

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
SUPERFUND STANDBY CONTRACT

BECKER ELECTRONICS MANUFACTURING SITE
EAST DURHAM, NEW YORK

WORK ASSIGNMENT NO. D002472-15

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DETAILED WORK PLAN

JUNE 1994

ABB Environmental Services

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BECKER ELECTRONICS MANUFACTURING
EAST DURHAM, NEW YORK

SITE NO. 4-20-007

Submitted to:

New York State Department of Environmental Conservation
Albany, New York

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June 1994

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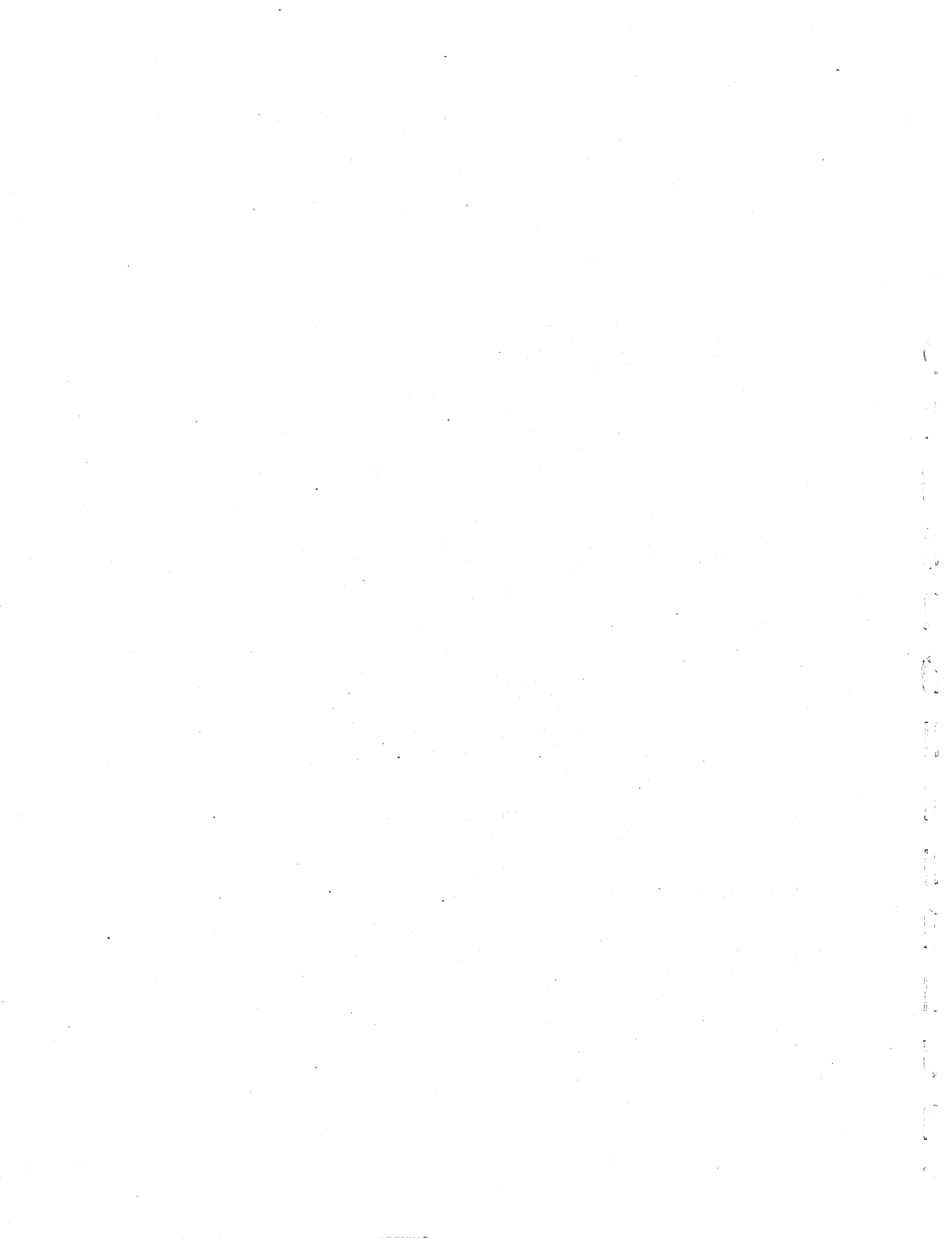


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BECKER ELECTRONICS MANUFACTURING SITE
 REMEDIAL INVESTIGATION/FEASIBILITY STUDY
 DETAILED WORK PLAN

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1.0 INTRODUCTION

ABB Environmental Services (ABB-ES), under contract to New York State Department of Environmental Conservation (NYSDEC), is submitting this Detailed Work Plan for completion of the Remedial Investigation/Feasibility Study (RI/FS) of the Becker Electronics Manufacturing Corporation site (hereinafter, Becker) in East Durham, Greene County, New York. Becker is listed as a Class 2 hazardous waste site, No. 4-20-007, in the Registry of Hazardous Waste Sites in New York State. This Detailed Work Plan has been prepared in accordance with the requirements of NYSDEC as identified in Work Assignment (WA) No. D002472-15, dated November 24, 1993, under the New York State Superfund Standby Contract Supplemental Agreement No. One.

The RI and FS for the Becker site are being conducted using a phased approach in accordance with the guidelines in the Superfund Amendment and Reauthorization Act (SARA) and New York State regulations (United States Environmental protection Agency [USEPA], 1988 and NYSDEC, 1990). This approach integrates the RI and other field investigations and risk assessment (RA) with the screening and evaluation of alternatives performed during the FS. In particular, Phase I RI and Phase I and Phase II FS activities have been completed to date (Metcalf and Eddy, Inc. [M&E], 1992a, 1992b, 1992c, and 1992d). This Detailed Work Plan presents a technical scope of work, as well as an estimated level of effort and schedule for completing Phase II RI and Phase II FS activities and preparing the final RI and FS reports.

The objectives of the Phase II RI are to determine the nature and distribution of contamination associated with site source areas and groundwater, and to revise assessment of potential threats to human health and the environment presented by the release of hazardous substances from the Becker site. The objectives of the FS are to evaluate potential remedial alternatives from an engineering, environmental, public health, and economic perspective and to develop a preferred alternative based on that evaluation. This Detailed Work Plan presents the current understanding of the problems at the site.

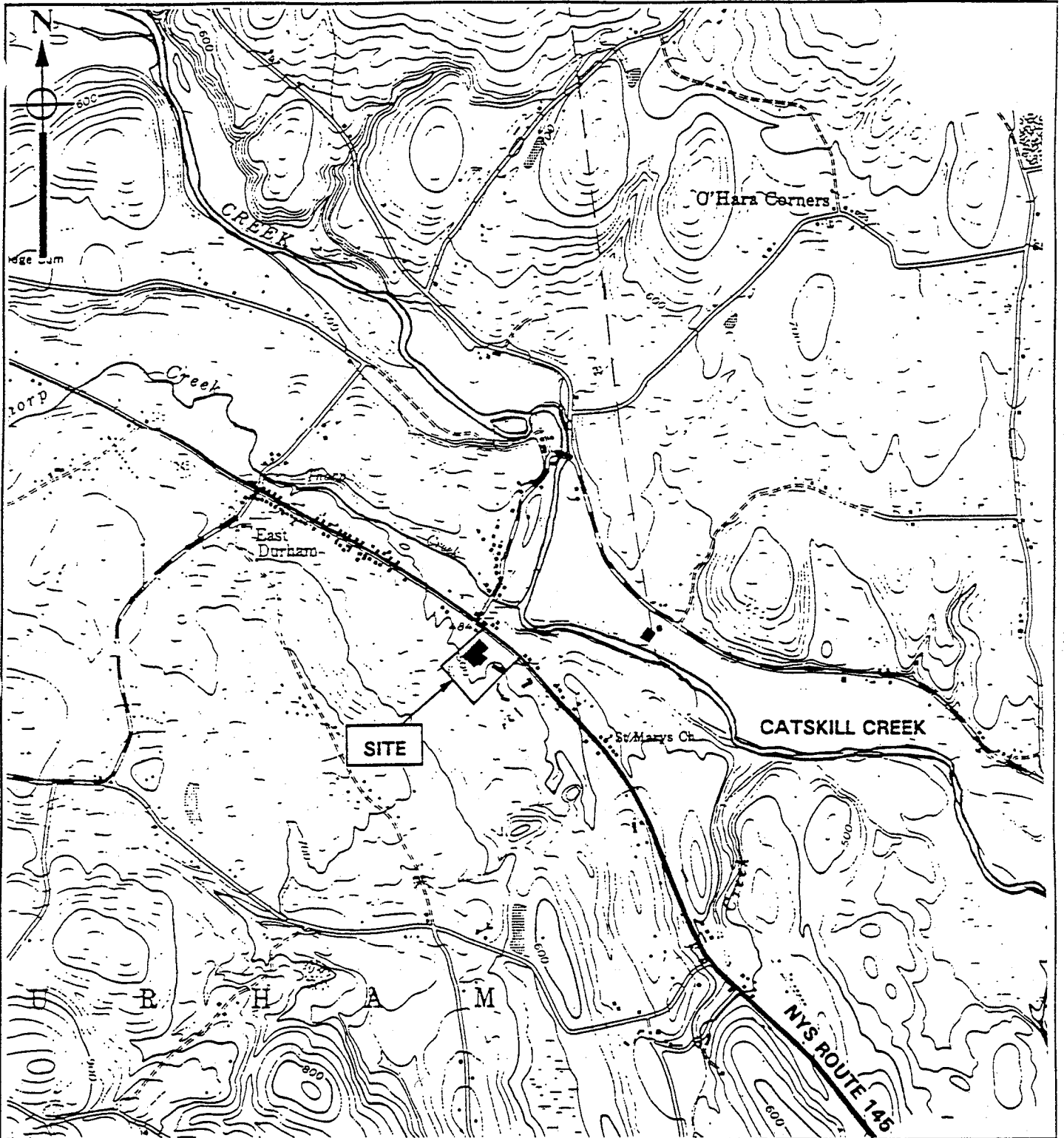
This Detailed Work Plan is organized into six (6) sections. Section 1.0 consists of a review of existing site information and presents a conceptual model of the site. Section 2.0 details the work to be performed to complete the work assignment:

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(1) Task 2 - Phase I and Phase II FS Review; (2) Task 3 - Phase II (Post Screening) RI Activities; (3) Task 4 - Phase III FS Report Preparation; (4) Task 5 - Community Relations Support; and (5) Task 6 - Final RI/FS Report Preparation. Section 3.0 presents the baseline schedule to complete the work assignment. Section 4.0 presents ABB-ES' staffing plan and responsibilities of key staff positions. Section 5.0 presents the subcontract development plan to procure drilling, geophysical, survey, and analytical laboratory services. The budget to complete the work assignment is detailed in Section 6.0. The Detailed Work Plan is supplemented by Appendices bound to the end of the document: (1) Appendix A - List of Cost Schedules; (2) Appendix B - Quality Assurance Project Plan (QAPjP); and (3) Appendix C - Health and Safety Plan (HASP).

1.1 PRELIMINARY REVIEWS OF EXISTING DOCUMENTS AND DATA

The Becker site is located on Route 145 in East Durham, Greene County, New York (Figure 1-1), and produced high fidelity speakers and speaker components before declaring bankruptcy and closing in 1988. Since 1980, various studies have identified groundwater contamination at the Becker site, specifically industrial solvents



SOURCE: METCALF & EDDY (1992C).



NEW YORK

QUADRANGLE LOCATION



SCALE IN FEET

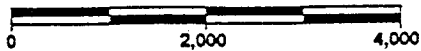


FIGURE 1-1
SITE LOCATION MAP
BECKER ELECTRONICS
DURHAM, NEW YORK

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(primarily 1,1,1-trichloroethane [TCA]) used in the company's manufacturing operations. Area homes and businesses now use carbon filtration systems because of contaminated private water supplies.

NYSDEC and the New York State Department of Health (NYSDOH) and private consultants previously investigated the Becker site. NYSDEC and its contractors performed RI/FS and Interim Remedial Measure (IRM) activities. Subsection 1.1 presents chronological summary of the activities completed to date. ABB-ES obtained the existing documents and data forming the basis of this section during a review of the NYSDEC and NYSDOH files on December 8, 1993.

1.2 PREVIOUS INVESTIGATIONS

The following chronology summarizes previous investigations and other historical information related to the Becker site. ABB-ES personnel reviewed these documents and information to prepare a scope of work in response to the Phase II RI/FS work assignment. Locations of previous sampling locations and existing site features are shown on Figure 1-2.

Industrial Waste Study for Becker Electronics Manufacturing Corporation (Brinnier and Larios, 1981). Documents the source and disposal of industrial wastewater at the site, and summarizes environmental sampling results from 1980 and 1981. Recommends improvements to the industrial wastewater treatment process and cleanup of contamination.

