BUILDING B-2 CHROMIUM PLATING FACILITY
IN-SITU SOIL AND GROUNDWATER TREATMENT
STRATFORD ARMY ENGINE PLANT
TIME-CRITICAL REMOVAL ACTION MEMORANDUM

Prepared for:

AlliedSignal, Inc.
Stratford, Connecticut

Prepared by:

Harding Lawson Associates
(formerly ABB Environmental Services, Inc.)
Portland, Maine
Project No. 2842-20

August 28, 1998

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1.0 PURPOSE

This Time-Critical Removal Action Memorandum (TCRAM) documents the decision to perform a time-critical removal action for the former Building B-3 Chromium Plating Facility at Stratford Army Engine Plant (SAEP) in Stratford, CT.

The regulatory authority for this removal action is the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

In September 1995, SAEP was placed on the Base Realignment and Closure (BRAC 95) list for realignment and closure, *and is thus subject to the special provisions for federal facilities under CERCLA.* In addition, with the passage of SARA, all remedial investigation/feasibility study (RI/FS) activities at SAEP are being conducted, when appropriate, in accordance with applicable U.S. Environmental Protection Agency (USEPA) guidance.

To perform a time-critical removal action at the former Chromium Plating Facility, a Removal Action Work Plan (RAWP) will be prepared by Harding Lawson Associates (HLA) (formerly ABB Environmental Services, Inc.[ABB-ES]). The RAWP will identify the method and scope for removal of hexavalent chromium (or chromium VI) from the soils and groundwater beneath the Chromium Plating Facility. HLA has been contracted by AlliedSignal as the remedial action contractor for the Chromium Plating Facility.

2.0 SITE CONDITIONS AND BACKGROUND

2.1 SITE DESCRIPTION

2.1.1 Property Information and Description of Facilities

SAEP is located in Stratford, Connecticut, on the Stratford Point peninsula in the southeast corner of Fairfield County (Figure 2-1). The plant lies on the borderline of the Bridgeport and Milford Quadrangles. Latitudinal and longitudinal coordinates of SAEP are approximately 41°-10' North and 73°-07' West.

SAEP consists of approximately 124 acres, of which about 76 acres are improved land and 48 acres are riparian (water) rights (Figure 2-1). For purposes of this report, directions (i.e., north, south, east, and west) are referenced to the SAEP facility plan north direction, which deviates approximately 26 degrees from magnetic north (Figure 2-1). The plant is bounded as follows:

North. AlliedSignal-owned property, consisting of paved parking lot and a small wetlands area;

East. Housatonic River;

South. Open field, a drainage channel that flows to the Marine Basin, and several commercial businesses; and

West. City of Bridgeport property occupied by a hangar, the Sikorsky Memorial Airport, several businesses including a strip mall, gas stations, and restaurants, and Frash Pond.

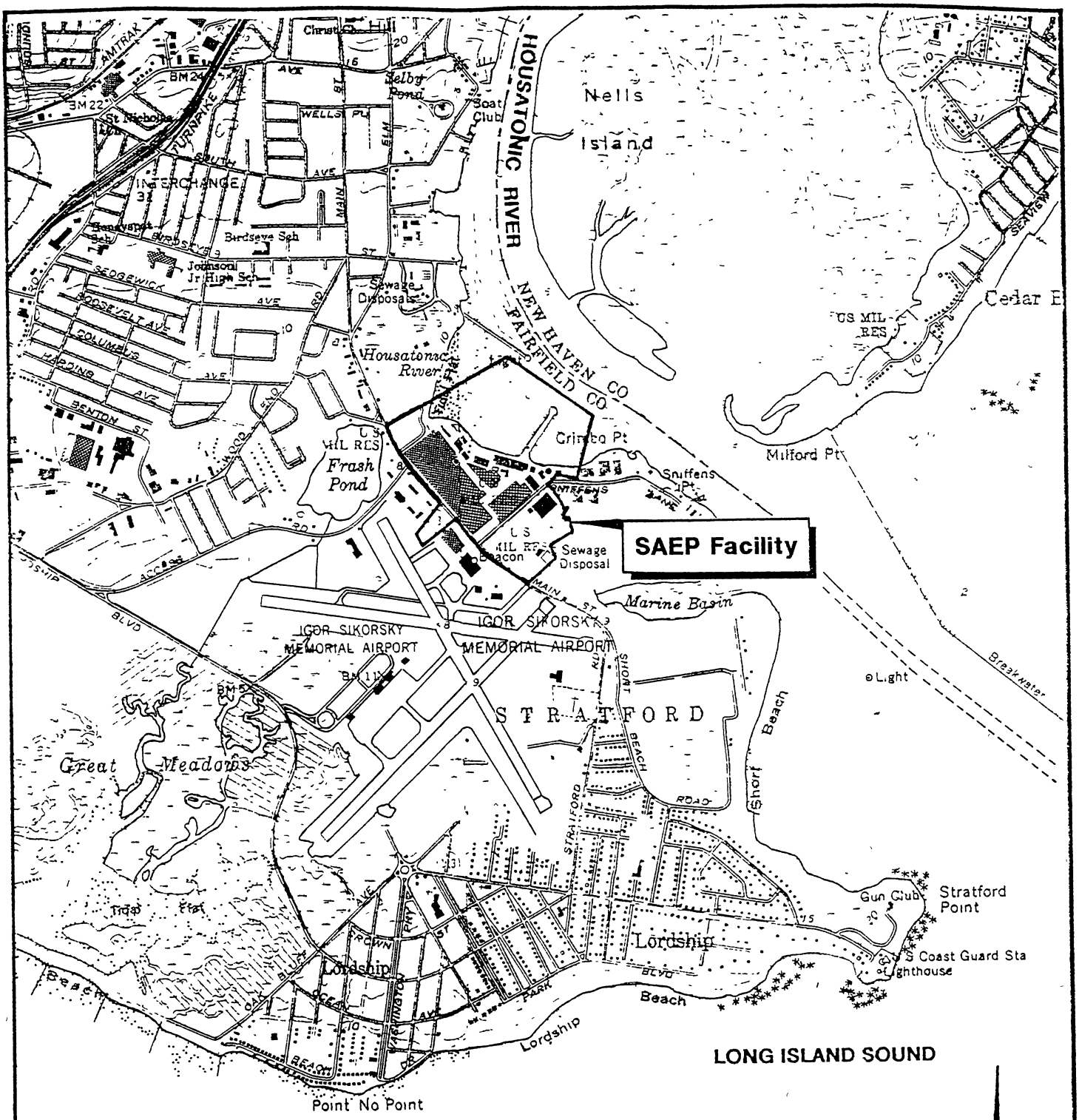
As of August 1998, SAEP is transitioning from an active production facility to caretaker status. The SAEP land and buildings are owned by the U.S. Army, and former plant equipment (removed in early 1998) was owned by both the U.S. Army and AlliedSignal. The U.S. Army-owned land, buildings, and equipment were formerly provided to AlliedSignal in a facilities contract for executing government contracts. AlliedSignal paid rent to the U.S. Army for the use of the plant in manufacturing commercial products (ABB-ES, 1996). The SAEP property has been improved, and consists of 49 buildings, paved roadway and grounds, and five paved parking lots (Figure 2-1). Subsection 2.1.2 presents a brief history of SAEP.

