia, Washington**

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1.0 INTRODUCTION

This Interim Action Plan (IAP) identifies interim remedial actions selected by the Department of Ecology (Ecology) for the former American Plating, Inc. facility in Tacoma, Washington. This IAP has been developed in accordance with the Washington Model Toxics Control Act (MTCA) and Chapter 173-340 of the Washington Administrative Code (WAC). In particular, this IAP is intended to fulfill the submittal requirements for an interim action outlined in WAC 173-340-430(7). Interim actions at the site will be conducted by Ecology and the current property owner under the provisions of WAC 173-340-510.

1.1 SITE DESCRIPTION

The former American Plating facility (the site) is located at 2110 East D Street in Tacoma, Washington. The site occupies approximately 1.4 acres on the edge of the Thea Foss Waterway⁵.

The site property has been owned by Lewis R. Jones since 1962. Between 1955 and 1976 the site was occupied by Puget Sound Plating and Seymour Electroplating. From 1976 to 1986 the site was occupied by American Plating. All three of these firms performed metal electroplating, including brass, cadmium, chromium, copper, nickel, and zinc plating. American Plating ceased operations in January 1986. No operations are currently being conducted at the site.

The site includes two abandoned buildings and a concrete pad (Figure 1). Building 1 housed most of the plating lines. Zinc, cadmium, and nickel plating operations were located in the southeastern portion of the building. Brass, chromium, copper, and nickel plating operations occupied the western portion of the building; these operations were located over a 25,000 gallon concrete-lined sump. A 1,000-gallon degreasing tank was located in the south central part of the building. This tank was used to degrease parts prior to plating and used chlorinated organic solvents. In addition to electroplating, Building 1 was also used for painting operations, chemical storage, product testing, and office space.

Building 2 reportedly housed a zinc plating line and was also used to store drums of chemicals and wastes.

During operation, spent plating and washdown solutions from both buildings were directed to the large sump in Building 1. Wastes from the plating operations in the western part of Building 1 went directly into the underlying sump through a grated floor. Wastes from operations in the southeast part of Building 1 were directed to the sump via drains in a recessed portion of the floor. Wastes from plating operations in Building 2 were directed via a trench cut into the concrete floor of the building to a small sump immediately to the west of the building. From there, the wastes were pumped to the large sump in Building 1.

⁵ The Thea Foss Waterway was formerly known as City Waterway; some earlier reports refer to it this way.

Between 1976 and 1978, wastes that accumulated in the large sump were pumped directly into the Thea Foss Waterway via an above-ground effluent line. From 1978 until 1986, wastes were discharged to the municipal sanitary sewer system. Until 1984, the wastes entering the sewer system were not pre-treated. Beginning in 1984, wastes were routed to a pretreatment plant located immediately to the west of Building 1. Records suggest that pretreatment utilized limestone, gravel, and carbon filtration and was designed to achieve reduction of hexavalent chromium, oxidation of cyanide, and precipitation of metals.

The concrete pad is located to the south of Building 1. Prior to 1978, the pad was the site of a third building on the site. Since that time, its use is largely unknown. In 1987 and 1988 18 drums were observed being stored on the pad. At least one drum was thought to contain paint-booth sludge, and another was thought to contain chloroethane. Some of the other drums were overpack drums remaining from site stabilization activities.

An underground storage tank (UST) of unknown capacity and construction exists east of Building 1 adjacent to East D Street. According to AGI (1989), interviews with former employees of American Plating indicated that the tank had been used in the late 1960s for gasoline storage and that the tank had not been used during the operation of American Plating. Investigation of the tank in 1988 indicated that it contained about three inches of water and one-eighth inch of floating product. Chemical analyses of the residual material were consistent with the tank having been formerly used for fuels such as gasoline, diesel, or light fuel oil.

1.2 REGULATORY HISTORY

The following discussion summarizes the regulatory and enforcement history of the site. Table 1 summarizes the various environmental investigations that have been conducted.

- 1980 through 1985: A number of inspections by Ecology determined that discharges, leaks, and spills occurred at the site as a result of facility operations and that American Plating was in potential violation of a number of state dangerous waste regulations.
- January 1986: American Plating ceased operations. Chemicals and equipment used in the electroplating processes were abandoned on site.
- March 1986: A preliminary site assessment conducted by EPA determined that the site posed a serious environmental threat and that high levels of plating wastes and contaminated materials were present on site.
- April 1986: American Plating filed for Chapter 7 bankruptcy.
- November 20, 1986: Ecology entered into a consent order with the property owner, Lewis R. Jones, for an emergency site stabilization.

- June 1987: Site stabilization activities were performed by Northwest Enviroservices and overseen by Ecology. These activities included transporting and disposing of hazardous chemical solutions and sludges that remained on the site to a permitted waste disposal facility and cleaning of storage tanks and floors of the buildings. The UST adjacent to Building 1 was not addressed during site stabilization.
- September 23, 1987: Ecology signed a second consent order with Lewis R. Jones, requiring a remedial investigation of the site. The investigation was to include soil and groundwater sampling in order to identify the areas and levels of on-site contamination to assess site closure options.
- September 30, 1987: EPA took over lead-agency status from Ecology and began to address corrective action and closure of the site under the federal Resource Conservation and Recovery Act (RCRA). EPA issued a complaint and compliance order with American Plating and Lewis R. Jones addressing a number of potential RCRA violations that had been noted in an August 1987 EPA inspection. These violations included not having a closure plan, not installing a groundwater monitoring system, not demonstrating financial assurance, not conducting facility inspections, and not securing the facility from unauthorized entry.
- February 9, 1988: EPA issued a consent agreement and final order with American Plating and Mr. Jones requiring a detailed hydrogeological, soil, and groundwater investigation, including the installation of a groundwater monitoring well network.
- 1988, 1989, 1994: Mr. Jones' contractor, Applied Geotechnology, Inc. (AGI), conducted Phase I and Phase II site investigations and a supplemental groundwater investigation. These investigations included characterization of soil and groundwater contamination and included installation of 12 monitoring wells.
- July 1994: EPA's contractor, Science Applications International Corporation (SAIC), prepared a RCRA Facility Assessment (RFA) for the site. No additional environmental sampling was conducted as part of this RFA.
- January 1995: EPA's contractor, PRC Environmental Management, Inc. (PRC), prepared a Comprehensive Groundwater Monitoring Evaluation (CME). This evaluation included an additional groundwater sampling round.
- October 17, 1995: Ecology once again assumed lead-agency status for the site. EPA rescinded the RCRA closure order and agreed that the site could be cleaned up by Ecology under MTCA. Ecology added the site to its Site Information System (SIS) of known or suspected contaminated sites and recommended it for a Site Hazard Assessment (SHA).
- August 5, 1997: The Tacoma-Pierce County Health Department (TPCHD) completed an SHA on the site. The site's ranking was determined to be a "2" under the Washington Ranking Method (WARM) and the site was placed on Ecology's Hazardous Sites List (HSL).