NYSDOH File - Water Supply Well Data from Vicinity of Becker Electronics Site - 1981 to Present. Documents concentrations of groundwater contaminants at water supply well/receptor locations.

Map Titled "Location of Proposed Monitoring Wells" (Dunn Geoscience, 1982a). Shows proposed locations for monitoring wells, locations of existing Becker water supply wells number (no.) 1, no. 2, and no. 3, and location of industrial leachfield.

Map Titled "Approximate Location of 1,1,1-TCA Sources" (Dunn Geoscience, 1982b). Shows locations of Becker water supply wells, septic tanks, and leachfields.

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Figure 1-2 Existing and Proposed Exploration Locations

(see figure in pocket at back of document)

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Map Titled "Selected Water Sampling Points and Concentrations of 1,1,1-TCA" (Dunn Geoscience, 1982c). Shows results of 1,1,1-TCA analysis of leachfield, septic tank, and Becker water supply well samples.

Interim Report - Hydrogeologic Investigation Preliminary Findings For Becker Electronics (Dunn Geoscience, 1983). Documents results of preliminary sampling and geologic characterization performed by Dunn Geoscience. Indicates on-site bedrock fracture sets trend North 40 degrees East and North 95 degrees East, and illustrates the interpreted extent of groundwater contamination exceeding 50 micrograms per liter ($\mu\text{g/L}$) of 1,1,1-TCA. Indicates spilling and burning of wastes occurred on the ground surface on the north side of the Becker manufacturing building and via the industrial leachfield. Includes a summary of detected 1,1,1-TCA concentrations from on- and off-site sampling points.

NYSDEC State Pollutant Discharge Elimination System (SPDES) Permit - Becker Electronics Manufacturing Site (NYSDEC, 1984). Presents sanitary and industrial waste leachfields discharge permit requirements and accompanying site detail map.

Proposal for Groundwater Contamination Assessment and Remediation Program for Becker Electronics Manufacturing Corporation (Bagdon Environmental Associates, 1986). Prepared for Becker. Summarizes the existing groundwater problem, and notes that fluctuations in 1,1,1-TCA and dichloroethane (DCA) concentrations occur seasonally, with the highest concentrations in water supply wells occurring in the winter when usage is lowest. Recommends a pump test of the Becker no. 2 water supply well, installation of a pump-and-treat system, and remediation of the septic systems and soil.

Becker Electronics Manufacturing Corporation - Well no. 2 Pump Test Report (Bagdon Environmental Associates, 1987). Details step-drawdown and three-day constant-rate pump test results for the Becker no. 2 water supply well performed in 1987. Estimates a transmissivity of between 2,000 and 5,000 gallons per day (gpd)/foot with a maximum pumping rate of 20 to 30 gallons per minute (gpm). Predicts the cone of depression created by pumping this well to be elongated preferential to one of the joint sets identified by Dunn Geoscience.

Hydrogeologic Evaluation of Proposed Remedial Options at the Becker Electronics Site as Related to Human Exposure to a Contaminated Drinking Water Supply (P.A. Rubin, 1987). Provides a detailed review of the Bagdon Associates pump test.

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Concludes that the pump test was poorly designed and did not provide representative data from which to assess the aquifer characteristics, and recommends another pump test.

Affidavit in Support of Motion for Summary Judgment (State of New York against Becker Electronics Manufacturing Corporation, 1990 - draft). Details a summary of the studies performed to date, with evidence that contamination at the adjacent Weldon House (a resort hotel) originated from the industrial leachfield. Concludes that groundwater contamination will continue as long as sources remain. Recommends an RI/FS to assess the areal extent of contamination. Includes a summary of groundwater data from 1980 to 1988, a summary of on-site surface water and septic system data from 1981 to 1987, and private water supply well data from 1980 to 1989.

Citizen Participation Plan for Becker Electronics Manufacturing Site (NYSDEC Division of Hazardous Waste Remediation, 1992a). Encourages communication between the NYSDEC and the community during the RI/FS process for the site. Summarizes the site history, noting that Becker declared bankruptcy in 1988, and outlines the RI/FS process for the site to be performed by a NYSDEC Superfund standby consultant.

Interim Remedial Measure - Evaluation of Water Treatment Systems for Weldon House (M&E, 1992b). Details assessment of the water treatment system used at the Weldon House and recommends changes to the system.

Remedial Investigation Report (M&E, 1992c). Describes the activities and results of the first phase of the RI. Provides an initial determination regarding the location and characterization of sources of contamination and begins defining migration pathways, extent of contamination, and exposed populations. Confirms that residual volatile organic compound (VOC) contamination remains in the septic systems on-site, in soil at the chemical storage building, and in groundwater throughout the site. Presents transmissivity values calculated from pump test data between 4,000 gpd/foot and 5,000 gpd/foot. Shows on-site bedrock outcrops joint sets trend North 30 degrees East and North 60 degrees West, expressed as the observed bend in nearby Catskill Creek.

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As part of Task 1 of the work assignment, ABB-ES was tasked to perform a detailed review of the existing data, including existing pump test data collected during the Phase I RI. ABB-ES' review of the Phase I pump test has identified the following:

- Equilibrium was not reached between the step drawdown and constant rate pumping tests.
- The transducers were not placed optimally to obtain complete data sets.
- The observation wells used to observe drawdown were not in the best locations. Additional wells to the southwest, north, and east would provide more information on the effects of pumping.

Although the data are adequate to calculate transmissivity and storativity, they are not adequate for final design of a groundwater extraction remedial alternative. Should groundwater extraction be selected as part of a remedial measure, an additional pumping test(s) would be necessary as part of remedial design.

Baseline Human Health Risk Assessment and Environmental Risk Assessment (M&E, 1992a). Identifies potential carcinogenic and noncarcinogenic risks associated with source and groundwater contamination. Compares site contaminants in sediment and surface water samples to the NYSDEC Class C surface water standards and sediment cleanup criteria. Recommends that the second phase RI clarify the extent of off-site contamination of surface water and sediment, and identify significant aquatic or wildlife populations potentially exposed to contamination.

Phase I and Phase II Feasibility Study Report (M&E, 1992d). Discusses and identifies remedial technologies for site groundwater and other site media that may require remediation. Remedial alternatives are developed for site bedrock groundwater only.

Subsurface Investigation (Environmental Products and Services, Inc. [EPS], 1992). Documents a post-IRM investigation of shallow groundwater at the location of a former aboveground waste oil tank where surface spills occurred. Identifies shallow groundwater solvent contamination throughout the vicinity of the truck loading docks and chemical storage building, but no significant groundwater contamination

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associated with the former tank location. IRM activities completed at the site are summarized in Subsection 1.3.

Analytical Report for Becker Site (NYSDEC, 1992b; unpublished). Documents results of the NYSDEC background soil sampling.

Mobile Laboratory Submission (NYSDEC, 1993; unpublished). Documents results of surface soil polychlorinated biphenyl (PCB) screening and surface water and sediment VOC analyses. Shows the site does not have significant PCB contamination, and that VOC contamination currently does not appear to migrate off site via surface water and sediment transport.

1.3 SITE RECONNAISSANCE

On December 9, 1993, ABB-ES personnel performed a site reconnaissance with the NYSDEC representatives (Mr. John Stawski, Mr. Bob Edwards, and Mr. Russ Shaver) and a NYSDOH representative (Mr. Rich Fedigan) to familiarize ABB-ES with the location, perform a walk-through of the buildings to look for potential data gaps in the RI, and observe the condition of a large debris pile. During the reconnaissance, ABB-ES and NYSDEC discussed the proposed work assignment scope and possible modifications. In addition, Russ Shaver of NYSDEC Region 4 reviewed the IRMs completed as on-site source control actions by NYSDEC. The IRMs consisted of the following actions:

- Five underground structures (septic tanks and pump stations) associated with all three site septic systems were pumped out and steam cleaned. The structures were either backfilled with soil or removed.
- Soil from leach field No. 1 was excavated and placed on plastic sheeting adjacent to the gravel parking area near the site gate. The soil was tested for disposal parameters (e.g., full Toxicity Characteristic Leaching Procedure [TCLP], PCBs, pH, cyanide, flashpoint, reactivity, and sulfide analyses). As the laboratory results were non-detect, the soil was spread out at that location.

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- At the oil/water separator (septic tank) for the industrial waste septic system, the tank and some soil was excavated. The tank and soil remain on-site.
- An above ground waste oil tank and contaminated soil were removed from the back of the warehouse/truck maintenance building.
- A 5,000 gallon underground storage tank (UST) (fuel oil) was removed from the south side of the manufacturing building.
- A 5,000 gallon UST (fuel oil) was identified beneath the northeast portion of the manufacturing building foundation. The UST was cleaned in place and backfilled with cement grout.
- Approximately 90 drums of flammable corrosive waste were removed from the chemical storage building and other portions of the site for disposal.
- A chain link fence was erected across the east side of the site facing Route 145 to restrict access. At a later time, a chain and posts were placed at a dirt access road on the west side of the site. Some building doors have been nailed or bolted shut. These security actions were performed due to evidence of building break-ins and vandalism.

1.4 SITE GEOLOGY

Based on information in the Phase I RI and the IRM report (M&E, 1992d; EPS, 1992), a thin layer of overburden or fill overlays bedrock. The overburden is composed of brown to red silt and fine to coarse sand with varying amounts of gravel. Natural overburden at the site is mapped as a till (U.S. Geological Survey [USGS], 1987). Overburden/fill is as much as 17 feet thick. Up to several feet of weathered bedrock overlies competent bedrock. Competent bedrock consists of a closely fractured shale unit ranging from grey-green to red-brown in color. The shale unit dips in a northeasterly direction toward Catskill Creek. The bedrock consists of the Plattekill Formation (shale) and the Ashokan Formation (underlying sandstone), which are Middle Devonian in age. These formations can be highly fractured at 90 degree angles and are often seen as structurally controlling factors for

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Catskill Creek (USGS, 1970). The joint sets in the shale were measured in Phase I to trend North 30 degrees East and North 60 degrees West (M&E, 1992d).

Groundwater is commonly encountered 3 to 10 feet below ground surface (bgs) in the overburden and 7 to 10 feet bgs in bedrock (M&E, 1992d). The ditches draining the site likely intercept the shallow water table. Groundwater flow at the site appears to vary with location and fracture orientation, but overall flows toward Catskill Creek.

1.5 CONCEPTUAL MODEL

Based on previous investigations and data, and site geology, ABB-ES developed the following conceptual model of the site:

- Becker appears to have released solvents to the environment through various means, including (1) discharge to on-site sanitary waste and industrial waste septic systems, (2) spills at the chemical storage building, and (3) disposal on the ground surface and on debris piles. The primary solvent released at the site was 1,1,1-TCA, and secondarily trichloroethene (TCE) and tetrachloroethene. Degradation products of the solvents (1,1-DCA, 1,1-dichloroethene [DCE], and chloroethane) are present in site media. The debris piles reportedly contain buried containers of liquid waste (55-gallon drums of xylenes).
- Once released to the thin overburden on the site via leachfields or surface spills, the solvents migrated directly to groundwater. Groundwater at the site is located in both overburden and bedrock. Shallow groundwater (in overburden) discharges downward into bedrock and laterally into site drainage ditches. Bedrock groundwater flow is fracture-dominated, with the dominant fracture sets oriented northeast and northwest. A northeast-southwest trending fault may cross the site's southeastern boundary as evidenced from the morphology of Catskill Creek near the site.
- Possible dense, non-aqueous phase liquid may be present in bedrock, based on a one-time reported detection of 72 milligrams per liter (mg/L) of 1,1,1-TCA in a water supply well immediately south of the

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site (at a location potentially downgradient of the industrial leachfield and debris pile); a one-time reported detection of 27 mg/L of 1,1,1-TCA in an on-site water supply well; and historical information that small quantities of waste 1,1,1-TCA were disposed of on the ground surface at the sanitary waste septic system no. 3 and potentially at septic system no. 2, and the debris pile area. Other site contaminants detected during the Phase I RI include 1,4-dichlorobenzene, methyl ethyl ketone (or 2-butanone), phthalates, polynuclear aromatic hydrocarbons, and metals.