2.1.2 Property History

The first manufacturing facility at the SAEP property was constructed on approximately 26 acres in 1929. Prior to that time, the land use in and around the plant was agricultural. Since 1929, the plant has been expanded by the acquisition of land and construction of buildings. SAEP now consists of 49 buildings situated on about 124 acres. The historical growth and use of SAEP property is documented by aerial photographs, site plans, property maps/titles/deeds, and reports prepared by various agencies and individuals (ABB-ES, 1996). A brief history of the facility is presented below.

Sikorsky Aero Engineering Corporation/Sikorsky Aviation Corporation (1929 to 1939). The Sikorsky Aero Engineering Corporation was established in March 1923. Sikorsky manufactured sea planes at the Stratford plant from 1929 to 1939.

Vought-Sikorsky Aircraft/Chance Vought Aircraft (1939 to 1948). Sikorsky experienced economic difficulties in the latter part of the 1930s, and production at the plant nearly halted in 1938. Chance Vought Aircraft, another subsidiary of United Aircraft and Transport Corporation, relocated to the Stratford plant in April 1939, and the new subsidiary became known as Vought-Sikorsky Aircraft Division. The "Kingfisher" airplane was mass-produced at the Stratford plant from 1940 to 1942, and mass production of the Corsair began in June 1941.



SOURCE: WOODWARD-CLYDE CONSULTANTS, 1991
FINAL PAS

0 1000 2000 FT
SCALE

CT

ABB Environmental Services, Inc.

SITE LOCATION MAP

STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Chromium Plating Facility TCRAM

2842-00

FIGURE 2-1

Vacant (1948 to 1951). Chance Vought moved its entire manufacturing operation to Texas in 1948. Following that, a severe flood of the Housatonic River rendered the Stratford plant's 1,580,000 square feet of manufacturing space unusable. The plant was listed for sale, and in 1951 the U.S. Air Force purchased the plant and renamed it Air Force Plant No. 43.

Air Force Plant No. 43/Bridgeport Lycoming Division (1951 to 1976). In February 1951, the Avco Corporation, through its Bridgeport Lycoming Division, occupied the Stratford plant as the contractor for the U.S. Air Force. Avco produced the Curtis Wright nine-cylinder radial engine and major components of the J-47 jet aircraft engine. Avco also developed and manufactured various gas turbine helicopter engines throughout the remainder of the 1950s. During the 1960s and early 1970s, Avco continued to develop and manufacture turbine engines for more diversified uses, such as helicopters, amphibious hydrofoils, hovercraft, and land vehicles.

Stratford Army Engine Plant/Avco Lycoming or Textron Lycoming, Stratford Division (1976 to 1994). The Stratford plant was transferred from the U.S. Air Force to the U.S. Army in 1976. At that time the plant was renamed the Stratford Army Engine Plant. In 1978, Avco was contracted by the U.S. Army to manufacture the AGT-5000 engine to power the Abrams tank. In 1986, a cyanide/chromium treatment facility was constructed and improvements were made to the Chemical Waste Treatment Plant (CWTP).

Stratford Army Engine Plant/AlliedSignal Engines (1994 to Present)
The contract for SAEP operation was transferred to AlliedSignal, Inc. in 1994. Turbine engines for military and commercial aircraft, as well as land vehicles, continue to be developed, manufactured, and tested at SAEP. In September 1995, SAEP was placed on the BRAC 95 list for realignment and closure. All production was ceased in the fall of 1997. SAEP is currently transitioning from an active production facility to caretaker status.

2.1.3 Tenant Activities and Practices

The following historical tenant activities and practices were conducted at SAEP:

- Industrial Operations
- Accumulation and Storage
- Waste Disposal Practices
- Use of Pesticides, Rodenticides, and Herbicides
- Explosives/Ordnance Storage and Use
- Use of Radiological Materials

The Chromium Plating Facility, located in the southeast corner of Building B-2 (Figure 2-2), has been used as a plating facility since 1951 (ABB-ES, 1996). Operations in the facility have included the following (INEL, 1991):

- chromium plating
- nickel plating
- copper plating
- acid cleaning

Chemicals and solutions used in these processes have included chromic acid, copper cyanide, sodium cyanide, sulfuric acid, nitric acid, hydrochloric acid, hydrofluoric acid, potassium hydroxide, and 1,1,1-trichloroethane. Plating activities occurred on an elevated concrete platform, beneath which were located floor drains and ventilation chambers. The open chambers were evacuated with air scrubbers located outside Building B-2 to discharge of harmful vapors generated during plating processes. Numerous spills and leaks occurred during the plating process, which resulted in spillage to the concrete floor beneath the raised concrete platform. All plating tanks, piping, and the raised concrete platform were dismantled and removed in 1997-1998. Currently, the former plating facility is an empty room in Building B-2.