- February 13, 2001: The City of Tacoma's contractor, Hart Crowser, Inc., prepared a brief summary of previous investigations at the American Plating site and described a conceptual cleanup action scenario involving soil removal. This work was conducted for the City of Tacoma as part of an evaluation of potential hazardous waste sites associated with the City's East D Street Grade Separation Project.
- September 29, 2002: Ecology contracted with SAIC to prepare this Interim Action Plan (IAP) for the site.

1.3 GEOLOGY AND HYDROGEOLOGY

The following summary was drawn largely from the RFA (SAIC 1994). Additional detail, including geological cross sections, well logs, and water table contours are presented in AGI (1989).

Geology at the site consists of fill of variable thickness overlying unconsolidated silt which ranges from 0 to over 15 feet thick. Beneath the silt is a deposit of sand, gravel, and silt which ranges in thickness from 5 to over 10 feet. The deepest unit encountered is a dense to very dense silty sand to silty gravel of unknown thickness, which was encountered approximately 25 to 30 feet below the surface. This unit was interpreted to be glacial till.

Groundwater at the site occurs primarily in the upper fill unit (the "fill aquifer") and in the sand, gravel, and silt unit (the "sand aquifer"). The upper unconsolidated silt, and the lower till form aquitards. The relationship between the two aquifers is complex and they appear to be connected in some places.

Depth to groundwater ranges from approximately 5 to 9 feet below ground surface.

Groundwater flow is interpreted to be in a general northwesterly direction towards the Thea Foss Waterway. Vertical flow components are difficult to establish at the site because of complicated stratigraphy and tidal influence. Rates of groundwater flow have been estimated to be 17 ft/year in the fill and 41 ft/year in the sand and gravel.

Groundwater at the site is in close communication with the marine water in the adjacent Thea Foss Waterway as evidenced by the significant tidal influence of the onsite wells and by the high salinity of much of the groundwater (e.g., chloride concentrations up to percent values).

2.0 CLEANUP LEVELS

In this section, soil and groundwater cleanup levels are developed for the site. These levels represent contaminant concentrations above which action must be taken as part of the final site cleanup. For the purposes of the present document, cleanup levels are used as benchmarks to focus the discussion of the nature and extent of contamination (Section 3).

2.1 SOIL

Soil cleanup levels to address human health via direct contact (ingestion) were developed for this site in accordance with WAC 173-340-740. Standard Method B soil cleanup levels for unrestricted (residential) land use were selected; these levels were derived from *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulation (CLARC)*, Version 3.1, Publication 94-145, updated 11/01. These levels are presented in Table 2.

In addition, soil cleanup levels to address protection of marine organisms through the soil-to-groundwater-to-surface-water pathway were also developed for copper and nickel. Soil cleanup levels were developed for these two metals because their concentrations in groundwater exceed groundwater cleanup levels (see Section 2.2, below). Soil concentrations protective of surface water were calculated for copper and nickel using the fixed parameter three-phase partitioning model described in WAC 173-340-747(4). The calculated values were 1.4 mg/kg for copper and 10.7 mg/kg for nickel. Since these values are below statewide background levels, cleanup levels were set at background, per WAC 173-340-740(5)(c), using the values for statewide background in Ecology (1994) of 36 mg/kg for copper and 38 mg/kg for nickel. These levels are presented in Table 2.

Soil cleanup levels to address drinking water protection were not developed as groundwater at the site is considered non-potable according to WAC 173-340-720(2)(b)(ii) due to its association with water in Thea Foss Waterway and its resultant high salinity. Soil cleanup levels to address protection of terrestrial animals and plants were not developed because the site and surrounding area contain insufficient habitat per WAC 173-340-7491(1)(c).

Table 2 provides a comparison of the maximum detected concentrations of chemicals in site soil to cleanup levels. Those chemicals whose maximum concentrations exceeded cleanup levels were statistically compared to cleanup levels in accordance with the procedure described in WAC 173-340-740(7)(d) (Ecology 1992, 1995). This comparison involves consideration of the following three attributes of the chemical concentration data:

- A conservative estimate of the central tendency of the concentration of the chemical in soil at the site compared to the cleanup level.
- The frequency with which individual samples exceed the cleanup level.
- The degree to which the maximum detected concentration exceeds the cleanup level.

Under MTCA, the central tendency measure that is used for comparison to cleanup levels is the upper one-sided ninety-five percent confidence limit on the true mean soil concentration (UCL). For this project, UCL values were calculated using *MTCASat* version 3.0. This software application, developed by Ecology, is used to statistically analyze environmental data.

Under WAC 173-340-740(7)(d), a parameter is considered to exceed its soil cleanup level in any of the following situations:

- The UCL exceeds the cleanup level, or
- More than ten percent of individual samples exceed the cleanup level, or
- The maximum concentration in any one sample exceeds two times the cleanup level

Table 3 summarizes the results of this evaluation. Based on this analysis, the following contaminants were determined to exceed cleanup levels in soil at the site:

- Cadmium
- Copper
- Lead
- Nickel
- Vinyl chloride

In addition to these five chemicals, cyanide is also considered contaminant of concern in soil. Cyanide concentrations in soil are elevated. Although cyanide concentrations in soil do not exceed soil cleanup levels, it appears cyanide in soil contributes to cleanup-level exceedances in groundwater.

2.2 GROUNDWATER

Groundwater cleanup levels were developed based on protection of human contact with surface water (MTCA Method B surface water levels) and on protection of marine organisms (WAC 173-201A). Cleanup levels based on protection of drinking water were not developed because the shallow groundwater beneath the site is considered non-potable under WAC 173-340-720(2)(b)(ii). Groundwater cleanup levels for the site are presented in Table 4.

Table 4 provides a comparison of the maximum detected concentrations of chemicals in site groundwater to cleanup levels. Those chemicals whose maximum concentration exceeded the numerical cleanup level were evaluated using the statistical procedure described above for soil (Table 5). From this analysis, the following contaminants were determined to exceed MTCA cleanup levels in groundwater at the site:

- Copper
- Nickel
- Cyanide

Groundwater data used for the comparisons described above included the most recent complete sampling rounds from 1993 and 1994 (AGI 1994; PRC 1995). Several earlier sampling rounds,

conducted in the 1980s, detected generally higher concentrations of VOCs. A limited groundwater sampling event was conducted in 2000 as part of the City of Tacoma East "D" Street Grade Separation Project (Hart Crowser 2001). Contaminant levels appeared to be generally similar to those detected in 1993 and 1994.

3.0 NATURE AND EXTENT OF CONTAMINATION

This section describes the distribution of the contaminants of concern in soil and groundwater that were identified in Section 2.0.

3.1 SOIL

Cadmium

Cadmium concentrations in excess of the soil cleanup level appears to be restricted to areas within and adjacent to Building 1. The highest cadmium concentrations, in excess of 1,000 mg/kg, are from beneath the recessed area in Building 1 (Figure 2). At station S-17, contamination well in excess of the cleanup level extends from the surface to a depth of at least 6.5 feet. Surface soil contamination of several hundred mg/kg was also detected at S-3 and S-18. The depth of contamination at S-18 appears to be limited as the underlying sample did not exceed the cleanup level of 80 mg/kg. High cadmium concentrations beneath the recessed area are consistent with this area's former use for cadmium plating operations and with the poor condition of the concrete floor of this part of the building.