- Contaminated groundwater migrating from the site moves southeast and northeast along fracture zones in the bedrock toward Catskill Creek. Along these flow paths, contaminated groundwater is intercepted by several water supply wells. Pumping water supply wells likely cause seasonal changes in bedrock groundwater flow directions. Water supply wells capturing contaminated groundwater from the site have been sampled by the NYSDOH since 1981. Sampling shows that groundwater intercepted by these wells contains 1,1,-DCE (up to 65 $\mu\text{g/L}$); 1,1-DCA (up to 580 $\mu\text{g/L}$); trans-1,2-DCE (up to 8 $\mu\text{g/L}$); TCE (up to 18 $\mu\text{g/L}$); chloroethane (up to 10 $\mu\text{g/L}$); and 1,1,1-TCA (up to 310 $\mu\text{g/L}$). Groundwater extracted from these supply wells is treated with granular activated carbon systems, which have been shown by the NYSDOH to sufficiently remove the contaminants to non-detectable levels.
- Ultimately, contaminated surface water and groundwater discharging to Catskill Creek is diluted to non-detectable levels. Phase I RI sampling shows surface water in on-site ditches to contain up to 12 $\mu\text{g/L}$ of TCE. The NYSDEC sampling after the RI showed traces (4 $\mu\text{g/L}$) of 1,1,1-TCA in one surface water sample. Historically, when the industrial leachfield was operative, surface water exiting the site was found to contain as much as 190 $\mu\text{g/L}$ of 1,1,1-TCA in the ditch adjacent to New York State Route 145.

1.6 TECHNICAL OBJECTIVES

Based on information gained from the Phase I RI and other studies at the Becker site, the following information is needed to complete the RI:

- The extent of contamination at debris pile area, and leachfield and septic tank for septic system no. 2 needs to be assessed through laboratory analysis of debris, subsurface soil, and groundwater samples and through direct measurements of the aerial extent and thickness (of debris). Current information is not sufficient to consider the scope of potential remedial alternatives for these areas although they are suspected to have been the dominant source of bedrock groundwater contamination migrating from the site.
- Shallow groundwater at the location of septic system no. 3 needs to be characterized, due to detection of solvents in the septic tank during the Phase I RI. If evidence of significant shallow groundwater contamination is detected, test pitting in the leachfield would be warranted to assess the extent of soil (source) contamination.
- The extent of soil and groundwater contamination at the chemical storage building area needs to be determined. Existing data is insufficient to assess potential remedial alternatives.
- The extent of groundwater contamination migrating from the site requires further definition to evaluate potential remedial alternatives in detail. In addition, groundwater flow directions and gradients away from the vicinity of septic system no. 2 (the industrial septic system) towards Catskill Creek needs to be evaluated, and water treatment parameters [hardness, Total Organic Carbon (TOC), total suspended solids (TSS), chemical oxygen demand (COD), biological oxygen demand (BOD), alkalinity, and metals content] need to be measured in bedrock monitoring wells.
- Because shallow groundwater contamination has been shown to discharge to surface water at the site, resampling of surface water for VOCs is necessary. In response to NYSDEC comments on the Phase I RI, an additional surface water/sediment pair is needed to characterize

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a small wetland area north of the site receiving surface water from the site, and additional on-site surface water/sediment pairs are needed to complete assessment of the nature and distribution of contamination in on-site drainages and the fire pond.

2.0 RI/FS TASKS

The WA detailed six tasks to be performed by ABB-ES. Task 1 consisted of preparation of (1) a Project Management Work Plan (Project Scoping Plan); and (2) the Detailed Work Plan and Costing tables. Task 1 activities are to organize activities and detail budgets to complete the remaining five tasks (Task 2 through Task 6). The work assignment tasks to be completed are the following:

- Detailed RI/FS Work Plan Preparation (Task 1)
- Phase I and Phase II FS Review (Task 2)
- Phase II (Post-Screening) RI Activities (Task 3)
- Phase III FS Report Preparation (Detailed Analysis of Alternatives) (Task 4)
- Community Relations Support (Task 5)
- Final RI/FS Report Preparation (Task 6)

2.1 DETAILED RI/FS WORK PLAN PREPARATION (TASK 1)

Upon NYSDEC's acceptance of the Project Management Detailed Work Plan (Task 1A), ABB-ES prepared this Detailed Work Plan and final budget (Task 1B). The approach completing the RI/FS at the Becker site has been designed with several controlling factors in mind. These include the following:

- Results of review of the Phase I RI and FS activities performed previously, and a subsurface investigation performed in support of IRMs.
- Use of applicable or relevant and appropriate requirements (ARARs) and New York State Standards, Criteria, and Guidance (SCGs) as an evaluation tool throughout the process. Location-specific and chemical-specific ARARs and/or SCGs have been reviewed during

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preparation of the Detailed Work Plan. Action-specific ARARs will also be identified for proposed alternatives and will be used to evaluate the effectiveness and administrative feasibility of each alternative.

- Emphasis on including alternatives which involve, as a principal element, treatment which significantly and permanently reduces the volume, toxicity, or mobility of site contaminants, where practicable. This emphasis on permanent remedies is revisited throughout the remedy selection process.

As a final product, the RI/FS will recommend a preferred option to address site contamination at Becker which is consistent with the requirements of the New York State Environmental Conservation Law (ECL) and the Comprehensive Environmental Response, Cleanup and Liability Act (CERCLA) of 1980, as amended by SARA, and related guidance documents (USEPA, 1988 and NYSDEC, 1990).

2.2 PHASE I AND PHASE II FS REVIEW (TASK 2)

ABB-ES has performed a preliminary review of the prior RI data and existing FS documents during Task 1 to understand the work completed to date at the site and to prepare a revised scope of work for the Phase II RI. Upon receipt of Notice to Proceed on Tasks 2 through 6 from NYSDEC, ABB-ES will begin the detailed review (Task 2) of the Phase I and II FS (ABB-ES has also inventoried the data collected during the Phase I RI and forwarded by the NYSDEC to ABB-ES). Task 2 will be completed after the Phase II RI (Task 3) so that new data from the RI can be considered when finalizing the list of appropriate groundwater remedial alternatives. ABB-ES will prepare and submit a technical memorandum to NYSDEC summarizing the review of the Phase I and II FS. This technical memorandum will address any inadequacies in the Phase I and II FS, given the supplemental data from the Phase II RI, and will present a list of groundwater remedial alternatives for evaluation in the Phase III FS. Based on the new information, remedial action objectives will be reviewed and possibly revised. If results of the Phase II RI indicate the need for potential remediation of a source area, a preliminary list of options for the source area will be provided for NYSDEC's consideration as IRMs. These options will include no action and removal alternatives.

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2.3 PHASE II (POST-SCREENING) RI ACTIVITIES (TASK 3)

The primary objective of the proposed field activities is to provide data supporting an evaluation of the site-related problems and the selection of potentially feasible remedial alternatives for Becker. Activities proposed for the Phase II RI field program include investigation of air, debris, subsurface soil, surface water and sediment, and groundwater on-site and in the vicinity of the site. Specific activities are as follows:

- Site Reconnaissance and Mobilization (Subsection 2.3.1.1)
- Baseline Air Monitoring (Subsection 2.3.2)
- Surface Geophysical Survey (Subsection 2.3.3)
- Fracture Trace Analysis (Subsection 2.3.4)
- Surface Water/Sediment Sampling (Subsection 2.3.5)
- Test Pitting (Subsection 2.3.6)
- Water Table Monitoring Well/Piezometer Installation (Subsection 2.3.7)
- Bedrock Borings and Borehole Geophysical Survey (Subsection 2.3.8)
- Bedrock Monitoring Well Installation and Existing Bedrock Well Reconstruction (Subsection 2.3.9)
- Monitoring Well Development (Subsection 2.3.10)
- Monitoring Well/Water Supply Well Sampling (Subsection 2.3.11)
- Hydrogeologic Characterization (Subsection 2.3.12)
- Exploration Location and Elevation Survey (Subsection 2.3.13)
- Ecological Characterization (Subsection 2.3.14)

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- Miscellaneous Tasks (Subsection 2.3.15)
- Laboratory Analysis of Samples and Resultant Data Validation (Subsection 2.3.16)

Table 2-1 is a summary of the field activities plan. Table 2-2 identifies the primary modifications to the field program in the Work Assignment, as discussed in the February 10, 1994, scoping meeting. The field investigations will be conducted in accordance with specifications presented in the Program Quality Assurance Plan (QAPP) (ABB-ES, 1994) and the site-specific QAPjP (Appendix B). Quality Assurance/Quality Control (QA/QC) procedures are presented in the QAPP for sample handling, sample shipment, and data validation. The QAPjP identifies data quality objectives for the Phase II RI, analytical methods, and additional information pertaining to QA/QC such as sample analytical methods, containers, preservation, and holding time requirements (Appendix B). Health and safety procedures for all on-site activities are presented in the HASP included as Appendix C. Exploration locations are shown in Figure 1-2. The sample collection and analysis program is summarized in Table 2-3. The drilling and test pitting program is summarized in Table 2-4.

2.3.1 General Field Activities

General field activities for Task 3 including mobilization, health and safety, decontamination, and disposal of investigation derived wastes (IDW) are presented in the following subsections.

2.3.1.1 Site Reconnaissance and Mobilization. The objectives of the site reconnaissance are to select and stake sampling locations, determine local permit and utility clearance requirements, identify support facilities for the field program (i.e., drilling water supply source), and conduct a walk-through scope of work with subcontractors (drilling/surveying/geophysics/excavating/waste disposal). In addition, we will notify local emergency response agencies listed in the HASP of the upcoming fieldwork.

Mobilization will consist of completing any additional subcontracting efforts begun during Detailed Work Plan preparation (Task 1); orienting field personnel; and

TABLE 2-1
SUMMARY OF FIELD ACTIVITIES PLAN
BECKER ELECTRONICS MANUFACTURING SITE

AREA AND CONCERN	DATA GAPS	SAMPLING PLAN	DATA REQUIREMENTS
<p><u>Debris Pile Area</u></p> <p>- Debris pile area consists of several large and small piles of waste wood products from speaker cabinet manufacturing. Recent verbal statements to NYSDEC by former Becker employees indicate solvents were disposed on the debris piles</p>	<p>- Confirmation that no buried containers present in debris pile</p> <p>- Characterization of debris pile and soils beneath debris pile</p> <p>- Confirm that debris piles are not classified as hazardous waste</p> <p>- Characterization of shallow groundwater at debris pile area</p>	<p>- Perform geophysics prior to test pitting. Map debris piles and surface metal during survey. Results contoured in field for immediate use.</p> <p>- Excavations in debris piles</p> <p>- 1 sample of debris or soil for chemical analysis per pit</p> <p>- Locations based on geophysical survey</p> <p>- Two composite samples for TCLP chemical analysis from debris area</p> <p>- 1 boring drilled to estimated 10 ft bgs by rotary methods</p> <p>- 1 well located in debris pile area</p>	<p>- Magnetometer data collected in 300 ft by 300 ft grid at 10-foot spacing</p> <p>- Up 20 soil/debris samples for PID screening</p> <p>- 2 composite samples for TCLP</p> <p>- 12 samples collected for laboratory analysis for TCL VOCs, SVOCs, and metals.</p> <p>- Water level measurements</p> <p>- 1 groundwater sample for laboratory analysis for TCL VOCs and TCL SVOCs</p> <p>- Field estimates of aerial and vertical extent, and volume and weight of composite samples</p>
<p><u>Septic System No. 2</u></p> <p>- Septic system No. 2 was the only permitted industrial septic system on the site (SPDES 003)</p> <p>- RI data showed septic tank contents and associated soil and groundwater contaminated with solvents (1,1,1-TCA)</p>	<p>- Delineation of industrial leachfield partially beneath debris pile area</p> <p>- Nature and extent of soil contamination in leachfield needs delineation</p> <p>- Shallow groundwater at septic tank and leachfield needs further characterization to assess nature and extent of solvent contamination</p>	<p>- Perform geophysics prior to test pitting. Map debris piles and surface metal during survey. Results contoured in field for immediate use.</p> <p>- Excavation locations based on geophysical survey</p> <p>- Excavations to bedrock if possible</p> <p>- Boring drilled to estimated 10 ft bgs by rotary methods</p> <p>- 1 well located at leachfield area</p>	<p>- Terrain conductivity data collected in 300 ft by 300 ft grid at 10-foot spacing</p> <p>- Up to 10 soil samples PID screening</p> <p>- 5 soil samples for laboratory analysis for TCL VOCs, TCL SVOCs, and metals</p> <p>- Water level measurements</p> <p>- 2 groundwater samples for laboratory analysis for TCL VOCs and TCL SVOCs (includes existing well MW-2S)</p>
<p><u>Septic System No. 3</u></p> <p>- RI data show area septic system, soils, surface water contaminated with solvents (1,1,1-TCA), toluene and 1,4-dichlorobenzene. RI excavation indicated only visible septic tank exit pipe discharged to nearby ditch.</p>	<p>- Shallow groundwater at septic tank and leachfield needs further characterization to assess nature and extent of solvent contamination</p>	<p>- Borings drilled to estimated 10 ft bgs by rotary methods</p> <p>- 1 well installed at septic tank</p> <p>- 1 well installed at discharge pipe outfall</p> <p>- Wells straddle water table</p>	<p>- Water level measurements</p> <p>- 2 groundwater samples for laboratory analysis for TCL VOCs and TCL SVOCs</p>