2.2 Release Or Threatened Release Into The Environment Of A Hazardous Substance, Pollutant, Or Contaminant

In June 1998 SAEP hired AJS Environmental Services, Inc. (AJS) of Millbury, MA to perform soil sampling beneath the floor of the Chromium Plating Facility. AJS collected over 60 subsurface soil samples from 30 borings (C-1 through C-30) (Figure 2-2), and analyzed all the samples for total chromium. Analytical results indicated chromium concentrations in subsurface soils exceeding Connecticut Department of Environmental Protection (CTDEP) Remediation Standard Regulations (RSRs) for hexavalent chromium. No chromium speciation was performed as part of this initial sampling event. Cyanide was also detected in samples with relatively high chromium concentrations.

As a result of the detected chromium contamination, AlliedSignal/SAEP contracted HLA to perform additional site characterization and develop removal action alternatives. Attachment 1 contains the work plan prepared by HLA to perform additional site characterization. On August 20, 1998, HLA collected 12 additional soil samples from six locations and two additional groundwater samples beneath the former plating facility. Subsurface soil analytical results indicate concentrations of chromium (analyzed by SPLP) which exceed the CTDEP Pollutant Mobility Criteria RSR (see Attachment 2). Hexavalent chromium concentrations in groundwater exceed the CTDEP Surface Water Protection Criteria RSR (see Attachment 2) by two orders of magnitude.

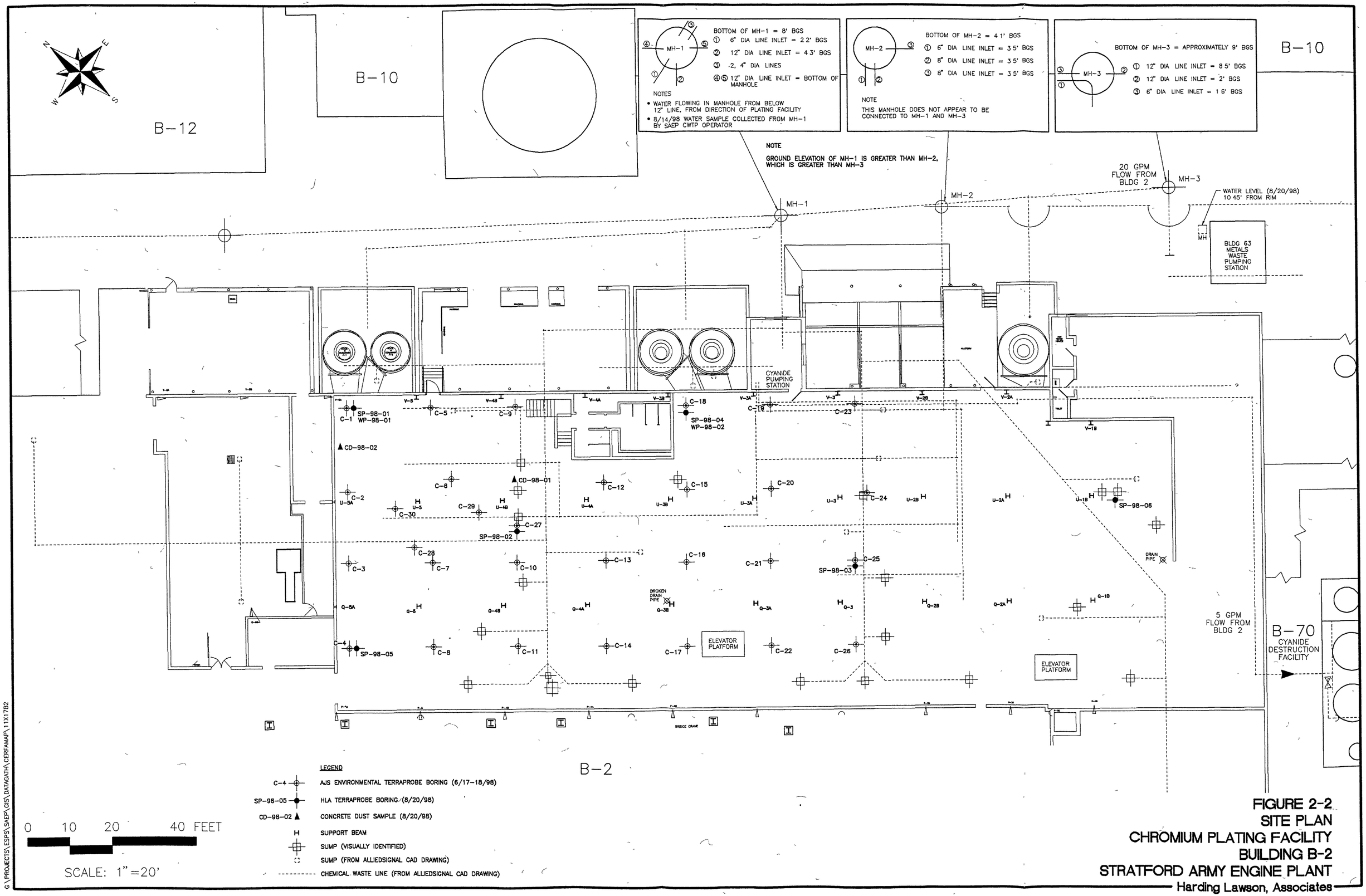


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FIGURE 2-2
SITE PLAN
CHROMIUM PLATING FACILITY
BUILDING B-2
STRATFORD ARMY ENGINE PLANT

Harding Lawson, Associates

Analytical data from AJS's and HLA's investigations and a sample location figure are presented in Attachment 2.