A relatively high concentration of cadmium was also detected west of Building 1 at S-13 in the 2 – 3 ft sample. The underlying sample at this location did not exceed the soil cleanup level. Somewhat lower exceedances were detected in surface soils along the south side of Building 1 at stations APSS-02, APSS-03, and S-22. Contamination in these areas may be associated with various spills and leaks from the cadmium plating operations that took place in Building 1.

Detections of elevated cadmium concentrations are restricted to fairly shallow soils. For example, all exceedances of the cleanup level were detected in or above the 5 – 6.5 ft sampling interval. However, it should be noted that at several of the stations where the highest cadmium concentrations were detected sampling did not extend below the 5 – 6.5 ft interval so it is not known how deep elevated levels might extend at these locations.

Copper

Unlike the relatively restricted distribution of elevated levels of cadmium, copper exceedances are widespread at the site. Copper concentrations in excess of the soil cleanup level of 36 mg/kg (which is based on statewide background concentrations) occur in one or more samples from nearly every station at the site (Figure 3). No sample contained concentrations exceeding the human-health based Method B criterion of 2,960 mg/kg.

The highest detected concentrations, ~300 mg/kg to ~1,000 mg/kg are clustered near at the southwest side of Building 1 and beneath the cut trench in Building 2. In addition, one sample from beneath the concrete pad contained 924 mg/kg of copper. The detection of high levels of copper in and near Buildings 1 and 2 are consistent with the former use of the buildings for copper and brass electroplating operations and/or the management of associated plating solutions

and wastes. The elevated copper concentration from below the concrete pad suggests that this location may also have been used for the handling of copper plating solutions.

In general, elevated copper concentrations appear to be restricted to fairly shallow soils. For example, all exceedances greater than 100 mg/L were detected in or above the 5 – 6.5 ft sampling interval.

Lead

The distribution of lead exceedances are fairly widespread at the site. The highest detected lead concentration, >3,000 mg/kg, was found in the 2 – 3 ft sample from beneath the concrete pad at S-5. Other relatively high concentrations were found in shallow soil at APSS-03 and MW-2, and from the 6 ft samples at S-22 and S-2 (Figure 4).

Moderate lead exceedances were detected in two samples from directly beneath the trench cut into the floor of Building 2 as well as from a sample from the south end of Building 2. Numerous lower-level exceedances, between 250 and 500 mg/kg, are scattered widely throughout the site.

In general, elevated lead concentrations appear to be restricted to fairly shallow soils. For example, all except for one slight exceedance of the soil cleanup level for lead were detected in or above the 5 – 6.5 ft sampling interval.

The source of the lead contamination in soil is not clear. Earlier reports do not speculate on the potential sources of lead at the site. Lead-containing solutions are not mentioned in descriptions of facility operations, and waste inventories do not mention lead-based materials. The RFA (SAIC 1994) noted that the facility had numerous heavy-metal violations of its wastewater discharge permit in the early 1980s; however, none of the violations presented involved lead.

Potential sources of lead contamination may include:

- **Lead-lined tanks.** Although not explicitly mentioned in facility descriptions, it is possible that the operation used some lead-lined tanks to hold acidic plating solutions (e.g., chromic acid). Such tanks are sometimes used in electroplating because of their acid resistance (EPA 2000). It seems likely that acidic solutions stored in such tanks would become contaminated with lead and thereby introduce lead into the waste stream. (There is some evidence for this in that one sample of wastewater from the large sump in Building 1 taken in 1986 was found to contain 5 mg/L of lead.) Once in the waste stream, lead could end up in soil via leaks and spills.

- **Tacoma smelter plume.** Another possible source of lead in site soils is airborne deposition from the former Asarco Tacoma Smelter. The smelter was located approximately five miles to the northwest of the site and is a known source of arsenic and lead contamination in soils in Pierce and King Counties. Studies of smelter contamination conducted by the Tacoma-Pierce County Health Department indicate a zone of high lead concentrations in soil that extends from the former smelter in the direction of the tideflats (TPCHD 2003). The health department sampling did not extend southeastward all the way to the tideflats; however, lead levels similar to those found at the American Plating site ($>1,000$ mg/kg) have been found in soils within about a mile to the northwest of the site.
- **Prior site uses.** Before its use by electroplating operations, the site was used for boat building and other marine-oriented activities. Few details of these former operations are known; however, it is conceivable that some of the lead contamination could be related to these past uses.

Nickel

Like copper, nickel exceedances are widespread at the site. Nickel concentrations in excess of the soil cleanup level of 38 mg/kg (which is based on statewide background concentrations) occur one or more samples from most stations at the site (Figure 5). Only one sample, a surface soil sample from Station 3, contained concentrations exceeding the human-health based Method B criterion of 1,600 mg/kg.

The highest detected nickel concentrations, ranging from ~500 mg/kg to ~3,000 mg/kg, are clustered beneath and adjacent to the southwest corner of Building 1. These detections are consistent with the former use of Building 1 for nickel plating operations. In general, elevated nickel concentrations appear to be restricted to fairly shallow soils. For example, all exceedances of the background-based soil cleanup level were detected in or above the 5 – 6.5 ft sampling interval.

Cyanide

By far the highest concentrations of cyanide at the site, ~500 mg/kg to ~1,000 mg/kg, were found in soil samples from beneath the recessed area of Building 1 at Stations S-3, S-17, and S-16 (Figure 6). Much lower concentrations were detected from other locations throughout the site. Cyanide solutions are very common components of electroplating processes, and were widely used at the site.

Vinyl Chloride

Vinyl chloride was detected at levels exceeding the soil cleanup level in two locations, both associated with Building 1. The highest concentration, 8.4 mg/kg, was found in the 5 – 6.5 ft sample from station S-17 in the recessed area (Figure 7). The other exceedance was located just to the south of Building 1 in the 5 – 6 ft sample from station S-4.

Vinyl chloride is an environmental degradation product of several commonly-used chlorinated solvents, including trichloroethene and 1,1,1-trichloroethane. Both of these solvents were reportedly used in the degreasing tank located in Building 1. It is likely that the vinyl chloride is from leaks or spills of degreasing solvents and their subsequent degradation in the environment.

3.2 GROUNDWATER

Copper

During the 1994 sampling round, copper was only detected in one well, MW-11, at 3.4 ug/L. This is essentially equal to the most stringent surface water criterion of 3.1 ug/L. However, the reporting limits for the other wells ranged from 15 ug/L to 30 ug/L, precluding meaningful comparisons to this criterion. Copper had been detected during previous sampling rounds in several other wells, including MW-1, MW-5, and MW-12, in the 40 ug/L to 70 ug/L range (Figure 8).

The source of elevated copper levels in groundwater is probably associated with the leaching of copper from contaminated soils at the site. Although copper in soil did not exceed direct contact human health criteria, copper concentrations in onsite soil are elevated above expected background levels (e.g., soil concentrations >1,000 mg/kg versus expected background of <40 mg/kg) throughout much of the site.