TABLE 2-1
SUMMARY OF FIELD ACTIVITIES PLAN
BECKER ELECTRONICS MANUFACTURING SITE

AREA AND CONCERN	DATA GAPS	SAMPLING PLAN	DATA REQUIREMENTS
<p><u>Chemical Storage Building Area</u></p> <ul style="list-style-type: none"> - RI and IRM data show area soils and groundwater contaminated with solvents (1,1,1-TCA) and hydrocarbons - Historical reports that solvents may have been spilled in building and outside during transfers. - Potential for diesel UST in vicinity of building 	<ul style="list-style-type: none"> - Delineation of extent of soil contamination by solvents and hydrocarbons - Delineation of extent of shallow groundwater contamination throughout storage building area 	<ul style="list-style-type: none"> - Excavations to 10 feet bgs - Locations based on best judgement - Samples collected using standard groundwater procedures - 1 well adjacent to storage building - 1 well downgradient of storage building area - All borings drilled to estimated 10 ft bgs by rotary methods - Wells straddle water table 	<ul style="list-style-type: none"> - Up to 10 soil samples for PID screening - 5 soil samples for laboratory analysis for TCL VOCs, TCL SVOCs, and metals - 7 groundwater samples for laboratory analysis for TCL VOCs - Water level measurements - 2 groundwater samples for laboratory analysis for TCL VOCs and TCL SVOCs
<p><u>Site Drainages</u></p> <ul style="list-style-type: none"> - RI data show onsite drainages contaminated with VOCs and 1,4-Dichlorobenzene, phthalates, metals 	<ul style="list-style-type: none"> - Need current data on VOC concentrations in drainages - Address data gaps from previous studies 	<ul style="list-style-type: none"> - 6 Surface water/sediment pairs collected along drainages 	<ul style="list-style-type: none"> - 5 sample pairs collected on-site for laboratory analysis for TCL VOCs, SVOCs, and metals - 1 surface water/sediment sample pair collected off-site for laboratory analysis for TCL VOCs, SVOCs, and metals - All sediment samples analyzed also for TOC
<p><u>Bedrock Groundwater (Not source-specific)</u></p> <ul style="list-style-type: none"> - Nature and extent of VOC and SVOC groundwater contamination beneath and migrating from site is not adequately known - Characterization of groundwater metals, hardness, alkalinity, TOC, TSS, COD, and BOD to assess groundwater pretreatment needs in the FS 	<ul style="list-style-type: none"> - Assess nature of groundwater contamination in existing bedrock wells MW-4, MW-5, and MW-6 - Assess probable groundwater flow paths in bedrock - Characterization of upgradient groundwater quality 	<ul style="list-style-type: none"> - Well screens reinstalled in most fractured zone based on results of packer testing - Conduct area bedrock outcrop mapping - Shallow boring drilled to 10 feet - Deep boring drilled to 65 feet - Drilled upgradient of site - Packer sampling and testing - Wells installed in upgradient borings 	<ul style="list-style-type: none"> - Analysis of 3 water samples from reinstalled wells for TCL VOCs and metals - Water level measurements - Slug testing of three wells - Review of aerial photos and geologic maps - Collection of strike/dip data from outcrops at and downgradient of the site - Packer testing at five foot intervals - Borehole geophysical data - Water level measurements - Slug tests to determine well permeability - 1 upgradient bedrock groundwater sample for laboratory analysis for TCL VOCs and metals - 1 upgradient shallow groundwater sample collected for TCL VOCs, SVOCs, and metals

TABLE 2-1
SUMMARY OF FIELD ACTIVITIES PLAN
BECKER ELECTRONICS MANUFACTURING SITE

AREA AND CONCERN (Bedrock Groundwater - Cont'd)	DATA GAPS	SAMPLING PLAN	DATA REQUIREMENTS
<ul style="list-style-type: none"> - Characterization of bedrock groundwater at debris pile area 	<ul style="list-style-type: none"> - Boring drilled 10 feet in overburden and 55 feet into bedrock - Boring drilled at debris piles - Packer testing - One well installed in debris pile boring, with depth of screen based on packer testing and borehole logging results 	<ul style="list-style-type: none"> - Packer testing at five foot intervals - Borehole geophysical data - Water level measurements - Slug test to determine well permeability - 1 groundwater samples for laboratory analysis for TCL VOCs and metals 	
<ul style="list-style-type: none"> - Characterization of bedrock groundwater at septic system No. 2 	<ul style="list-style-type: none"> - One boring drilled downgradient of leachfield - One boring drilled near septic tank - Each boring drilled 10 feet in overburden and 55 feet into bedrock - Packer testing - Well screens installed based on packer testing and borehole logging results 	<ul style="list-style-type: none"> - Packer testing at five foot intervals - Borehole geophysical data - Water level measurements - Slug tests to determine well permeability - 2 groundwater samples for laboratory analysis for TCL VOCs and metals; 1 groundwater sample for laboratory analysis for alkalinity, TOC, TSS, BOD, COD 	
<ul style="list-style-type: none"> - Characterization of bedrock groundwater at septic system No. 3 	<ul style="list-style-type: none"> - Boring drilled near septic tank - Boring drilled 10 feet in overburden and 55 feet into bedrock - Packer testing - Well screen installed based on packer testing and borehole logging results 	<ul style="list-style-type: none"> - Packer testing at five foot intervals - Borehole geophysical data - Water level measurements - Slug tests of one well - 1 groundwater sample for laboratory analysis for TCL VOCs, metals, alkalinity, TOC, TSS, BOD, and COD 	
<ul style="list-style-type: none"> - Characterization of bedrock groundwater at chemical storage building 	<ul style="list-style-type: none"> - Boring drilled at building area - Boring drilled 10 feet in overburden and 55 feet into bedrock - Packer testing - Well screen installed based on packer testing and borehole logging results 	<ul style="list-style-type: none"> - Packer testing at five foot intervals - Borehole geophysical data - Slug tests of one well - 1 groundwater sample for laboratory analysis for TCL VOCs, metals, alkalinity, TOC, TSS, BOD, COD 	

TABLE 2-1
 SUMMARY OF FIELD ACTIVITIES PLAN
 BECKER ELECTRONICS MANUFACTURING SITE

AREA AND CONCERN	DATA GAPS	SAMPLING PLAN	DATA REQUIREMENTS
(Bedrock Groundwater - Cont'd)	<ul style="list-style-type: none"> - Complete characterization of off-site groundwater 	<ul style="list-style-type: none"> - Borings locations based on available data - Borings drilled 10 feet in overburden and 55 feet into bedrock 	<ul style="list-style-type: none"> - Packer testing at five foot intervals - Borehole geophysical data
Habitat-Based Assessment	<ul style="list-style-type: none"> - Site habitat needs additional characterization to identify indicator species for habitat-based assessment. Assessment to use existing data for exposure concentrations in affected ecosystems 	<ul style="list-style-type: none"> - Packer testing - Well screens installed based on packer testing and borehole logging results 	<ul style="list-style-type: none"> - Water level measurements - Slug tests - 4 groundwater samples for laboratory analysis for TCL VOCs and metals
Other Miscellaneous Activities	<ul style="list-style-type: none"> - Identify location of and sample Becker No. 1 Well 	<ul style="list-style-type: none"> - Site walkover survey - Need all available TCL/TAL data validated and reviewed for adequacy 	<ul style="list-style-type: none"> - One groundwater sample collected for TCL VOCs and metals
	<ul style="list-style-type: none"> - Resampling of Becker Wells No. 2 and No. 3 - Abandonment of Becker Wells 		<ul style="list-style-type: none"> - Two groundwater samples collected for TCL VOCs and metals - None
	<ul style="list-style-type: none"> - Demobilization and disposal of PPE and other investigation-derived wastes 		<ul style="list-style-type: none"> - To be determined by removal subcontractor
	<ul style="list-style-type: none"> - Survey of Phase II RI and all previously unsurveyed data collection points and explorations - Air Monitoring Program 		<ul style="list-style-type: none"> - Surveyed to NYSDEC standard specifications
		<ul style="list-style-type: none"> - Meteorological monitoring - One upwind sampling location - Three on-site sampling locations - Testing performed during mobilization - Data compared in RI to NYSDEC Air Guide 1 standards 	<ul style="list-style-type: none"> - Four air samples collected for TCL VOCs and selected SVOCs

TABLE 2--2
 COMPARISON OF FIELD ACTIVITIES PLAN TO WORK ASSIGNMENT REQUEST
 BECKER ELECTRONICS MANUFACTURING SITE

WORK ASSIGNMENT REQUEST	PROPOSED SCOPE	REASON FOR CHANGE
MAJOR TASKS:		
A minimum of 8 monitoring wells installed to define the extent of contamination and further characterize the local hydrogeology	10 Bedrock monitoring wells; 7 water table monitoring wells; and 4 water table piezometers	Assessment of extent of shallow and bedrock groundwater contamination needs to be performed for FS; piezometers needed to assess hydrogeology/vertical gradients; 1 bedrock well upgradient; 5 bedrock wells on site; 4 bedrock wells off site
Permeability testing and packer testing	Permeability testing and packer testing; geophysical logging	No change
A reconnaissance effort to locate, and if possible, utilize former Becker Well No. 1 as an additional on-site sampling well for groundwater quality	Locating and sampling Becker Well No. 1	No change
A subsurface soil investigation in areas of suspected leaching fields utilizing test pits to define areal extent of contamination resulting from the leaching systems, and to confirm the effectiveness of recent IRMs	Excavation of 5 test pits at leachfield No. 2	Note that IRM did not include removal of leachfields; data from IRM did not identify significant contamination at leachfield #1 and no further investigation is warranted. Leachfield #2 needs further soil characterization as it was not sampled previously (leachfield #2 is the permitted industrial leachfield); leachfield #3 soil is not being investigated further; shallow groundwater data is being collected to determine if leachfield #3 is a source of contamination
Measurement of the dimensions of the debris piles in the southwest portion of the site; sampling and investigations of the underlying soils will be conducted to determine if hazardous waste is present	Excavation of 12 test pits in debris pile area; geophysical survey to delineate potential buried debris and nearby leachfield No. 2; extent of debris disposed measured during site survey; estimation of the volume and mass of debris pile	Verbal communication between NYSDEC regional representative and ABB-ES notes several former Becker employees have described disposal of solvents in the debris piles; in addition, very recent information from NYSDEC indicates potential for drums of xylenes to have been disposed in this area

TABLE 2-2
 COMPARISON OF FIELD ACTIVITIES PLAN TO WORK ASSIGNMENT REQUEST
 BECKER ELECTRONICS MANUFACTURING SITE

WORK ASSIGNMENT REQUEST	PROPOSED SCOPE	REASON FOR CHANGE
<p>SAMPLING AND ANALYSIS:</p>		
<p>Surface soil samples adjacent to the existing debris piles and former surface disposal areas (10-12 samples, TCL VOCs, SVOCs, PCBs, and metals)</p>	<p>No surface soil sampling is planned</p>	<p>PCBs not a site contaminant as per NYSDEC. Solvent contamination expected to be greatest in subsurface</p>
<p>Subsurface soil samples from test pits and soil borings with approximately 10-15 test pit soil samples to be analyzed for TCL VOCs, SVOCs, and metals; 5 composite debris samples to be analyzed for TCL VOCs, SVOCs, and metals; 2 composites to be analyzed for TCLP; 2-4 subsurface soil samples collected during MW installation to be analyzed for TCL VOCs, SVOCs, and metals</p>	<p>Collection of 22 soil samples and debris pile samples for analysis for TCL VOCs, SVOCs, metals; collection of 2 debris composite samples to be analyzed for TCLP</p>	<p>Focus on assessing the debris pile, subsurface soils, and leachfields as sources of contamination; evaluating the vertical and horizontal distribution of contamination</p>
<p>One round of groundwater samples from existing and new monitoring wells; groundwater elevation data will be collected at the time of sampling; ideally, groundwater elevation data will be collected every 3 months to determine the effect of large seasonal production wells on the groundwater flow patterns (14 groundwater samples for TCL VOCs, SVOCs, and metals)</p>	<p>Analysis of 30 monitoring wells and 3 Becker water supply wells to be analyzed for TCL VOCs, and metals; collection of three rounds of water level measurements (Spring-Summer). Shallow groundwater samples analyzed also for TCL SVOCs</p>	<p>Increase in number of wells to be sampled as complete round</p>
<p>Resampling of 14-16 private water supply wells for TCL VOCs</p>	<p>Not proposed at this time</p>	<p>A substantial database exists for the domestic wells at NYSDOH which can be used in the RI/FS. No additional sample collection is necessary at this time, although future sampling may be required if the existing data are inadequate.</p>