2.3 OTHER ACTIONS TO DATE

2.3.1 Previous Actions

As discussed in Section 2.2, subsurface soil and groundwater samples were collected at the plating facility in June and August 1998 to evaluate potential contamination of the subsurface environmental as a result of plating facility operations. Chromium was detected at concentrations exceeding CTDEP RSRs in soil and groundwater beneath the plating facility.

2.3.2 Current Actions

and/or stabilize

A time-critical removal action has been planned to remove hexavalent chromium from the subsurface environment to decrease the negative impact to groundwater. Following a pilot study, in-situ reduction (by injection of a ferrous sulfate solution) of the hexavalent chromium to the less mobile and less toxic trivalent chromium. Sampling will be performed beneath the plating facility to evaluate the effectiveness of the technology. A full-scale system will be implemented pending results of the pilot study.

2.4 STATE AND LOCAL AUTHORITIES ROLES

The U.S. Army is the lead agency for removal actions. The U.S. Army is funding and overseeing the removal action proposed in this TCRAM. USEPA Region I and the CTDEP concur with the decision to conduct a time-critical removal action and will be provided copies of this TCRAM, as well as the RAWP, to review.

3.0 THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

This section provides an overview of potential risk associated with chromium contamination beneath the plating facility. Plating facility operations have been in process since 1951, creating the potential for the release of hazardous constituents to the environment, specifically soils and groundwater, and possibly the intertidal waters of the Housatonic River. As noted in Section 2.2, soils and groundwater in the vicinity of the plating facility are contaminated.

Since the former plating operations are likely the source of chromium contamination in soils and groundwater beneath the plating facility, and since there are unacceptable concentrations of chromium in subsurface soils and groundwater, the time-critical removal action for the plating facility is justified.

3.1 PRELIMINARY REMEDIATION GOALS

This time-critical removal can best be described as a chemical transformation of hexavalent chromium by in-situ reduction. Evaluation of the success of the in-situ reduction will be performed by means of a pilot test prior to full-scale implementation of the remedy.

Following the pilot test, confirmation samples will be analyzed for total chromium, hexavalent chromium, and chromium by SPLP. Evaluation of the in-situ reduction technology will be evaluated using the confirmation data, and a decision will be made as to whether or not to implement the full-scale remedy. The potential exists that the pilot scale will not be completely effective at reducing hexavalent chromium concentrations, and that some percentage of the soils beneath the plating facility will need to be excavated and disposed of off-site.

CTDEP has established chemical-specific applicable or relevant and appropriate requirements (ARARs) for soil and groundwater. The USEPA Region I does not have chemical specific ARARs for soil or groundwater. Therefore, CTDEP ARARs will be used to guide the removal action.

3.2 REMOVAL ACTION OBJECTIVES

The objective of this time-critical removal action is to reduce concentrations of hexavalent chromium (by in-situ reduction) from the subsurface soils, and groundwater, beneath the plating facility. This will achieve the objective of removing/reducing the principal source of subsurface soil and groundwater contamination and prevent further degradation of the environment.

4.0 ENDANGERMENT EVALUATION

Actual releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this TCRAM, may present an imminent endangerment to public health, welfare, or the environment as presented in Section 3.0. Additionally, because SAEP is being handled under the Base Realignment and Closure Act (BRAC), security measures have been significantly reduced. Consequently, access to the public is not as strictly controlled as in the past, and potential human health hazards will be increased because of the likelihood of direct exposure of future workers to site contaminants. Ecological receptors are also potentially at risk, as contaminated groundwater beneath the plating facility may be discharging to the intertidal zone of the Housatonic River.

5.0 PROPOSED ACTIONS AND ESTIMATED COSTS

5.1 PROPOSED ACTIONS

5.1.1 Proposed Removal Action Description

In-situ chromium reduction is proposed for both soil and groundwater remediation at the Chromium Plating Facility. This technology involves introduction of a reducing agent (i.e., ferrous sulfate) to hexavalent chromium-contaminated soil and groundwater which reduces the chromium to it less toxic, trivalent state.

A pre-design investigation would be conducted to delineate the extent of groundwater plume and to determine concentrations in both soil and groundwater for use in reducing agent dosage calculations. In addition to chromium detected in groundwater, cadmium, copper, nickel, and zinc have been detected in the CWTP sewer line (sample MH-1). The pre-design investigation will also test for the presence of these contaminants in groundwater.

Because in-situ chromium reduction is an emerging technology, a pilot test would also be conducted to assess the effectiveness of ferrous sulfate as a reducing agent under site-specific conditions and also to determine the effectiveness of the proposed method of injection. The pilot test would be conducted in a 20 foot by 20 foot area located in the northeast corner of the Chromium Plating Facility where the some of the highest levels of chromium contamination have been observed. Ferrous sulfate solution would be injected into subsurface soil and groundwater within the test area via existing boreholes. Soil and groundwater sampling and analysis prior to initiation of the pilot test and following completion of the test will determine the effectiveness of the ferrous sulfate in reducing hexavalent chromium concentrations. Additionally, piezometers will be installed in the test area and monitored to evaluate the hydraulic distribution of ferrous sulfate solution in site soils. Evaluation of the pilot test results may require re-evaluation of the full-scale implementation and costs.