Nickel

Nickel was detected during the 1994 sampling round in monitoring wells MW-10 and MW-12 at 110 ug/L and 120 ug/L, respectively. These concentrations are well above the most stringent surface water criterion of 8.1 ug/L. However, the reporting limit for the other wells in this sampling round was 30 ug/L, making comparison to the nickel criterion impossible for these samples. Nickel had been detected during previous sampling rounds in several other wells, including MW-3, MW-5, and MW-7, in the 20 ug/L to 30 ug/L range. It was also detected in MW-12 at 880 mg/L during the 1993 sampling round (Figure 9).

The source of elevated nickel levels in groundwater is probably associated with the leaching of nickel from contaminated soils at the site. Nickel concentrations in onsite soil are elevated above expected background levels (e.g., soil concentrations ~3,000 mg/kg versus expected background of <40 mg/kg) throughout much of the site.

Cyanide

Cyanide was detected at 10 of the 12 monitoring wells at the site at concentrations above the groundwater cleanup level of 1 ug/L (based on protection of aquatic organisms). Detected concentrations ranged from 3 ug/L to 30 mg/L. The highest concentrations occurred just to the east of Building 1, in MW-10 and MW-11, and just to the west of Building 2, in MW-3 (Figure 10). Cyanide solutions are very common components of electroplating processes, and were

widely used at the site. Elevated levels of cyanide were detected in soils and are the likely source of the cyanide observed in groundwater in these locations.

It is important to note that the surface water quality criterion for cyanide of 1 ug/L is based on the fraction of the total cyanide that is weak-acid dissociable (WAD). The groundwater results, on the other hand, are from analysis of *total* cyanide. Depending on the exact forms of cyanide in the groundwater, the total results could overstate the WAD fraction to an unknown degree.⁶

3.3 SUMMARY OF CONTAMINANT DISTRIBUTION

This section summarizes the major soil and groundwater contaminants. This information forms the basis for selection of interim actions and will eventually form the basis for the development of final cleanup actions for the site.

Cadmium

Cadmium could pose a human health risk from contact/ingestion of site soil, particularly from soil beneath and adjacent to Building 1. Groundwater results from the most recent comprehensive sampling round (PRC 1994) indicate that cadmium is not a significant human health or ecological issue in site groundwater (via the surface water pathway). Cadmium was detected in an earlier sampling round at 1,700 ug/L in MW-12. This concentration does exceed surface water levels for protection of human health (contact/ingestion of surface water) and aquatic organisms.

Copper

Copper does not pose a significant human health risk from contact/ingestion of site soil. In addition, groundwater concentrations do not pose a significant risk to human health (via contact/ingestion of surface water). Groundwater concentrations of copper do, however, exceed surface water levels for protection of aquatic organisms.

Lead

Lead could pose a human health risk from contact/ingestion of site soil, particularly from soil beneath and north of Building 2, beneath the concrete pad, and near the southwest corner of Building 1. Groundwater concentrations indicate that lead is not an issue for human health or aquatic organisms via surface water pathways.

⁶ The toxicity of cyanide is due to the presence of free cyanide. Cyanide-metal complexes are much less toxic. For example, iron, nickel, and silver cyanide complexes are stable and do not release free cyanide under normal ambient water conditions. Zinc, copper, and cadmium complexes are less stable and can release free cyanide. Total cyanide analysis uses strong acid treatment to measure all types of cyanide, including cyanide that, in the environment, is strongly bound in stable metal complexes. The weak-acid dissociable (WAD) method uses weak acid treatment of waters to determine free cyanide and those cyanide complexes which might dissociate to free cyanide in ambient waters. Total cyanide analyses can overestimate the amount of the biologically available cyanide. WAD cyanide provides a more appropriate criterion for protecting aquatic organisms.

Nickel

Nickel does not pose a significant human health risk from contact/ingestion of site soil. In addition, groundwater concentrations do not pose a significant risk to human health (via contact/ingestion of surface water). Groundwater concentrations of nickel do, however, exceed surface water levels for protection of aquatic organisms.

Cyanide

Cyanide does not pose a significant human health risk from contact/ingestion of site soil. In addition, groundwater concentrations do not pose a significant risk to human health (via contact/ingestion of surface water). Groundwater concentrations of cyanide may, however, exceed surface water levels for protection of aquatic organisms, depending on the degree to which the cyanide present in groundwater is in the form of free cyanide.

Vinyl Chloride

Vinyl chloride does not pose a significant human health risk from contact/ingestion of site soil. Although vinyl chloride was detected in two soil samples above human-health based cleanup levels, both samples were from a depth of about five feet below land surface, where human contact would be minimal. In addition, vinyl chloride no longer appears to be an issue in groundwater via the surface water pathway. Concentrations of VOCs in groundwater have declined through the years to relatively low levels.

4.0 INTERIM REMEDIAL ACTIONS

4.1 OBJECTIVES

Ecology has determined that interim remedial actions are warranted at this site in order to reduce potential threats to human health and the environment by reducing exposure to hazardous substances. The interim actions will also reduce physical hazards and will provide additional site characterization which will facilitate development and implementation of final cleanup actions.

The interim actions described below are expected to provide a partial cleanup of the site, but are not necessarily expected to achieve cleanup standards everywhere. Final cleanup actions will be conducted at a later time and will be spelled out in a prospective purchaser consent decree between Ecology and a new property owner at the time of property transfer.

Specifically, interim actions are intended to achieve the following objectives:

- Reduce human health risk by limiting the potential for contact with contaminated soils.
- Reduce potential risk to aquatic organisms in the Thea Foss Waterway caused by exposure to groundwater discharging from the site.
- Address physical hazards at the site associated with dilapidated structures and an open sump.
- Provide additional site characterization to aid in the development and implementation of interim and final cleanup actions.

The following section presents the development of numerical interim action levels. Subsequent sections describe the interim actions for this site.

4.2 INTERIM ACTION LEVELS

Interim action levels were developed for contaminants in site soil because soil constitutes the main exposure pathway to humans. Interim action levels for protection of groundwater and surface water were not developed; however, it is expected that actions taken to address contaminated soil will decrease contaminant concentrations in groundwater and surface water over the long term.

Interim action levels were developed for cadmium and lead (Table 6). Interim action levels for these contaminants are based on protection of human health. Cadmium and lead pose potential human health risk in near-surface soil via ingestion in a future residential use scenario.

Interim action levels for cadmium and lead were set at 160 mg/kg and 500 mg/kg, respectively for the 0–3 ft depth interval where most human exposure would occur. These levels are two times soil cleanup levels. Remediation of soils that exceed these concentrations will significantly reduce potential human health risk at the site associated with soil ingestion.

Additional interim action levels were established for soil based on TCLP test results for cadmium and lead. These levels were set at 1 mg/L and 5 mg/L, respectively, and apply from the surface down to a depth of eight feet (to the water table, if it is shallower than eight feet). The TCLP-based interim action levels for cadmium and lead are equal to the Washington state dangerous waste levels for these contaminants.

Interim action levels were not developed for copper, nickel, and cyanide. Although these contaminants may pose a risk to aquatic organisms via the groundwater-to-surface-water pathway, they do not pose a significant human health risk at the site.