TABLE 2-2
 COMPARISON OF FIELD ACTIVITIES PLAN TO WORK ASSIGNMENT REQUEST
 BECKER ELECTRONICS MANUFACTURING SITE

WORK ASSIGNMENT REQUEST	PROPOSED SCOPE	REASON FOR CHANGE
Resampling of on-site drainage ditches and fire pond. Off-site sampling of drainage ditches, wetland marsh, Thorp Creek and Catskill Creek for water and sediment (20 samples for TCL VOCs, SVOCs, metals, some PCBs, some lead only)	5 surface water/sediment pairs collected on-site for TCL VOCs, SVOCs, and metals analysis; one surface water/sediment pair collected from wetland north of site for TCL VOCs, SVOCs, and metals	Sediment and surface water samples collected by NYSDEC in Fall, 1993; proposed on-site sampling to assess current VOC, SVOC, metal contamination for comparison to shallow groundwater data; surface water/sediment pair identified as remaining data gap
MISCELLANEOUS TASKS:		
Abandonment of existing Becker water supply wells	Abandonment of existing Becker water supply wells	No change
As built survey of new wells	As-built survey of all explorations from site to Catskill Creek	Increase in survey needed to document all sampling locations
On- and off-site habitat based assessment and generation of a vegetative cover map	On- and off-site habitat based assessment and generation of a vegetative cover map	No change
Demobilization and disposal of PPE and sampling equipment	Demobilization and disposal of PPE and sampling equipment, soil, and purge water	Anticipate disposal required for approximately 70 drums total of PPE, soil cuttings, and water from investigation

TABLE 2-3
 SUMMARY OF LABORATORY ANALYTICAL PROGRAM
 BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	SAMPLE TYPE	LABORATORY ANALYSIS										
		TCL VOC	TCL SVOC	NIOSH SVOC	TAL METALS	TCL VOC	TCLP VOC	TOC	ALKALINITY	BOD	COD	TSS
DEBRIS PILE	TEST PIT SOIL (TP-101 to TP-112)	12	12	0	12	0	0	0	0	0	0	0
AREA	DEBRIS COMPOSITES	0	0	0	0	2	0	0	0	0	0	0
	SHALLOW GROUNDWATER (MW-102S)	1	1	0	0	0	0	0	0	0	0	0
SEPTIC SYSTEM NO. 2	TEST PIT SOIL (TP-113 to TP-117)	5	5	0	5	0	0	0	0	0	0	0
	SHALLOW GROUNDWATER (MW-103 and MW-2S)	2	2	0	0	0	0	0	0	0	0	0
SEPTIC SYSTEM NO. 3	SHALLOW GROUNDWATER (MW-104, MW-105S)	2	2	0	0	0	0	0	0	0	0	0
CHEMICAL STORAGE BLDG.	TEST PIT SOIL (TP-112 to TP-118)	5	5	0	5	0	0	0	0	0	0	0
	SHALLOW GROUNDWATER (MW-106S, MW-107, MW-1EPS, MW-4EPS, MW-5EPS, MW-TANK, MW-BOX, MW-SPILL)	9	2	0	0	0	0	0	0	0	0	0
BEDROCK GROUNDWATER	SHALLOW GROUNDWATER (MW-101S)	1	1	0	1	0	0	0	0	0	0	0
	BEDROCK GROUNDWATER (MW-101D, MW-102D, MW-105D, MW-106D, MW-108, MW-109, MW-110, MW-111, MW-112, MW-113, MW-4, MW-5, MW-6)	13	0	0	13	0	0	3	3	3	3	3
MISCELLANEOUS	ON-SITE SEDIMENT (SD-101 to SD-105)	5	5	0	5	0	0	5	0	0	0	0
	ON-SITE SURFACE WATER (SW-101 to SW-105)	5	5	0	5	0	0	0	0	0	0	0
	OFF-SITE SURFACE WATER (SW-106)	1	1	0	1	0	0	0	0	0	0	0
	OFF-SITE SEDIMENT (SD-106)	1	1	0	1	0	1	0	0	0	0	0
	ON-SITE WATER SUPPLY WELLS: (Becker #1, #2, #3)	3	0	0	3	0	0	0	0	0	0	0
	BASELINE AIR SAMPLES (LG-101 to LG-104)	4	0	4	0	0	0	0	0	0	0	0

TABLE 2--3
 SUMMARY OF LABORATORY ANALYTICAL PROGRAM
 BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	SAMPLE TYPE	LABORATORY ANALYSIS											
		TCL VOC	TCL SVOC	NIOSH SVOC	TAL METALS	TAL METALS	TCLP VOC	SVOC METALS	TOC	ALKALINITY	BOD	COD	TSS
SUBTOTAL: SOIL/DEBRIS/SEDIMENT SAMPLES		28	28	0	28	28	2	0	6	0	0	0	0
SUBTOTAL: SURFACE WATER SAMPLES		6	6	0	6	6	0	0	0	0	0	0	0
SUBTOTAL: GROUNDWATER SAMPLES		31	5	0	17	17	0	3	3	3	3	3	3
SUBTOTAL: BASELINE AIR SAMPLES		4	0	4	0	0	0	0	0	0	0	0	0
QA/QC SAMPLES		3	3	0	3	3	0	0	0	0	0	0	0
SOIL DUPLICATES		1	1	0	1	1	0	0	0	0	0	0	0
SURFACE WATER DUPLICATES		4	2	0	2	2	0	2	2	2	2	2	2
GROUNDWATER DUPLICATES		1	0	1	0	0	0	0	0	0	0	0	0
AIR DUPLICATES		1	0	1	0	0	0	0	0	0	0	0	0
SOIL RINSATES		1	1	0	1	1	0	0	0	0	0	0	0
SURFACE WATER RINSATES		4	3	0	2	2	0	2	2	2	2	2	2
GROUNDWATER RINSATES		1	1	0	0	0	0	0	0	0	0	0	0
SOURCE WATER BLANKS		3	3	0	3	3	0	3	3	3	3	3	3
TRIP BLANKS (WATER ONLY)		10	0	0	0	0	0	0	0	0	0	0	0
TRIP BLANKS (AIR)		2	0	1	0	0	0	0	0	0	0	0	0
SOIL MATRIX SPIKES		1	2	0	2	2	0	0	0	0	0	0	0
SOIL MSDs/MSBs		4	4	0	2	2	0	0	0	0	0	0	0
SURFACE WATER MATRIX SPIKES		1	1	0	1	1	0	0	0	0	0	0	0
SURFACE WATER MSDs/MSBs		2	2	0	1	1	0	0	0	0	0	0	0
GROUNDWATER MATRIX SPIKES		2	1	0	2	2	0	0	0	0	0	0	0
GROUNDWATER MSDs/MSBs		4	2	0	2	2	0	0	0	0	0	0	0
TCLP SPIKE		0	0	0	0	0	1	1	0	0	0	0	0
TOTAL ANALYSES PER METHOD:		113	68	6	73	73	3	16	10	10	10	10	10

NOTES:

TCLP -- Toxicity Characteristics Leaching Procedure analysis for VOCs, SVOCs, and Metals only
 BASELINE AIR SAMPLES -- VOC and SVOC analyses to be performed using applicable NYSDOH methods (TO-14 and NISH 5506) and detection limits
 MSDs/MSBs -- Matrix Spike Duplicates/Matrix Spike Blanks
 TCL -- Target Analytes List
 TAL -- Target analytes list (excluding cyanide)
 VOC -- Volatile Organic Compound
 SVOC -- Semivolatile organic compound
 NIOSH SVOC -- NIOSH Method 5506 for air samples

TOC -- Total organic carbon
 BOD -- biological oxygen demand
 COD -- Chemical oxygen demand
 TSS -- Total suspended solids

TABLE 2-4
SUMMARY OF TEST PITTING/DRILLING PROGRAM
BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	EXPLORATION TYPE	TEST PITS		SPUN FLUSH JOINT CASING DRILLING		AIR-ROTARY DRILLING	
		EXCAVATIONS (EA)	DAYS (EA)	4-INCH I.D. 0 TO 50 FEET (L.F.)	8-INCH I.D. 0 TO 50 FEET (L.F.)	6-INCH I.D. 0 TO 50 FEET (L.F.)	6-INCH I.D. 50 TO 100 FEET (L.F.)
DEBRIS PILE AREA	TEST PITS (TP-101 TO TP-112)	12	1.5	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-102S	NA	NA	15	0	0	0
SEPTIC SYSTEM NO. 2	TEST PITS (TP-113 TO TP-117)	5	0.75	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-103	NA	NA	15	0	0	0
SEPTIC SYSTEM NO. 3	SHALLOW GROUNDWATER WELLS	NA	NA	15	0	0	0
	↳ MW-104 ↳ MW-105S	NA	NA	15	0	0	0
CHEMICAL STORAGE BLDG.	TEST PITS (TP-118 TO TP-122)	5	0.75	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELLS ↳ MW-106S ↳ MW-107	NA	NA	15	0	0	0
BEDROCK GROUNDWATER	SHALLOW GROUNDWATER WELL (UPG) MW-101S	NA	NA	15	0	0	0
	BEDROCK GROUNDWATER WELLS	NA	NA	0	15	35	15
	MW-101D (UPG)	NA	NA	0	15	35	15
	MW-102D	NA	NA	0	15	35	15
	MW-105D	NA	NA	0	15	35	15
	MW-106D	NA	NA	0	15	35	15
	MW-108	NA	NA	0	15	35	15
	MW-109	NA	NA	0	15	35	15
	MW-110	NA	NA	0	15	35	15
	MW-111	NA	NA	0	15	35	15
	MW-112	NA	NA	0	15	35	15
	MW-113	NA	NA	0	15	35	15

TABLE 2-4
 SUMMARY OF TEST PITTING/DRILLING PROGRAM
 BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	EXPLORATION TYPE	TEST PITS		SPUN FLUSH JOINT CASING DRILLING		AIR ROTARY DRILLING	
		EXCAVATIONS (EA)	DAYS (EA)	4-INCH I.D. 0 TO 50 FEET (L.F.)	8-INCH I.D. 0 TO 50 FEET (L.F.)	6-INCH I.D. 0 TO 50 FEET (L.F.)	6-INCH I.D. 50 TO 100 FEET (L.F.)
	SHALLOW PIEZOMETERS						
NA	PZ-4	NA	NA	15	0	0	0
NA	PZ-6	NA	NA	15	0	0	0
NA	PZ-110	NA	NA	15	0	0	0
NA	PZ-112	NA	NA	15	0	0	0
NA	RECONSTRUCT ON-SITE WELLS						
NA	MW-04	NA	NA	NA	NA	NA	NA
NA	MW-05	NA	NA	NA	NA	NA	NA
NA	MW-06	NA	NA	NA	NA	NA	NA
NA	LOCATE ON-SITE WATER SUPPLY WELL	1	0.5	NA	NA	NA	NA
NA	OPTIONAL TEST PITS	12	1.5	NA	NA	NA	NA
TOTALS:		35	5	165	150	350	150

TABLE 2-4
SUMMARY OF TEST PITTING/DRILLING PROGRAM
BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	EXPLORATION TYPE	WELL/BORING DEVELOPMENT		PACKER TESTING	WELL SCREEN	
		BY PUMP AND SURGE 2-INCH I.D. (HR.)	6-INCH I.D. (HR.)		10-FOOT PVC (0.006"- SLOT) 2-INCH I.D. (L.F.)	10-FOOT PVC (0.010"- SLOT) 2-INCH I.D. (L.F.)
DEBRIS PILE AREA	TEST PITS (TP-101 TO TP-112)	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-102S	2	0	NA	10	0
SEPTIC SYSTEM NO. 2	TEST PITS (TP-113 TO TP-117)	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-103	2	0	NA	10	0
SEPTIC SYSTEM NO. 3	SHALLOW GROUNDWATER WELLS	2	0	NA	10	0
	MW-104 MW-105S	2	0	NA	10	0
CHEMICAL STORAGE BLDG.	TEST PITS (TP-118 TO TP-122)	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELLS MW-106S MW-107	2	0	NA	10	0
BEDROCK GROUNDWATER	SHALLOW GROUNDWATER WELL (UPG)	2	0	NA	10	0
	MW-101S	2	4	5	0	10
	BEDROCK GROUNDWATER WELLS	2	4	5	0	10
	MW-101D (UPG)	2	4	5	0	10
	MW-102D	2	4	5	0	10
	MW-105D	2	4	5	0	10
	MW-106D	2	4	5	0	10
	MW-108	2	4	5	0	10
	MW-109	2	4	5	0	10
	MW-110	2	4	5	0	10
	MW-111	2	4	5	0	10
	MW-112 MW-113	2	4	5	0	10