The final design will be based on the results of the pilot-test, but is anticipated to include pressurized injection of a ferrous sulfate solution through existing boreholes located approximately 20 feet on center throughout the chromium plating facility and through ten proposed injection wells located downgradient of the building. Associated equipment, including tanks, pumps, and controls, would be housed within the chromium plating facility. It is anticipated that the ferrous sulfate solution would be delivered to both the soil and groundwater in one application process. The vadose zone soils would be saturated with a ferrous sulfate solution which would then percolate into the groundwater. Subsequent applications will be based on monitoring results. Because the reducing agent and by-products produced by the reduction reaction are not toxic, nothing needs to be recovered from the subsurface. Because the reactions are virtually instantaneous once the

reducing agent is made available to contaminated soil, it is anticipated that this injection system will be in operation for one year or less.

Groundwater samples would be conducted quarterly to monitor the effectiveness of the system in reducing the hexavalent chromium to trivalent chromium and in delivering the reducing agent to all areas of the plume. A single soil sampling event would be conducted after a given period of time to confirm reduction of hexavalent chromium.

In-situ chromium reduction will not reduce concentrations of total chromium, therefore it is anticipated that an Environmental Land Use Restriction (ELUR) will be required for soils beneath the Chromium Plating Facility because concentrations of chromium (by SPLP) will remain above the PMC. The CTDEP RSRs indicate that PMCs are not applicable to environmentally isolated soils, provide an ELUR is in place that prohibits removal of the building that ensures that soils will not be exposed to infiltration (Subsection 2(C)(4)(B) of the RSRs).

5.1.2 Contributions to Remedial Performance

In-situ chromium reduction will eliminate continuing sources of hexavalent chromium contamination to soil and groundwater. This alternative can be completed in a relatively short period of time and will not require demolition of the building. Any remaining soil and/or groundwater contamination will be addressed at a later date through the CERCLA process.

5.1.3 Description of Alternative Technologies

Soil excavation and groundwater extraction and treatment were evaluated as alternative technologies for removal of chromium contamination at the Chromium Plating Facility.

As with in-situ chromium reduction, a pre-design investigation would be conducted to delineate the extent of chromium contamination in soil and groundwater.

Based on existing soil data, it is assumed that soil beneath the entire Chromium Plating Facility would be excavated to the water table (approximately 3,100 cy) due to exceedances of the PMC which would eliminate potential for continuing sources of chromium contamination to groundwater. Structural columns and walls would be supported during excavation using sheet piling and/or support cables. Confirmation samples would be collected from the sidewalls and floor of the excavation to verify that soil exceeding PMC has been removed. Excavated soil would be stockpiled at a lined and covered stockpile area on-site. Characterization samples would be collected from the stockpiles at a frequency of one sample per 100 cy of excavated soil to determine appropriate disposal. It has been assumed that 10% of excavated material would exceed TCLP criteria and would be disposed off-site as RCRA-hazardous waste, and the remaining 90% of excavated soil would be disposed off-site at a non-hazardous waste.

Additionally, it is assumed that the concrete floor material removed during excavation would be disposed off-site as a non-hazardous waste.

Chromium contamination in groundwater would be addressed with conventional extraction and treatment at the CWTP. It is assumed that five extraction wells would be installed. A combined flow of approximately 10 gallons per minute (gpm) would tie into the existing sump system. In accordance with current practices, the extracted groundwater would be held until sufficient volume exists for batch treatment at the CWTP. Groundwater monitoring and water level measurements would be conducted on a quarterly basis to assess the effectiveness of the extraction system. Influent and effluent sampling would be conducted on a monthly basis to assess the effectiveness of the treatment system and meet the requirements of a discharge permit. It is assumed that the groundwater extraction and treatment system would be in operation for 10 years.

5.1.4 Applicable or Relevant and Appropriate Requirements

The National Contingency Plan (NCP) requires that removal actions pursuant to CERCLA Section 106 attain ARARs under federal or state environmental laws or facility citing laws to the extent practicable considering the urgency of the situation and the scope of the removal. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically addresses a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. Other requirements to be considered, including advisories and guidance issued by the state or federal government, should be identified and used to confirm protection of human health and the environment if there are no specific ARARs for a chemical or site conditions or if ARARs are not deemed sufficiently protective. Other requirements to be considered do not have the status of potential ARARs because they are non-promulgated and are not legally binding. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be ARARs.

As discussed in Section 3.1, CTDEP RSRs are appropriate for this time-critical removal action evaluation, and will be incorporated into the work plan, which will be provided to the CTDEP and USEPA.

5.1.5 Project Schedule

It is anticipated that the Pre-Design Investigation and Pilot Test would be initiated by the end of September 1998 and would require approximately two weeks to complete. Based on the results of the Pilot Test, it is anticipated that a full-scale implementation could begin in November 1998 and would require one year or less to complete.

5.2 ESTIMATED COSTS

Estimated costs for the time-critical removal action of in-situ treatment is approximately $555,000. The alternative action cost of excavation and off-site disposal are estimated to be approximately $3,100,000.

6.0 CONSEQUENCES OF DELAY OR NO ACTION

If the proposed actions are delayed or not implemented, impacts to groundwater may increase (as a result of tidal fluctuations affecting the water table elevation, and/or facility flooding) and create a larger area of concern.

7.0 OUTSTANDING POLICY ISSUES

There are no outstanding policy issues for this time-critical removal action.

8.0 ENFORCEMENT

There are no enforcement issues at this site. Complete funding for this removal action is approved and provided by the U.S. Army.

9.0 RECOMMENDATION

This decision document represents the rationale for selection of the time-critical removal action for the site, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the administrative record for the site.

Conditions at the site meet the NCP Section 300.415(b)(2) criteria for a time-critical removal action; therefore, approval of the time-critical removal action is recommended. To minimize the threat of continuing releases/migration, this time critical removal action will be implemented by December 1, 1998.

10.0 PUBLIC PARTICIPATION

This TCRAM will be placed in the administrative record for SAEP within 60 days of initiation of field activities. The public will have an opportunity to review the scope of this removal action at that time.