Interim action levels for vinyl chloride, the other contaminant of concern in soil, were not developed because concentrations exceeding human-health criteria were not detected in soil at depths shallower than three feet, where most exposure would occur. Also, although vinyl chloride has been detected at low concentrations in groundwater at the site, it is not considered to pose a significant risk to aquatic organisms because of its lack of persistence in the marine environment.

The interim action levels selected represent a balance between risk reduction and remediation cost. The levels selected represent an emphasis on reduction of human health risk from contact with contaminated soil. Reduction of potential risk to aquatic organisms via the groundwater-to-surface-water pathway is not considered to be a major goal of the interim actions. Ecological risks may be more fully addressed as part of final cleanup.

4.3 REMOVE STRUCTURES

4.3.1 Remove Buildings

Buildings 1 and 2—along with their contents and all miscellaneous debris lying outside the buildings—will be removed. The buildings have been abandoned for a number of years and are in poor condition. Building 1 shows signs of structural failure and possible collapse. This building also shows some evidence of occasional human habitation. In addition to resolving public safety concerns, removal of the buildings will facilitate additional site characterization and interim remedial actions.

Debris from the building removal will be hauled offsite. It is expected that some of the demolition debris will be suitable for disposal in a landfill permitted to accept demolition waste. To the extent practicable, this material will be recycled or reused. Material for which recycling/reuse is not feasible will be landfilled. Considerable amounts of the demolition material (e.g., the heavily-stained bases of wooden supports and some concrete flooring in Building 1 and unidentified drums in Building 2) are contaminated with heavy metals and minor amounts may be classified as dangerous waste under WAC 173-303. Some samples of suspected building materials have been collected and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals⁷ to determine if it is dangerous waste. Consultation with Ecology's

⁷ TCLP metals are arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

Hazardous Waste and Toxics Reduction Program personnel has resulted in a finding that these materials can be disposed of in a Subtitle D landfill. Consultation with one Subtitle D landfill confirms this finding and that this type of material, when minor amounts contain dangerous waste levels of contaminants, can still be accepted; the more heavily contaminated material is accepted as "incidental to the load" of non-dangerous waste material.⁴⁸

4.3.2 Remove Foundations, Concrete Pad, and Sumps

The foundations of Buildings 1 and 2, the concrete pad, and the large sump in Building 1 will be removed from the site. This action will allow removal of underlying soils that are known to exceed interim action levels. In addition, removal of the sump will eliminate a potential safety concern, as it is several feet deep and has the potential for becoming filled with water. Previous testing indicates that the water currently in the sump should be acceptable for discharge to sanitary sewer. At the request of Tacoma Sewer Utility, the water will be retested just prior to pumping and discharge to verify this. These removal actions could occur either before or after the additional soil characterization sampling (discussed below). The concrete will be removed so as to leave the underlying soil as undisturbed as possible. During removal, the corners of the building foundations and the concrete pad will be marked for locational reference during subsequent interim actions.

4.3.3 Remove Underground Storage Tank

The underground storage tank located to the east of Building 1, including all associated piping, will be removed. UST removal shall be conducted in accordance with the Underground Storage Tank Regulations (WAC 173-360-385). Any petroleum contaminated soil (PCS) encountered during UST or line removal will be excavated, stockpiled, sampled, and properly managed. Excavation of PCS will continue as long as the soils exhibit any one or more of the following characteristics:

- Visible free product is present.
- Soil is visibly stained.
- Soil PID (Photo Ionization Detector) or FID (Flame Ionization Detector) readings, using a headspace analysis technique, are greater than 100 ppm.

The following are limits placed on the PCS excavation:

- The excavation will not extend beyond the site boundary.
- The excavation will not endanger the stability of buildings and roads adjacent to the site.
- The excavation will not extend below the groundwater table.

During PCS removal, soil samples from the excavated area and stockpiled soil will be taken in accordance with guidelines set forth in *Guidance for Remediation of Petroleum Contaminated Soils*, Washington State Department of Ecology Toxics Cleanup Program Publication 91-30,

⁴⁸ Per correspondence with Kerry Graber, SWRO HWTR and Elisa Webb, Rabanco.

November, 1995 and *Guidance for Site Checks and Site Assessments for Underground Storage Tanks*.

4.4 ADDITIONAL SOIL CHARACTERIZATION

Sampling results indicate that soil exceeding interim action levels is restricted to the area beneath and between Building 1, Building 2, and the concrete pad. For purposes of the present report, this area is termed the "interim action area." The interim action area is shown on Figure 11.

Within much of the interim action area concentrations exceeding interim action levels have not been detected below a depth of about three feet. In other parts of the interim action area, however, concentrations exceeding interim action levels have either been detected in deeper samples or their presence below three feet cannot be ruled out because adequate deeper sampling has not been conducted. The areas of potential deep soil contamination are also shown on Figure 11. These areas encompass much of Building 1, including the adjacent area to the southwest of the building, as well as a portion of Building 2 beneath the cut trench.

In order to adequately define the soils that must be addressed as part of interim actions, additional soil sampling will be conducted. Soil samples will be collected using direct push (e.g., geoprobe) technology. This method allows for the rapid collection of continuous soil cores.

Geoprobe soil samples will be collected at selected locations within the interim action area. Within the areas of potential deep contamination, samples will be collected to a depth of eight feet. Elsewhere in the interim action area, samples will be collected to four feet. Depending on the sequence of interim action activities, it may be necessary to core through the concrete building foundations in order to obtain access to the underlying soil.

Soil samples representing three-foot intervals will be collected from each probe (i.e., one sample will be collected from 0 – 3 ft. in shallow probe locations; two samples will be collected, from 0 – 3 ft. and from 5 – 8 ft, in the deep probe locations). Samples will be analyzed for total cadmium, lead, copper, nickel, and cyanide, as well as TCLP copper and lead. Samples will also be analyzed for cyanide reactivity (dangerous waste reactivity characteristic); this information may be necessary for soil disposal classification purposes (see Section 4.6.2, below). Analytical methods will be used that are sensitive enough to quantify each analyte at or below its soil *cleanup* level (not interim action level).

This additional soil characterization will be performed under appropriate safety and health and sampling and analysis plans meeting the requirements of WAC 173-340-810 and -820, respectively.

4.5 ADDITIONAL GROUNDWATER CHARACTERIZATION

The seven monitoring wells that tap the upper fill/marsh aquifer (MW-1, -2, -3, -4, -5, -11, and -12), plus any seeps present along the shore of the Thea Foss Waterway, will be sampled and analyzed for total and dissolved metals, total cyanide, and weak-acid dissociable cyanide. These

analyses will provide a recent, pre-interim action baseline for the site. The analyses will also determine the forms of cyanide that occur in groundwater at the site. As discussed in Section 3.2 above, the surface-water based groundwater cleanup level for cyanide is based on WAD cyanide; however, only total cyanide has ever been analyzed at the site. This additional sampling round will determine whether groundwater exceeds the cleanup level for cyanide and whether soil interim action to address cyanide is warranted.