TABLE 2-4
SUMMARY OF TEST PITTING/DRILLING PROGRAM
BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	EXPLORATION TYPE	WELL RISER		WELL SCREEN SAND PACK		BENTONITE PELLETT SEAL	
		SCH. 40 PVC 2-INCH I.D. (L.F.)	SCH. 40 PVC 4.0 INCH I.D. BORING (<50 FT. DEPTH) (L.F.)	2-INCH WELL/ 4.0 INCH I.D. BORING (<50 FT. DEPTH) (L.F.)	2-INCH WELL/ 6.0 INCH I.D. BORING (<50 FT. DEPTH) (L.F.)	2-INCH WELL IN 4.0 INCH I.D. BORING (<50 FT. BGS) (L.F.)	2-INCH WELL IN 6.0 INCH I.D. BORING (<50 FT. BGS) (L.F.)
DEBRIS PILE AREA	TEST PITS (TP-101 TO TP-112)	NA	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-102S	8	0	12	0	2	0
SEPTIC SYSTEM NO. 2	TEST PITS (TP-113 TO TP-117)	NA	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-103	8	0	12	0	2	0
SEPTIC SYSTEM NO. 3	SHALLOW GROUNDWATER WELLS	8	0	12	0	2	0
	MW-104	8	0	12	0	2	0
CHEMICAL STORAGE BLDG.	TEST PITS (TP-118 TO TP-122)	NA	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELLS MW-106S	8	0	12	0	2	0
	MW-107	8	0	12	0	2	0
BEDROCK GROUNDWATER	SHALLOW GROUNDWATER WELL (UPG) MW-101S	8	0	12	0	2	0
	BEDROCK GROUNDWATER WELLS	0	58	0	12	0	2
	MW-101D (UPG)	0	58	0	12	0	2
	MW-102D	0	58	0	12	0	2
	MW-105D	0	58	0	12	0	2
	MW-106D	0	58	0	12	0	2
	MW-108	0	58	0	12	0	2
	MW-109	0	58	0	12	0	2
	MW-110	0	58	0	12	0	2
	MW-111	0	58	0	12	0	2
	MW-112	0	58	0	12	0	2
	MW-113	0	58	0	12	0	2

TABLE 2-4
 SUMMARY OF TEST PITTING/DRILLING PROGRAM
 BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	WELL RISER		WELL SCREEN/SAND PACK		BENTONITE PELLETS SEAL	
	SCH. 40 PVC 2-INCH I.D. (L.F.)	SCH. 40 PVC 4.0 INCH I.D. BORING (<50 FT DEPTH) (L.F.)	2-INCH WELL/ 4.0 INCH I.D. BORING (<50 FT DEPTH) (L.F.)	2-INCH WELL/ WELL/6.0 INCH I.D. BORING (<50 FT DEPTH) (L.F.)	2-INCH WELL IN 4.0 INCH I.D. BORING (<50 FT BGS) (L.F.)	2-INCH WELL IN 6.0 INCH I.D. BORING (<50 FT BGS) (L.F.)
SHALLOW PIEZOMETERS						
PZ-4	8	0	12	0	2	0
PZ-6	8	0	12	0	2	0
PZ-110	8	0	12	0	2	0
PZ-112	8	0	12	0	2	0
RECONSTRUCT ON-SITE WELLS						
MW-04	0	58	0	12	0	2
MW-05	0	58	0	12	0	2
MW-06	0	58	0	12	0	2
LOCATE ON-SITE WATER SUPPLY WELL	NA	NA	NA	NA	NA	NA
OPTIONAL TEST PITS	NA	NA	NA	NA	NA	NA
TOTALS:	88	754	132	156	22	26

TABLE 2-4
 SUMMARY OF TEST PITTING/DRILLING PROGRAM
 BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	EXPLORATION TYPE	CEMENT/BENTONITE GROUT 2-INCH WELL IN 4.0 INCH ID BORING (<50 FT BGS) (L.F.)	2-INCH WELL IN 6.0 INCH ID BORING (<50 FT BGS) (L.F.)	PROTECTIVE CASINGS ABOVE GR. 4-INCH I.D. W/ LOCK DRAIN CONCRETE APRON (EA.)	CONTAINERIZATION OF DRILLING FLUIDS IN 55-G. DRUMS (EA.)	OF DRILLING CUTTINGS IN 55-G. DRUMS (EA.)
DEBRIS PILE AREA	TEST PITS (TP-101 TO TP-112)	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-102S	0	0	1	1	0
SEPTIC SYSTEM NO. 2	TEST PITS (TP-113 TO TP-117)	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELL MW-103	0	0	1	1	0
SEPTIC SYSTEM NO. 3	SHALLOW GROUNDWATER WELLS					
	MW-104	0	0	1	1	0
	MW-105S	0	0	1	1	0
CHEMICAL STORAGE BLDG.	TEST PITS (TP-118 TO TP-122)	NA	NA	NA	NA	NA
	SHALLOW GROUNDWATER WELLS					
	MW-106S MW-107	0 0	0 0	1 1	1 1	0 0
BEDROCK GROUNDWATER	SHALLOW GROUNDWATER WELL (UPG)					
	MW-101S	0	0	1	1	0
	BEDROCK GROUNDWATER WELLS					
	MW-101D (UPG)	0	50	1	2	0
	MW-102D	0	50	1	2	0
	MW-105D	0	50	1	2	0
	MW-106D	0	50	1	2	0
	MW-108	0	50	1	2	0
	MW-109	0	50	1	2	0
	MW-110	0	50	1	2	0
	MW-111	0	50	1	2	0
	MW-112	0	50	1	2	0
	MW-113	0	50	1	2	0

TABLE 2-4
 SUMMARY OF TEST PITTING/DRILLING PROGRAM
 BECKER ELECTRONICS MANUFACTURING SITE

AREA OF CONCERN	EXPLORATION TYPE	CEMENT/BENTONITE GROUT		PROTECTIVE CASINGS		CONTAINERIZATION	
		2-INCH WELL IN 4.0 INCH I.D. BORING (<50 FT BGS) (L.F.)	2-INCH WELL IN 6.0 INCH I.D. BORING (<50 FT BGS) (L.F.)	ABOVE GR. 4-INCH I.D. W/ LOCK DRAIN CONCRETE APRON (EA.)	OF DRILLING FLUIDS IN 55-G. DRUMS (EA.)	OF DRILLING CUTTINGS IN 55-G. DRUMS (EA.)	
	SHALLOW PIEZOMETERS						
NA	PZ-4	0	0	1	1	0	0
NA	PZ-6	0	0	1	1	0	0
NA	PZ-110	0	0	1	1	0	0
NA	PZ-112	0	0	1	1	0	0
NA	RECONSTRUCT ON-SITE WELLS						
NA	MW-04	0	50	1	1	0	0
NA	MW-05	0	50	1	1	0	0
NA	MW-06	0	50	1	1	0	0
NA	LOCATE ON-SITE WATER SUPPLY WELL	NA	NA	NA	NA	NA	NA
NA	OPTIONAL TEST PITTS	NA	NA	NA	NA	NA	NA
TOTALS:		0	650	24	34	0	0

SECTION 2

obtaining necessary equipment during different phases of field activity (at initiation of drilling/source work and well sampling). We will hold field team orientation meetings to familiarize all personnel with the site history, health and safety requirements, and field procedures to comply with Occupational Safety Health Administration (OSHA) and ABB-ES requirements; we will reorient as necessary throughout the field program. Equipment mobilization will include, but is not limited to, setup of the following:

- site office trailer
- subcontractor(s) equipment and supplies
- utilities (electricity, telephone, portable toilet, potable water supply)
- sampling equipment and supplies
- health and safety equipment and supplies
- central decontamination pad for heavy equipment

NYSDEC is responsible for obtaining all easements and rights-of-way or other real property rights necessary to allow ABB-ES and its subcontractors access to all planned and previously completed sampling locations prior to initiating field activities. ABB-ES will identify and obtain any required licenses and permits and complete any associated applications with the assistance of NYSDEC. During mobilization, ABB-ES will mark all planned intrusive exploration locations with stakes and/or paint, and then notify the Underground Facility Protection organization (UFPO) (telephone number 1-800-962-7962) to obtain utility clearances for the planned intrusive exploration locations. Utility clearance by the UFPO is performed in three full work days from the date of notification. Permits that may be required for the site include written permission for use of a potable drilling water source (such as a hydrant).

Mobilization activities are anticipated to commence in early June 1994, following NYSDEC approval of the Detailed Work Plan and issuance of the Notice to Proceed. We anticipate that a NYSDEC representative will be on site for all major field activities. This will allow timely communication, facilitate input from the NYSDEC on day-to-day field activities, and encourage a "team" approach to the conduct of work. Based on timely review of geophysical and other field data (such as packer test [PT] results and photoionization detector [PI] meter screening results), ABB-ES field and office personnel will design final test pit excavation and final monitoring well locations and well screen depths. ABB-ES and NYSDEC project

ABB Environmental Services

managers will concur on field decisions as well as any field changes to the program after appropriate technical verification(s).

2.3.1.2 Health and Safety. A site-specific HASP is provided as Appendix C. Based on available site information, ABB-ES anticipates that all sampling activities will be performed at Level C dermal protection. Should site conditions pose a threat to ABB-ES, its subcontractors, or other on-site representatives, and/or should site conditions warrant an upgrade from Level C to Level B (as defined by the HASP), work will be discontinued and the situation reevaluated by NYSDEC and ABB-ES. ABB-ES will regularly monitor air quality at each sampling location for total volatile organic compounds using a PI meter equipped with a 11.6 electron-volt (eV) or similar bulb energy suitable for detection of 1,1,1-TCA. Potential combustible atmospheres will be monitored during subsurface activities using an oxygen/lower explosive limit (O₂/LEL) meter. Total suspended particulates will be monitored during site activities using respirable dust monitors. Particulate measurements will be recorded once every two hours at each of three monitoring locations. The procedure for conducting the particulate monitoring is described in the site-specific HASP, Subsection 3.1.4.1 and in Appendix B-4 of the site-specific HASP. Data from these monitoring devices will determine the appropriate level of protection for on-site workers and the surrounding community as described in the HASP.

2.3.1.3 Decontamination. Sampling methods and equipment for this field program have been chosen to minimize decontamination requirements and lessen the possibility of cross-contamination. Disposable personal protective equipment (PPE) and sampling tools will be containerized on-site in Department of Transportation (DOT) approved 55-gallon containers. Drill rig and backhoe decontamination will be performed at a central decontamination area to be located on the site.

Decontamination methods and materials are discussed in detail in the Program QAPP, Section 4.3, (ABB-ES, 1994). Drilling and sampling equipment will be steam cleaned prior to use at the site and between sampling locations. Polyvinyl chloride (PVC) well construction materials will be steam-cleaned prior to well installation. Drilling equipment will be decontaminated prior to leaving the site. The decontamination fluids from steam cleaning will be allowed to flow onto the ground at the central decontamination pad.

Non-disposable sampling equipment will be decontaminated between samples by scrubbing with potable water and Liquinox® detergent, potable water rinse, and a

SECTION 2

final rinse with deionized water. Small equipment decontamination fluids will be containerized.

DOT approved 55-gallon containers filled with IDW during the field procedures will be staged on-site in an area designated by NYSDEC. Containers will be labeled as described in the site-specific QAPjP (Appendix B).

2.3.1.4 IDW Containerization and Disposal. As a result of a Change Notification Memorandum (CNM), ABB-ES expects to be tasked by NYSDEC to dispose 55-gallon containers of IDW (fluids, solids, and disposable materials) filled during Task 3. NYSDEC has established guidance for the collection and disposal of IDW from drilling operations (NYSDEC TAGM 4032 and proposed TAGM on Disposal of Contaminated Groundwater Generated During Remedial Investigations). Based on ABB-ES' understanding of these TAGMs, the following will be performed during Task 3:

- All disposable sampling materials, PPE, and small equipment decontamination fluids will be containerized for disposal.
- During spun-casing drilling, a tub with a set of baffles will be used to separate drill cuttings from drilling fluid. Air-rotary and air-hammer methods will use a cyclone to separate cuttings directly into 55-gallon containers. Drilling fluid and air will not be recirculated. All drilling fluid and drill cuttings from off-site borings will be containerized and brought back to the site in 55-gallon containers. If a PI meter reading from the drum headspace is less than 5 parts per million (ppm), the cuttings and drilling fluids will be disposed on the ground surface of the site at a location identified in the field and agreed to by ABB-ES and NYSDEC. For drill cuttings and fluids from on-site borings, the materials will be screened with a PI meter as they exit the borehole. If PI meter readings remain less than 5 ppm, the cuttings and fluid will be discharged to the ground surface at the borehole, with the restriction that the materials must not flow into any on-site ditches or surface water bodies. If PI meter readings of drill cuttings or fluid in any circumstance exceed 5 ppm, the materials will be containerized for disposal.

- Well development and purge water will be handled as above for drilling fluids (i.e., containerization for disposal if PI meter readings exceed 5 ppm; transport of liquids collected from off-site wells back to the site; potential on-site disposal through infiltration).