LIST OF ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
AJS	AJS Environmental Services, Inc.
ARARs	Applicable or Relevant and Appropriate Requirements
BRAC	Base Realignment and Closure Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CTDEP	Connecticut Department of Environmental Protection
CWTP	Chemical Waste Treatment Plant
cy	cubic yards
ELUR	Environmental Land Use Restriction
gpm	gallons per minute
HLA	Harding Lawson Associates
NCP	National Contingency Plan
PMC	Pollutant Mobility Criteria
RAWP	Removal Action Work Plan
RI/FS	Remedial Investigation/Feasibility Study
RSRs	Remediation Standard Regulations
SAEP	Stratford Army Engine Plant
SARA	Superfund Amendments and Reauthorization Act of 1986
TCRAM	Time-critical Removal Action Memorandum
USEPA	United States Environmental Protection Agency

REFERENCES

ABB Environmental Services, Inc. (ABB-ES), 1996. Draft Environmental Baseline Survey Report. Prepared for United States Army Environmental Center. December 1995.

Idaho National Engineering Laboratory (INEL), 1991. Informal Report Phase III Stratford Army Engine Plant Process Optimization Survey (Draft). Prepared for United States Army Material Command.

U.S. Environmental Protection Agency (USEPA), 1990. *Superfund Removal Procedures Action Memorandum Guidance*. Office of Emergency and Remedial Response. December 1990. EPA/540/P-90/004.

ATTACHMENT 1

Phase I Work Plan

Harding Lawson Associates

August 18, 1998

Dr. John Fleming
AlliedSignal Engines
Stratford Army Engine Plant
550 Main Street
Stratford, CT 06615

SUBJECT: Work Plan for Phase I of the Chromium Plating Facility Remediation at Stratford Army Engine Plant, Stratford, CT

Dear Dr. Fleming,

This letter serves as Harding Lawson Associates' (HLA) Work Plan for Phase I of the Chromium Plating Facility Remediation at the Stratford Army Engine Plant (SAEP) in Stratford, CT. The elements of Phase I are based on a Draft Statement of Work received from John Burleson, BRAC Environmental Coordinator for SAEP.

Phase I consists of the Remedy Development and includes the following major elements:

1. Determination of the need for additional data required for remedy development (review adequacy of existing 6/24 and 7/7/98 AJS Environmental data);
2. Perform additional sampling, not to exceed 8 samples, as necessary;
3. Develop at least two remedial alternatives analyses with associated costs that are cost effective and consistent with Connecticut Department of Environmental Protection (CTDEP Remediation Standard Regulations (RSRs);
4. Prepare a proposed plan based on remedy recommendation that is protective and cost effective (focus should be on minimum amount of deconstruction required to accomplish containment).

Phase II will involve design and implementation of the remedial action. The following subsections describe the four elements of the Phase I work in greater detail. A schedule is attached which includes proposed dates for Phase I milestones.

Item 1 - Data Review

Review of the data collected by AJS Environmental in June and July 1998 indicates soil contamination by total chromium exists beneath the floor slab of the facility at concentrations up to 2460 parts per million (ppm). Of the 48 samples analyzed for total chromium, 6 of the samples were also analyzed for total chromium by TCLP, 6 were analyzed for total cyanide, and 6 were analyzed for reactive cyanide. No samples have been analyzed for chromium VI or for the CTDEP SPLP method. The CTDEP RSRs for chromium are as follows:

- Industrial/Commercial Direct Exposure Criteria (I/C DEC) for Soils
  Chromium III - 51,000 ppm
  Chromium VI - 100 ppm
- GB Pollutant Mobility Criteria (requires TCLP or SPLP analyses)
  Total Chromium - 0.5 ppm

Although the existing data defines chromium contamination in the soils beneath the floor slab, there is a need for additional chromium speciation data to establish comparisons to CTDEP RSRs, and to assist in evaluation of remedial alternatives.

Item 2 - Additional Sampling

A GeoProbe will be used to collect soil samples at 6 locations within the Chromium Plating Facility. Sampling locations will be adjacent to AJS Environmental samples C-1, C-4, C-18, C-25, C-27, and in one location in the southwestern end of the plating room outside of the AJS Environmental sampling grid. Up to 2 soil samples will be collected from each location at intervals from 0 to 4 feet and 4 to 8 feet beneath the concrete slab. All soil samples will be analyzed for total chromium and chromium VI; in addition, shallow soil samples will be analyzed for manganese, nickel, total cyanide, total organic carbon, pH, total chromium by SPLP, and cyanide by SPLP.

Two groundwater samples will be collected: one adjacent to AJS Environmental sample C-1, and the other from existing monitoring well ECD-4, located outside the plating facility. The unfiltered groundwater samples will be analyzed for total chromium, chromium VI, nickel, cyanide, sulfate, ferrous iron, and total iron.

Item 3 - Develop Remedial Alternatives and Associated Costs

At the time of preparation of this Work Plan, HLA is considering two remedial alternatives for the Chromium Plating Facility: excavation and off-site disposal, and in-situ chromium reduction using a ferrous sulfate solution. These remedial alternatives will be further researched and costed to allow SAEP, AlliedSignal, and the regulatory authorities to make a decision on the most cost effective remedial option.

Item 4 - Prepare a Proposed Plan

Based on comments from the remedial alternatives presented in Item 3, HLA will prepare a proposed plan based on a remedy recommendation that is protective and cost effective. The proposed plan will be in the format of a time-critical Action Memorandum per U.S. Environmental Protection Agency publication number EPA/540/P-90/004, OSWER Directive 9360.3-01, December 1990.