Analytical methods will be used that are sensitive enough to quantify each analyte at or below its groundwater *cleanup* level (not interim action level). Monitoring wells will be sampled during high-tide conditions in order to be comparable to previous groundwater results. The seep(s) will be sampled at low tide. Monitoring well samples will be collected using a submersible pump under low-flow conditions in order to minimize turbidity. The following field measurements will also be made during the sampling event:

- Static water level
- Depth to bottom of well
- pH
- Temperature
- Electrical conductivity
- Salinity
- Turbidity

The additional groundwater characterization will be performed under appropriate safety and health and sampling and analysis plans meeting the requirements of WAC 173-340-810 and – 820, respectively.

4.6 SOIL REMOVAL

The following subsections describe the excavation and disposal of contaminated site soil. This work will be conducted in compliance with applicable sections of WAC 173-340-400.

4.6.1 Excavation

Results for each soil sample will be compared to interim action levels for cadmium and lead. Soil that exceeds interim action levels for total cadmium and lead will be excavated to a maximum of three feet and removed from the site. In addition, soils from the area of potential deep soil contamination whose TCLP results for cadmium and lead exceed the TCLP-based interim action levels for these contaminants will be excavated to a maximum depth of eight feet or to the water table, whichever is shallower.

Excavated areas will be replaced with a minimum of two feet of clean fill and a minimum of one foot of topsoil. The area will be graded to allow proper drainage and vegetated to prevent erosion.

In areas where total cadmium or lead concentrations exceed soil *cleanup* levels below the three foot limit of excavation (as indicated by results from the 5 – 8 ft samples), a layer of permeable

geotextile will be placed prior to backfilling. This fabric will serve as a marker to help prevent the inadvertent excavation of contaminated soil in the future.

One monitoring well, MW-2, lies within the interim action area. Should soil at this well require removal, the well will be properly abandoned per the requirements of WAC 173-160-560.

4.6.2 Testing and Disposal

The disposal method for excavated soil will depend on whether it is classified as a dangerous waste under WAC 173-303. TCLP analysis of five soil samples by AGI (1989) indicates that a portion of the excavated soil will likely be classified as dangerous waste. Two of the five AGI samples, which were chosen to represent moderately to highly contaminated soil, exceeded TCLP limits for dangerous waste. One of the samples exceeded the limit for lead, the other exceeded the limit for cadmium.

Soils that are classified as dangerous waste must be disposed of in a Subtitle C landfill. Soils that are not classified as dangerous waste may be transported and disposed of in a Subtitle D landfill.

Soils that must be disposed as dangerous waste will be identified based on the results of the TCLP analyses and cyanide reactivity tests conducted during the additional soil characterization effort described above.

4.7 OTHER ACTIONS

Actions described in the following subsections may be performed as part of the interim action, as resources allow. If resources do not allow implementation of these actions, they may be implemented during final cleanup.

4.7.1 Institutional Controls

The following institutional controls will be established at the site:

Access control: The site fencing will be improved and maintained as necessary to prevent unauthorized access and to limit contact with potentially contaminated areas.

Maintenance of cover: By way of deed restriction or other appropriate method, current and subsequent property owners will be restricted from excavating or grading the site so as to leave less than three feet of clean soil cover over areas where contaminants exceeding soil cleanup levels exist. The property owner must maintain the surface of the property in such a way as to prevent erosion of the clean soil cover (e.g., maintain vegetative or paved surface). Should excavation into contaminated material be required, Ecology would be notified and the excavated soil must be appropriately handled and disposed of.

Drinking water well restrictions: By way of deed restriction or other appropriate method, property owners will be restricted from installing drinking water wells on the property.

4.7.2 Abandon Lower Aquifer Monitoring Wells

Monitoring wells MW-6, MW-7, MW-8, MW-9, and MW-11 will be abandoned per the requirements of WAC 173-160-560⁹. These wells tap the deeper "sand aquifer." The remaining wells tap the upper "fill/marsh aquifer." The upper aquifer wells have historically contained much higher contaminant concentrations and will provide the best indicators of long-term contaminant levels and trends. The deeper aquifer wells are of much less value for contaminant monitoring and their continued presence could unnecessarily provide potential connections between the aquifers.

4.7.3 Long-Term Groundwater Monitoring

The seven remaining shallow-aquifer monitoring wells, plus any seeps present along the bank of the Thea Foss Waterway, will be sampled annually for metals and WAD cyanide until final cleanup actions are implemented.

⁹ Well MW-2 will also be abandoned should it lie in an area where soil excavation is required.

5.0 REFERENCES

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TPCHD 2003. Areal Lead in Soil Concentrations, Tacoma Smelter Plume. Map, dated January 2003. Accessed at <http://www.tpchd.org/eh/Arsenic/LeadDotMap.htm>.

Weston 1986. Technical Assistance Team (TAT) Activities Report, American Plating Preliminary Site Assessment. Tacoma, Washington. March 13, 1986.

Tables

Table 1
Summary of Sampling Events at the American Plating Site

Sampling Event	Sampling Date / Reference	Samples Collected
Preliminary Site Assessment (EPA)	1986 / Weston (1986)	-17 surface soil samples.
Phase I Soil and Ground Water Investigation	1988 / AGI (1988)	-7 surface soil samples -35 subsurface soil samples. -9 monitoring wells installed; all sampled in May, August, and November.
Phase II Soil and Groundwater Investigation	1989 / AGI (1989)	-13 surface soil samples. -63 subsurface soil samples. -3 additional monitoring wells installed; all -12 wells sampled. -Seep sample. -Surface water (Thea Foss Waterway) sample.
Additional Groundwater Sampling Round	1989 / Tetra Tech (1989)	-All 12 monitoring wells sampled.
Supplemental Groundwater Investigation	1993 / AGI (1994)	-All 12 monitoring wells sampled. -Seep sample. -Surface water (Thea Foss Waterway) sample.
RCRA Comprehensive Groundwater Monitoring Evaluation (CME)	1994 / PRC (1995)	-8 monitoring wells sampled.
East "D" Street Grade Separation Project	2000 / Hart Crowser (2001)	-Additional soil and monitoring well sampling.

Table 2
Soil Cleanup Levels

Parameter	MTCA Cleanup Level (Meth. B, unless otherwise indicated)	Maximum Detected Soil Concentration¹	Maximum Exceeds Cleanup Level?
<i>Metals (mg/kg)</i>			
Cadmium	80	1,370	yes
Chromium, total	120,000	21,580 ²	no
Chromium VI	240	23	no
Copper	2,960	924	no
Copper-protection of surface-water based GW cleanup levels	1.4 (calculated) 36 (background)	924	yes
Nickel	1,600	2,845	yes
Nickel-protection of surface-water based GW cleanup levels	10.7 (calculated) 38 (background)	2,845	yes
Lead	250 ³	3,092	yes
Zinc	24,000	4,090	no
<i>Cyanide (mg/kg)</i>			
Cyanide, total	1,600	840	no
<i>VOCs (mg/kg)</i>			
Bromomethane	112	0.27	no
Chloroform	164	1.7	no
1,1-Dichloroethane	8,000	1.5	no
1,1-Dichloroethene	1.67	0.02	no
cis-1,2-Dichloroethene	800	2.9	no
trans-1,2-Dichloroethene	1,600	0.77	no
Methylene chloride	133	0.11	no
Tetrachloroethene	19.6	0.45	no
1,1,2,2-Tetrachloroethane	5	0.05	no
1,1,1-Trichloroethane	72,000	3.6	no
Trichloroethene	90.9	5.9	no
Trichlorofluoromethane	24,000	0.08	no
Vinyl chloride	0.667	8.4	yes

Method B refers to soil cleanup levels for unrestricted land use; value shown represents the lower of the carcinogen or non-carcinogen value.