As part of the disposal process, ABB-ES will subcontract IDW transport and disposal subject to New York State regulations, including preparation of the hazardous waste manifest (if required). Subcontracting for disposal will occur when all materials are collected (at completion of Task 3). ABB-ES will sign hazardous waste manifest (Figure 2-1) representing NYSDEC. The State of New York Hazardous Waste manifest specifically states that NYSDEC is the waste generator. In agreeing to sign the manifest; however, ABB-ES has developed a standard methodology for preparing the manifests for signature. ABB-ES' four part procedure is summarized below.

- An analysis will be performed to ascertain whether the Resource Conservation and Recovery Act (RCRA) Land Disposal Regulations apply to the waste being disposed or to meet the requirements of the IDW transport/disposal subcontractor to determine costs.
- Disposal options for liquid IDW may include on-site treatment, such as use of Carbtrol® (activated carbon treatment). This may be selected with the approval of NYSDEC.
- NYSDEC will authorize in writing ABB-ES to sign a manifest representing NYSDEC, allowing the transport of the waste.
- ABB-ES will prepare back-up files for all manifests including: completed waste profile sheets, actual or potential destination, and back-up data (e.g., laboratory analyses).

2.3.2 Baseline Air Monitoring

The objective of the baseline air monitoring program in the Phase II RI is to assess: (1) atmospheric migration as a potential contamination pathway; (2) risk to potential receptors from airborne contaminants; and (3) site conditions for health and safety purposes. The air monitoring program includes both qualitative and quantitative analyses of USEPA Target Compounds List (TCL) VOCs (USEPA Method TO-14 target compounds) plus the tentative identification of 10 additional compounds. In

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS SUBSTANCES REGULATION
HAZARDOUS WASTE MANIFEST
P.O. Box 12823, Albany, New York 12212

Please print or type. Do not staple.

Form Approved OMB No. 2350-0025 Expires 9-30-91

In case of emergency or spill immediately call the National Response Center (800) 424-9303 and the N.Y. Dept. of Environmental Conservation (609) 457-7362.

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator's US EPA No. N Y 18 19 12 16 15 13 15 11 18 11 10 10 178		Manifest Document No. 178		2. Page 1 of 1 information in the shaded areas is not required by Federal Law.	
3. Generator's Name and Mailing Address NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION 59 Wolf Road, Albany, NY 12233				A. State Manifest Document No. NY 18 151850 8		B. Generator's ID. BECKER ELECTRONICS MANUFACTURING SITE	
4. Generator's Phone (518) 457-9279				Attn: Leah Dolata		C. State Transporter's ID No. 102727	
5. Transporter 1 (Company Name) GOODWILL TRANSPORT				6. US EPA ID Number P 18 10 18 12 12 16 15 18 15 10		D. Transporter's Phone (800) 240-3818	
7. Transporter 2 (Company Name):				8. US EPA ID Number:		E. State Transporter's ID:	
9. Designated Facility Name and Site Address LDC, INC. Highway 1523 Calvert City, Kentucky 42029				10. US EPA ID Number KY 10 10 18 12 14 13 18 18 117		F. Facility's Phone (606) 306-3112	
11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number) RCR Hazardous Waste Solids X.O.S. (OSX-E) 805128				12. Containers No. Type 1 15 55GAL		13. Total Quantity 15.00	
14. Special handling instructions and Additional information Other Waste Numbers: F003, F005 Delivery: 10-25-89				15. Generator's Certification: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packaged, marked and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations. If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the appropriate method treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment OR if I am a small generator, I have made a good faith effort to minimize my waste and select the best waste management method that is available to me and that I can afford.		16. Handling Codes for Wastes Listed Above a. <input type="checkbox"/> b. <input type="checkbox"/> c. <input type="checkbox"/> d. <input type="checkbox"/> e. <input type="checkbox"/> f. <input type="checkbox"/> g. <input type="checkbox"/> h. <input type="checkbox"/> i. <input type="checkbox"/> j. <input type="checkbox"/> k. <input type="checkbox"/> l. <input type="checkbox"/> m. <input type="checkbox"/> n. <input type="checkbox"/> o. <input type="checkbox"/> p. <input type="checkbox"/> q. <input type="checkbox"/> r. <input type="checkbox"/> s. <input type="checkbox"/> t. <input type="checkbox"/> u. <input type="checkbox"/> v. <input type="checkbox"/> w. <input type="checkbox"/> x. <input type="checkbox"/> y. <input type="checkbox"/> z. <input type="checkbox"/> AA. <input type="checkbox"/> AB. <input type="checkbox"/> AC. <input type="checkbox"/> AD. <input type="checkbox"/> AE. <input type="checkbox"/> AF. <input type="checkbox"/> AG. <input type="checkbox"/> AH. <input type="checkbox"/> AI. <input type="checkbox"/> AJ. <input type="checkbox"/> AK. <input type="checkbox"/> AL. <input type="checkbox"/> AM. <input type="checkbox"/> AN. <input type="checkbox"/> AO. <input type="checkbox"/> AP. <input type="checkbox"/> AQ. <input type="checkbox"/> AR. <input type="checkbox"/> AS. <input type="checkbox"/> AT. <input type="checkbox"/> AU. <input type="checkbox"/> AV. <input type="checkbox"/> AW. <input type="checkbox"/> AX. <input type="checkbox"/> AY. <input type="checkbox"/> AZ. <input type="checkbox"/> BA. <input type="checkbox"/> BB. <input type="checkbox"/> BC. <input type="checkbox"/> BD. <input type="checkbox"/> BE. <input type="checkbox"/> BF. <input type="checkbox"/> BG. <input type="checkbox"/> BH. <input type="checkbox"/> BI. <input type="checkbox"/> BJ. <input type="checkbox"/> BK. <input type="checkbox"/> BL. <input type="checkbox"/> BM. <input type="checkbox"/> BN. <input type="checkbox"/> BO. <input type="checkbox"/> BP. <input type="checkbox"/> BQ. <input 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17. Transporter 1 (Acknowledgment of Receipt of Materials) Printed/Typed Name: Keith Shortleave Signature: Keith Shortleave Mo. Day Year: 10/24/89				18. Transporter 2 (Acknowledgment of Receipt of Materials) Printed/Typed Name: Signature: Mo. Day Year: 10/27/89			
19. Discrepancy Indication Space				20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in item 19. Printed/Typed Name: Steve York Signature: Steve York Mo. Day Year: 10/25/89			

EPA Form 5700-22 (Rev. 9-88) Previous editions are obsolete.

COPY 5—Generator—mailed by TSD facility

FIGURE 2-1
EXAMPLE OF NEW YORK STATE HAZARDOUS WASTE MANIFEST
BECKER ELECTRONICS MANUFACTURING SITE
EAST DURHAM, NEW YORK

addition, the air monitoring program includes screening evaluation of semivolatile organic compounds (SVOCs) at the site, consisting of the quantitative analysis of 17 polynuclear aromatic compounds using National Institute of Occupational Safety and Health (NIOSH) Method 5506.

USEPA Method TO-14 generally is capable of achieving detection limits of approximately 0.1 parts per billion (ppb). Measured VOC concentrations will be compared to the acceptable ambient levels (AALs) found in the "Air Guide 1" guidance document published by NYSDEC. The VOC detection limit will enable samples which are reported to be "below detectable limits" to be confirmed below NYSDEC AALs for target VOCs. There are a very limited number of VOC species that have an AAL below the analytical detection limit of Method TO-14 (e.g., vinyl chloride); these compounds are not target compounds at Becker, based upon previous soils and water sampling data. Method TO-14 represents a generally accepted sampling and analytical technique for the determination of trace levels of toxic organic compounds in the ambient air.

NIOSH Method 5506 for SVOCs is more representative of a screening technique; however, achievable detection limits are low, ranging from approximately 0.0007 to 5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Most of the target SVOCs in the NIOSH screening method do not have designated NYSDEC AALs; however, for those SVOCs that do have an AAL, the anticipated detection limits of the proposed method will be adequate to demonstrate that samples reported as "below detectable limits" are also below the AAL guideline.

To meet the project objectives, one sampling event, eight hours in duration, will be conducted prior to intrusive activities. Four sampling stations will be established for the event: one station upwind (background designated as LG-101) and three stations at or downwind of source areas (designated as LG-102 through LG-103) at the site (i.e., the waste pile/septic system no. 2; septic system no. 3; and the chemical storage building area). Station placement will be determined based on information from a portable meteorological monitoring (met) station set up and operating at the site for at least 24 hours prior. One duplicate VOC and SVOC sample will be collected at one of the downwind locations for quality control precision analysis.

For the sampling event, monitoring for both VOCs and SVOCs will be conducted over an 8-hour period at each sampling location. Sampling for VOCs will be conducted using passivated stainless steel "SUMMA" canisters in accordance with

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USEPA Method TO-14 as found in the "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air" (USEPA/600/4-89/017). Sampling for SVOCs will be performed using XAD-2 polymer sorbent tubes with pre-filters and personal sampling pumps in accordance with NIOSH Method 5506 as found in the NIOSH Manual of Analytical Methods. The following samples will be collected.

SAMPLE SOURCE	VOC SAMPLES	VOC TENTATIVELY IDENTIFIED COMPOUNDS	SVOC SAMPLES
Upwind (LG-101)	1	0	1
Downwind (source LG-102 through LG-104)	3	2 ¹	3
Duplicate	1	0	1
Trip Blank	1	0	1
Field Biased Blank	0	0	1
TOTAL	6	2	7

The two downwind samples with the highest total VOC content will be analyzed for tentatively identified VOC compounds.

Procedures for selecting sampling locations and air monitoring methodologies for VOCs and SVOCs are discussed in the following sections.

2.3.2.1 Selection of Sampling Locations. A portable met station will be set up on site and will operate at least 24 hours prior to selecting sampling station locations unless acceptable meteorological wind speed and direction data can be obtained from a local weather station. The met station will be erected between 10 and 20 feet above the ground (e.g., on top of a field trailer) in a secure location as free from wind obstructions and interferences as possible and accessible to the on-site ABB-ES scientist. The met station will be used to evaluate wind speed temperature and wind direction during sampling. A paper data logger will be used to provide a running

hard copy of the data for future use. Prior to its operation, the met station's sensors will be aligned and calibrated using a compass.

A portable PI meter with an 11.7 eV bulb (sensitive to 1,1,1-TCA) will be used to screen potential station locations to determine if any "hot spots" exist.

Selection of the sampling stations will be based on the prevailing wind data determined with information from both present meteorological conditions as well as available weather predictions by local weather stations, and with PI meter information. During sampling, if a sustained (one hour or more) wind direction shift is noted that will potentially affect the quality of the sample being collected, the sampling equipment will be temporarily shut down and the sampling stations relocated. The relocation of sampling equipment during a sampling event is to be avoided because of the increased potential for contamination during the additional handling of the equipment and the media.

Favorable ambient conditions must be present for sampling to take place (i.e., ambient temperature above 50 degrees Fahrenheit and no precipitation), to optimize the collection of airborne VOCs and SVOCs.

2.3.2.2 VOC Sampling Procedures. Sampling and analysis for VOCs will be conducted in accordance with USEPA Method TO-14. Air samples will be collected in SUMMA canisters arriving from the designated laboratory pre-cleaned and evacuated to a vacuum of approximately 30 inches of mercury. Flow controllers will be used to regulate the flow of air into the SUMMA canister to enable the collection of samples integrated over a period of 8 hours. A flow rate of approximately 8 milliliters per minute will be used to allow for a target volume of 4 liters to be collected per test over the 8-hour period. A SUMMA canister is 6 liters in size; collecting a 4 liter sample allows for a margin of safety. The flow controllers will either arrive pre-calibrated or calibrated on-site using a glass soap film-type flowmeter.

A pressure/vacuum gauge will be used on site to verify and record the initial vacuum on each canister prior to use. At each sampling location, a 5-foot stake pounded approximately one half-foot into the ground will be used to secure the sampling equipment about four feet off the ground. A SUMMA canister equipped with a flow controller will be secured to the stake. At the start of the sampling period, the valve to the canister will be opened. At the completion of the 8-hour test period, the valve

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to the canister will be closed and the canister removed from the stake. The final vacuum on the canisters will be checked and recorded after completion of the sampling event.

After the completion of sampling, the canisters will be shipped under chain of custody documentation to the designated laboratory for analysis. They will be analyzed by gas chromatography/mass spectrometry (GC/MS) for the USEPA Method TO-14 target compound list of VOCs. The approximate detection limit of this method is 0.1 parts per billion (ppb). In addition to the target compound list, tentative identification of 10 unknown peaks will be conducted on two VOC canisters collected. The two canister samples with the highest VOC concentrations detected will be subjected to the additional tentative compound identification analysis.