Proposed Schedule

Date	Action
8/19/98	Mobilize to SAEP for additional sampling
8/20/98	Collect additional soil and groundwater samples
8/28/98	Ship Draft Remedial Alternatives and Associated Costs to SAEP/AlliedSignal
9/18/98	Ship Draft Action Memorandum to SAEP/AlliedSignal

Please call me at (207) 775-5401 with any concerns or questions you have regarding this Work Plan.

Sincerely,

HARDING LAWSON ASSOCIATES

Nelson Walter, P.E.
Project Manager

cc: J. Burleson - SAEP
G Briggs - SAEP
J Frye - USACE-NY
R. Pendleton - HLA

ATTACHMENT 2

Analytical Data
Through August 1998

SOIL - Comp to RSRs

Locate_ID	Samp_Int	Units	Total Chromiun	Hexavalent Chromium	Total Cyanide	Reactive Cyanide	Manganese	Nickel	TOC	PH
SOIL ANALYTICAL RESULTS										
C-1	1	MGKG	2460							5.9
C-1	1	MGKG			0.144 U	5 U				
C-1	7	MGKG	2218							6 2
C-10	1	MGKG	176							7 3
C-10	7	MGKG	6 6							6 9
C-11	1	MGKG	8.31							8 1
C-11	7	MGKG	5							7 4
C-11	7	MGKG			0.144 U	5 U				
C-12	1	MGKG	17 1							8 5
C-13	1	MGKG	90							7.1
C-13	7	MGKG	7.4							6 5
C-13	7	MGKG			0 144 U	5 U				
C-14	1	MGKG	6 93							6 4
C-14	7	MGKG	4 82							6 5
C-15	1	MGKG	12 1							8 1
C-16	1	MGKG	59							8 3
C-17	1	MGKG	33							6 5
C-18	1	MGKG	360							6 7
C-18	7	MGKG	576							5 7
C-18	7	MGKG			0 579	5 U				
C-19	1	MGKG	16							9 7
C-2	1	MGKG	196							7 5
C-2	7	MGKG	51							6.1
C-20	1	MGKG	6							9 7
C-20	7	MGKG	12							7
C-21	1	MGKG	26 4							7 9
C-22	1	MGKG	24							7 7
C-23	1	MGKG	14 2							9 9
C-23	7	MGKG	7 61							8 1
C-23	7	MGKG			0 144 U	5 U				
C-24	1	MGKG	42 4							8
C-25	1	MGKG	1245							6 9
C-26	1	MGKG	781							6 8
C-26	7	MGKG	121							6 3
C-27	1	MGKG	1917							5 2
C-27	7	MGKG	180							6 9
C-27	7	MGKG			0 144 U	5 U				
C-28	1	MGKG	12.7							7
C-28	7	MGKG	33 1							8 4
C-29	1	MGKG	29.3							6 3
C-29	7	MGKG	45 4							6 9
C-3	1	MGKG	70 4							8.1
C-3	7	MGKG	114							5 3
C-30	1	MGKG	76.3							8
C-30	7	MGKG	160							6 5
C-4	1	MGKG	362							6
C-4	7	MGKG	4 44							6
C-5	1	MGKG	135							6 9
C-5	7	MGKG	56							5 8

SOIL - Comp. to RSRs

Locate_ID	Samp_Int	Units	Total Chromiun		Hexavalent Chromium		Total Cyanide		Reactive Cyanide	Manganese	Nickel		TOC		PH
C-6	1	MGKG	25												6.4
C-7	1	MGKG	22.4												8.1
C-8	1	MGKG	3.43												6.2
C-9	1	MGKG	118												6.2
C-9	7	MGKG	106												6.1
SP-98-01	0	MGKG	705		1.1	U	0.55	U		174	8.4		110	U	
SP-98-01	7	MGKG	586		80.4										
SP-98-02	0	MGKG	279		72.7		0.55	U		156	6.9		110	U	
SP-98-02	7	MGKG	162		35.7										
SP-98-03	0	MGKG	910		3.7		230			152	4.6	U	120	U	
SP-98-03	7	MGKG	1380		59.2										
SP-98-04	0	MGKG	46.8		8.9		0.55	U		234	71.8		140		
SP-98-04	7	MGKG	252		41.9										
SP-98-05	0	MGKG	1380		11.9		0.55	U		215	29.9		110	U	
SP-98-05	7	MGKG	15.3		5.9										
SP-98-06	0	MGKG	574		1.6		19			123	223		120	U	
SP-98-06	7	MGKG	6.6		1.2	U									
SOIL TCLP/SPLP ANALYTICAL RESULTS															
C-1	1	MGL	9.3												
C-11	7	MGL	0.06	U											
C-13	7	MGL	0.06	U											
C-18	7	MGL	0.5												
C-23	7	MGL	0.06	U											
C-27	7	MGL	0.21												
SP-98-01	0	MGL	7.3				0.01	U							
SP-98-02	0	MGL	3.7				0.01	U							
SP-98-03	0	MGL	1.1				0.01	U							
SP-98-04	0	MGL	0.1	U			0.01	U							
SP-98-05	0	MGL	21.8				0.01	U							
SP-98-06	0	MGL	0.2				0.01	U							

Note: Shaded boxes indicate exceedances of CTDEP RSRs

CTDEP RSRs

Direct Exposure Criteria for Soil (Industrial/Commercial):

Total Chromium	no criteria
Trivalent Chromium	51,000 mg/kg
Hexavalent Chromium	100 mg/kg
Total Cyanide	41,000 mg/kg
Manganese	no criteria
Nickel	7,500 mg/kg

GB Pollutant Mobility Criteria for Soil (by TCLP/SPLP):

Total Chromium	0.5 mg/L
Total Cyanide	2.0 mg/L

GROUNDWATER - Comp. to RSRs

Locate_ID	Samp_Int	Units	Cadmium	Copper	Chromium	Hexavalent Chromium	Cyanide	Reactive Cyanide	Total Iron	Ferrous Iron	Nickel	Sulfate	Zinc
WATER ANALYTICAL RESULTS													
MH-1	1	MGL	0.03	1.52	10.7				21.6		1.64		0.44
WP-98-01	1	MGL			5.2	10.4	0.01 U		4.4	0.05 U	0.04 U	37	
WP-98-02	1	MGL			0.026	0.02 U	0.01 U		0.05 U	0.05 U	0.04 U	43	

Note: Shaded boxes indicate exceedances of CTDEP Surface Water Protection Criteria

Sample MH-1 was collected by AlliedSignal inside the CWTP sewer line, and is not necessarily representative of groundwater chemistry conditions.