¹ Data source: AGI (1989)

² Site data indicate that little of the total Cr in soil is in the hexavalent state; in samples where both were analyzed, Cr IV was seldom detected, even in samples with very high levels of total Cr. Therefore, total Cr results are compared to cleanup levels for total Cr, not to cleanup levels for the more toxic Cr VI. Cr VI results are compared to the cleanup level for Cr VI.

³ Method A soil cleanup level for unrestricted land use.

Table 3
Comparison of Soil to Cleanup Levels

Parameter	Number of Samples	Minimum (mg/kg)	Maximum (mg/kg)	Mean (mg/kg)	Soil Cleanup Level (mg/kg)	UCL ⁴ (mg/kg)	UCL>Cleanup Level?	Percent of Samples Exceeding Cleanup Level	Maximum Concentration >2x Cleanup Level?
Cadmium	92	nd	1,370	52	80	236	yes	17%	yes
Copper	92	2	924	125	36	173	yes	57%	yes
Lead	92	1.0	3,250	210	250	577	yes	17%	yes
Nickel	92	5.5	2,845	107	38	100	yes	37%	yes
Vinyl chloride	92	nd	8.4	0.12	0.67	0.27	no	2%	yes

⁴ UCL is the upper one-sided 95-percent confidence limit on the mean. In cases where this value is greater than the maximum detected concentration, the maximum concentration is used for comparison.

Shaded chemicals indicate UCL>cleanup level *or* percent samples exceeding cleanup level>10% *or* maximum concentration exceeds 2x cleanup level.

Table 4
Surface-Water Based Groundwater Cleanup Levels

Parameter	MTCA Method B Surface Water Cleanup Levels ⁵ (Protection of Human Health)	State Surface Water Quality Standards ⁶ (Protection of Aquatic Organisms, Chronic Exposure)	State Surface Water Quality Standards ⁶ (Protection of Aquatic Organisms, Acute Exposure)	Maximum Detected Groundwater Concentration ⁷ (ug/L)	Maximum Exceeds Cleanup Level?
<i>Metals (ug/L)</i>					
Cadmium	20.3	42	9.3	10	yes
Chromium, total	--	--	--	nd	no
Chromium III	243,000	--	--	--	--
Chromium VI	486	1,100	50	--	--
Copper	2,660	4.8	3.1	3.4	yes
Nickel	1,110	74	8.2	150	yes
Lead	--	210	8.1	nd	no
Zinc	16,500	90	81	40	no
<i>Cyanide (ug/L)</i>					
Cyanide	52,000	1 (WAD cyanide)	--	29 (total cyanide)	yes
<i>VOCs (ug/L)</i>					
Benzene	22.7	--	--	1.8	no
Chloroform	283	--	--	1.4	no
1,1-Dichloroethane	--	--	--	140	no
1,2-Dichloroethane	59	--	--	0.2	no
1,1-Dichloroethene	1.9	--	--	0.26	no
cis-1,2-Dichloroethene	--	--	--	8.2	no
1,2-Dichloropropane	23	--	--	0.34	no
Ethyl benzene	691	--	--	0.5	no
Toluene	4,850	--	--	1.5	no
1,1,1-Trichloroethane	417,000	--	--	3.3	no
Trichloroethene	56	--	--	1.1	no
Vinyl chloride	3.7	--	--	3	no
Xylene	--	--	--	1.2	no

⁵ MTCA Method B (lower of carcinogenic and non-carcinogenic).

⁶ WAC 173-201A, marine water.

⁷ Concentrations from AGI 12/93-1/94 sampling event or, where available, from PRC 9/94 event (PRC 1995).

Parameters included in this table are those metals that have exceeded regulatory levels during any sampling round, cyanide, and all detected VOCs.

Table 5
Comparison of Groundwater to Surface-Water Based Cleanup Levels

Parameter	Number of Samples	Minimum (ug/L)	Maximum (ug/L)	Mean (ug/L)	Ground-water Cleanup Level (ug/L)	UCL⁸ (ug/L)	UCL> Cleanup Level?	Percent of Samples Exceeding Cleanup Level	Maximum Conc. >2x Cleanup Level?
Cadmium	12	nd	10	1.5	9.3	5.1	no	8%	no
Copper ⁹	12	nd	3.4	--	3.1	--	--	8%	--
Nickel ⁹	12	nd	150	--	8.2	--	--	17%	yes
Cyanide	12	nd	29	13	1	29	yes	92%	yes

Shaded chemicals indicate UCL>cleanup level or percent samples exceeding cleanup level>10% or maximum concentration exceeds 2x cleanup level.

⁸ UCL is the upper one-sided 95-percent confidence limit on the mean. In cases where this value is greater than the maximum detected concentration, the maximum concentration is used for comparison.

⁹ Reporting limits for copper and nickel were often well above their respective cleanup levels; this did not allow for calculation of meaningful statistics for these metals. The maximum detected concentration of nickel exceeded 2x its cleanup level, so nickel is shaded. The maximum detected concentration of copper did not exceed its cleanup level; however, many analyses had reporting limits of 20 ug/L. Current data do not allow a meaningful comparison of copper to cleanup levels; therefore, copper is retained as a contaminant of concern and is shaded in this table.

Table 6
Interim Action Levels for Soil

Parameter	Depth (ft)	Level	Comments
Cadmium, total	0 – 3	160 mg/kg	Protection of human health via direct contact (ingestion)
Lead, total	0 – 3	500 mg/kg	Protection of human health via direct contact (ingestion)
Cadmium (TCLP)	0 – 8 (or water table)	1 mg/L	Based on Washington state dangerous waste regulations
Lead (TCLP)	0 – 8 (or water table)	5 mg/L	Based on Washington state dangerous waste regulations

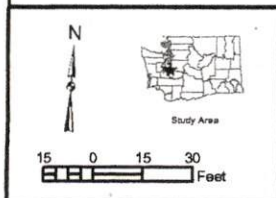
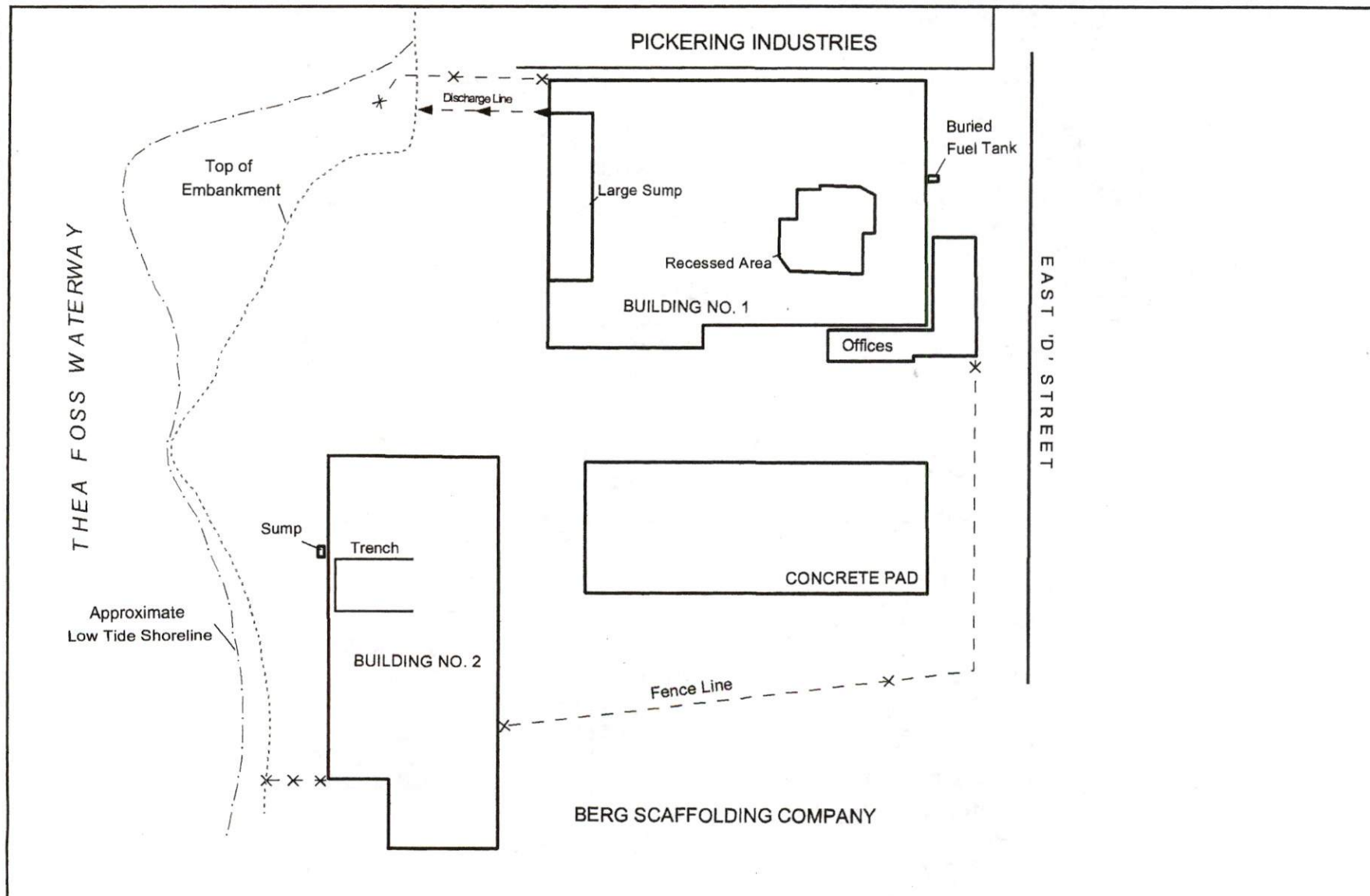
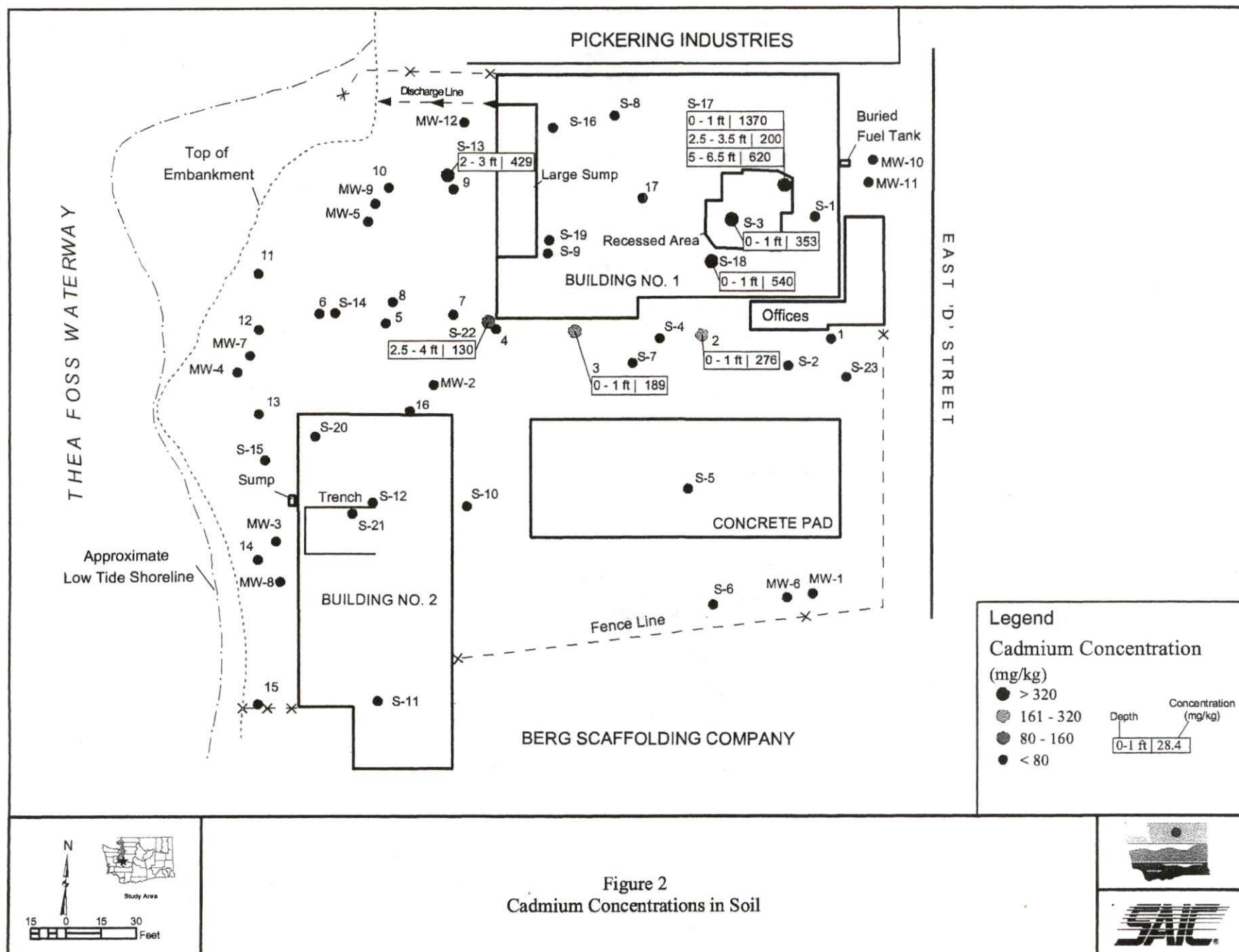


Figure 1
American Plating Site





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