CTDEP RSRs

Surface Water Protection Criteria:

Cadmium	0.006 mg/L
Copper	0.48 mg/L
Total Chromium	no criteria
Trivalent Chromium	1.2 mg/L
Hexavalent Chromium	0.11 mg/L
Cyanide	0.052 mg/L
Total Iron	no criteria
Nickel	0.88 mg/L
Sulfate	no criteria
Zinc	0.123 mg/L

Groundwater Protection Criteria for GB Aquifer (not applicable):

Cadmium	0.005 mg/L
Copper	1.3 mg/L
Total Chromium	0.05 mg/L
Trivalent Chromium	no criteria
Hexavalent Chromium	no criteria
Cyanide	0.2 mg/L
Total Iron	no criteria
Nickel	0.1 mg/L
Sulfate	no criteria
Zinc	5.0 mg/L

B-12

B-10

B-10

MH-1

BOTTOM OF MH-1 = 8' BGS
① 6" DIA. LINE INLET = 2.2' BGS
② 12" DIA. LINE INLET = 4.3' BGS
③ 2, 4" DIA. LINES
④⑤ 12" DIA. LINE INLET = BOTTOM OF MANHOLE

NOTES:
- WATER FLOWING IN MANHOLE FROM BELOW 12" LINE, FROM DIRECTION OF PLATING FACILITY
- 8/14/98 WATER SAMPLE COLLECTED FROM MH-1 BY SAEP CWTP OPERATOR

MH-2

BOTTOM OF MH-2 = 4.1' BGS
① 6" DIA. LINE INLET = 3.5' BGS
② 8" DIA. LINE INLET = 3.5' BGS
③ 8" DIA. LINE INLET = 3.5' BGS

NOTE:
THIS MANHOLE DOES NOT APPEAR TO BE CONNECTED TO MH-1 AND MH-3

MH-3

BOTTOM OF MH-3 = APPROXIMATELY 9' BGS
① 12" DIA. LINE INLET = 8.5' BGS
② 12" DIA. LINE INLET = 2' BGS
③ 6" DIA. LINE INLET = 1.6' BGS

B-10

MH-1	
Chromium	10.7 mg/L
Cadmium	0.03 mg/L
Copper	1.52 mg/L
Nickel	1.64 mg/L
Zinc	0.44 mg/L

NOTE:

GROUND ELEVATION OF MH-1 IS GREATER THAN MH-2, WHICH IS GREATER THAN MH-3.

20 GPM FLOW FROM BLDG 2

WATER LEVEL (8/20/98) 10.45' FROM RIM

MH

BLDG 63 METALS WASTE PUMPING STATION

WP-98-01	
Chromium	5.2 mg/L
Hexavalent Chromium	10.4 mg/L

SP-98-01	0 Feet
Chromium (SPLP)	7.3 mg/L

C-1	1 Foot
Chromium (TCLP)	9.3 mg/L

C-18	1 Foot
Chromium (TCLP)	0.5 mg/L

SP-98-02	0 Feet
Chromium (SPLP)	3.7 mg/L

SP-98-03	0 Feet
Chromium (SPLP)	1.1 mg/L

SP-98-05	0 Feet
Chromium (SPLP)	21.8 mg/L

CYANIDE PUMPING STATION

ELEVATOR PLATFORM

ELEVATOR PLATFORM

BROKEN DRAIN PIPE

DRAIN PIPE

5 GPM FLOW FROM BLDG 2

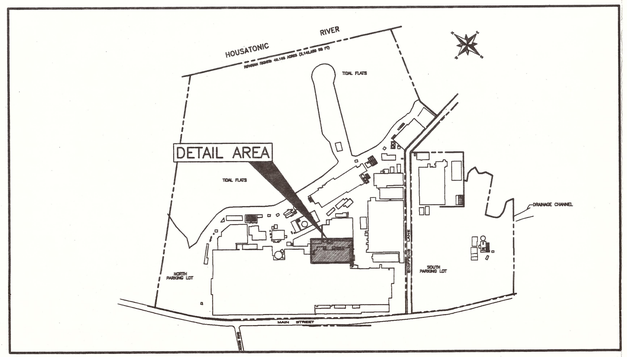
B-70 CYANIDE DESTRUCTION FACILITY

BRIDGE CRANE

B-2

LEGEND

- C-4 — AJS ENVIRONMENTAL TERRAPROBE BORING (6/17-18/98)
- SP-98-05 — HLA TERRAPROBE BORING (8/20/98)
- CD-98-02 — CONCRETE DUST SAMPLE (8/20/98)
- H — SUPPORT BEAM
- SUMP (VISUALLY IDENTIFIED)
- SUMP (FROM ALLIEDSIGNAL CAD DRAWING)
- CHEMICAL WASTE LINE (FROM ALLIEDSIGNAL CAD DRAWING)



0 5 10 20 FEET

SCALE: 1"=10'

FIGURE 1
EXCEEDANCES OF CTDEP RSRs
CHROMIUM PLATING FACILITY
BUILDING B-2
STRATFORD ARMY ENGINE PLANT

Harding Lawson, Associates