2.3.2.3 SVOC Sampling Procedures. Sampling and analysis for SVOCs will be conducted in accordance with NIOSH Method 5506. This method involves the collection of gaseous and particulate SVOC samples using an XAD-2 polymer sorbent tube with a pre-filter and a personal sampling pump. An electronic soap film flow meter will be used to calibrate each pump both before and after each sampling event. Calibrations will be performed using a "dummy" XAD-2 tube and prefilter to simulate sampling conditions. The flow rate of the pumps will be set to approximately two liters per minute; exact flow rates will be obtained from the calibration data. With the sampling period of 8 hours, the target sample volume is 1,000 liters.

Each pump will be calibrated immediately prior to use. At each sampling location, a pump should be attached to the stake used for the SUMMA canister. An XAD-2 tube will then be opened by snipping the glass ball off each end. The tube and prefilter will then be attached to the pump using a short piece of Tygon tubing. The personal sampling pump will be turned on and set to run for an 8-hour test. At the completion of the 8-hour test period, the pump will be shut off. The XAD-2 tube and the pre-filter will be removed from the pump apparatus, capped at each end, wrapped in aluminum foil, labeled, and placed in a cooler on ice. Each pump will be post-calibrated immediately following the sampling event.

The XAD-2 tubes and pre-filters will be shipped under chain of custody documentation to the designated laboratory for analysis. The laboratory will analyze the samples for the 17 target SVOCs by gas chromatography with flame ionization detection. The approximate detection limit for this method is between

0.0007 micrograms per cubic meter $\mu\text{g}/\text{m}^3$ to $5 \mu\text{g}/\text{m}^3$. The concentrations measured in the downwind samples will be compared to the upwind sample to evaluate the impact of the site on local air quality, as well as the potential for off-site migration. The measured VOC and SVOC concentrations will be compared to the NYSDEC Air Guide-1 AALs for each applicable compound.

2.3.2.4 Health and Safety Monitoring. During investigative activities, air monitoring will be performed with field instruments to monitor site conditions for health and safety purposes. Air monitoring will be performed with: (1) a PI meter using an 11.7 eV bulb (sensitive to 1,1,1-TCA); (2) color indicator/reactive Draeger tubes; (3) a dual oxygen meter/lower explosive limit meter; and (4) an aerosol/dust particle monitor. Use of these instruments and health and safety action levels are described in the HASP (see Appendix C).

2.3.3 Surface Geophysical Survey

Magnetometry and terrain conductivity will be used to investigate the site (see Table 2-1 and Figure 1-2). Surface geophysical surveys will be conducted by ABB-ES geophysicists at personal protection Level D; magnetometer and terrain conductivity survey procedures are detailed in the QAPP.

The magnetometer survey, covering the waste pile area, will be conducted to evaluate whether the debris piles contain buried metallic debris or waste containers. The magnetometer survey will use a vertical gradiometer capable of vertical gradient and total field measurements.

The terrain conductivity survey will be performed to attempt to map the location of the septic system no. 2 leachfield, which received industrial wastewater. Discharged wastewater contained potentially significant concentrations of phosphate salts and caustic soda and waste solvents. The terrain conductivity survey will be conducted with a data logger capable of inphase/quadrature measurements.

Magnetometer and terrain conductivity data will be collected at nodal points on a 10-by-10-foot grid covering the waste pile area. Deliverables for these surveys will consist of contour maps annotated with the interpretation of any pertinent information (i.e., potential buried debris, leachfield boundaries, debris pile, or surficial metal locations), and electronic data records.

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An optional geophysical task is to perform a limited ground-penetrating radar (GPR) survey at the waste pile area to further investigate anomalies, or at the chemical storage building to explore for potential USTs. A GPR survey would be performed before test pitting in these areas. If the optional work is needed, it will be specified in a CNM between ABB-ES and NYSDEC.

2.3.4 Fracture Trace Analysis

Fracture trace analysis will be performed prior to drilling activities. Fracture trace analysis activities to be performed will consist of the following:

- Existing aerial photos of the site will be reviewed in stereo to identify lineaments or other geomorphological features that may represent surficial expressions of major subsurface fracture systems or faults. This information will be transferred onto a regional map showing the location of the site.
- Existing geologic reference material (reports and maps) will be reviewed for information relating to faults or fracture orientations near the site.
- An ABB-ES geologist will visit the site to collect geologic data. The data collection to be performed will consist of mapping the locations of bedrock exposures, and using a Brunton® compass collect fracture and bedding plane strike and dip measurements, and describe the bedrock encountered. Work will extend from uphill of the site down to Catskill Creek, and along Catskill Creek.
- Upon completion of the bedrock mapping, the data collected will be entered into an IBM-computer format ASCII data file and evaluated using the Rose-PC 1.0 and Stereo 3.0 applications in the Rockworks® software package.
- Results of the aerial photograph survey, bedrock mapping, and fracture data analysis will be summarized onto a site base map indicating potential major-fracture locations in the vicinity of the site. This informational map will be used to locate bedrock monitoring well locations at and downgradient of the site.

2.3.5 Surface Water/Sediment Sampling

Surface water and sediment in ditches and the fire pond on-site will be sampled at five locations (designated as SW/SD-101 to SW/SD-105) for off-site laboratory analysis for TCL VOCs, SVOCs, and metals (see Table 2-1 and Figure 1-2). The purpose is to verify NYSDEC 1992 site sampling data which indicates that metals are not of concern and to better source identify/confirm the PAHs and phthalates found in the drainage ditches and soils during the Phase I RI. To fill a data gap in the ecological assessment, an additional surface water/sediment sample pair (SW/SD-106) will be collected from a low wetland area off the northern corner of the property near septic system no. 3, for laboratory analysis for TCL VOCs, TCL SVOCs, and Target Analyte List (TAL) metals. The six total sediment samples will also be analyzed for TOC. During sample collection, surface water pH, temperature, conductivity, and turbidity will be measured. PI meter (headspace) readings of the water and sediment samples will be performed to screen the samples for the presence of VOCs. Surface water sampling will be performed at dermal personal protection Level C. Surface water and sediment sampling procedures are detailed in the QAPP.

2.3.6 Test Pitting

The test pit exploration program will consist of excavations in the waste pile (TP-101 to TP-112), the septic system no. 2 leachfield (TP-113 to TP-117), and chemical storage building areas (TP-118 to TP-112) (see Table 2-1 and Figure 1-2). Test pitting will be performed to: (1) assess the thickness of, and sample any, debris or visually contaminated soil horizons; (2) assess the thickness of overburden; and (3) allow for detailed observation of geologic materials or buried debris or objects (such as USTs or drums) that might be encountered. Test pit excavation and logging is detailed in the QAPP.

A subcontractor will excavate test pits under the direction of ABB-ES. The work will proceed at a minimum of dermal personal protection Level C. The excavator equipment will include a tracked backhoe capable of excavating to 10 or more feet bgs, with a front-end loader or dozer blade for backfilling explorations. Work will be performed with readiness to upgrade to respiratory personal protection Level C. If conditions warrant upgrading to personal protection Level B, or if waste containers are encountered, work will be halted on the excavation and NYSDEC will be notified. One sample per test pit will be collected for TCL VOCs, SVOCs, and

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metals analysis. Two debris composite samples will be collected for TCLP laboratory analysis as described in Table 2-1. Test pit excavation and soil logging procedures are detailed in the QAPP.

The test pit and laboratory subcontracts include an option to complete additional test pitting activities and sample analyses if needed to assess the extent of contamination in site source areas. If the optional work is needed, it will be specified in a CNM between ABB-ES and NYSDEC. The reason for including an option for additional test pits and samples is to allow for the subcontractors to be available at reasonable cost should conditions warrant more investigation than currently anticipated.

2.3.7 Water Table Monitoring Well/Piezometer Installation

Six water table monitoring wells in overburden or bedrock will be installed in site source areas (the waste pile [MW-102S], septic system no. 2 [MW-103], septic system no. 3 [MW-104 and MW-105S], and chemical storage building [MW-106S and MW-107] areas) to assess the nature and distribution of groundwater contamination (see Table 2-1 and Figure 2-1). One additional upgradient water table monitoring well (MW-101S), two downgradient on-site water table piezometers (PZ-4 and PZ-6), and two downgradient off-site water table piezometers (PZ-110 and PZ-112) will also be installed. Where possible, the water table installations are paired with new or existing bedrock monitoring wells to assist in interpreting site hydrogeology (interpreting vertical flow gradients and shallow groundwater flow directions). This effort is essential because the shallow groundwater system in overburden at the site is perched (not hydraulically connected to the bedrock groundwater system), and the Phase I RI demonstrated that shallow groundwater contains VOCs. An understanding of the hydrologic connection between shallow groundwater and bedrock groundwater is needed to assess effective groundwater remedial alternatives in the FS.

Shallow monitoring wells/piezometers will be constructed of 2-inch PVC well construction material in the borings by a drilling subcontractor under the direction of ABB-ES as specified in the QAPP. PVC well materials will be used in shallow groundwater monitoring wells (screened in overburden or bedrock) unless field evidence (PI meter readings, odors, or other field observations) suggest the presence of significant contamination. If significant contamination is suspected through field observations (color, odor, PI meter readings), stainless steel well materials will be used. The borings will be drilled using 4-inch inside diameter (ID) spun casing and

reaming or by air-rotary or air-hammer methods to a depth eight feet into the static water table. The wells and piezometers will have 10-foot long, 0.006-inch slotted, schedule 40 screens and schedule 40 riser. A fine-graded filter pack will be installed from a minimum of 2 inches below the screen to two feet above the top of the screen. Above the sandpack, the remaining annulus will be backfilled with bentonite pellets or bentonite slurry. The installations will be completed with a locking, protective casing cemented in place over the riser stickup. All drilling water and soil cuttings collected from the boring will be collected and disposed as detailed in Subsection 2.3.1. Drilling will occur at a minimum of dermal personal protection Level C.

2.3.8 Bedrock Borings and Borehole Geophysical Survey

Bedrock borings will be drilled at 10 locations on and downgradient of the site for the installation of monitoring wells (see Subsection 2.3.9). One bedrock boring will be installed upgradient of the site; five will be installed at site source areas; and four will be installed downgradient of the site to assess the nature and distribution of bedrock groundwater contamination (see Table 2-1 and Figure 1-2). As noted in Subsection 2.3.7, some bedrock monitoring wells will be collocated with water table monitoring wells (MW-101S, MW-102S, MW-105S, and MW-106S) and piezometers (PZ-4, PZ-6, PZ-110, and PZ-112), to aid in assessing the vertical extent of contamination and vertical hydraulic gradients in the vicinity of the site. The final locations of all bedrock borings will be chosen based on results of a field fracture trace analysis during the week of mobilization (see Subsection 2.3.4). A subcontractor will drill bedrock borings under the direction of ABB-ES. Rock coring will not be performed unless requested by NYSDEC. The borings will be drilled by the following method:

- At each bedrock boring location, a 8-inch or 6-inch ID temporary spun casing will be advanced through the overburden and seated into unweathered bedrock (estimated to be encountered within 15 feet bgs at most boring locations).
- Bedrock boring advancement will continue through the temporary casing using 6-inch air rotary drilling or 6-inch air hammer drilling to a completion depth of 65 feet bgs.

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- Upon completion of the 6-inch ID boring, the driller will develop the borehole by pumping and surging until development water quality parameters (pH, temperature, conductivity, and turbidity) stabilize.

Purge water and soil cuttings collected from the borings will be containerized. Drilling will be undertaken at a minimum of dermal personal protection Level C.

After borehole development, the borehole temporary casing will be capped and allowed to equilibrate for a minimum of 72 hours. After this time period, the casings will be uncapped and the boreholes will be logged to locate fractured zones likely to transmit groundwater, in lieu of rock core collection and core logging. ABB-ES geophysicists will perform logging at dermal personal protection Level C. Logging will effect a cost- and time-saving measure for the project, resulting in collection of data of similar use to that obtained by coring but without the use of drilling fluids (which might have to be containerized for disposal or might be lost during drilling and potentially recovered during well development).

Caliper, temperature, and fluid conductivity borehole geophysical tools will be used. Temperature logging is used to identify zones of fluid flow which are indicated by anomalous temperature readings. Fluid conductivity logging results are interpreted in a similar manner. Caliper logging measures the borehole diameter. Changes in diameter can indicate fracture zones. Logging results will be evaluated with real-time packer test data to place monitoring well screens. Borehole logging instead of bedrock coring will be used as a cost- and time-saving measure. Deliverables for the borehole logging will consist of paper and electronic records of logs, and interpretations of geologic conditions.

Geophysical logging will be performed on the 10 planned and three existing boreholes at the site. Logging the three existing boreholes (MW-04, MW-05, and MW-06) will allow for direct correlation of existing rock core, packer test results, and geophysical logs, and interpretation of data from uncored holes. Geophysical tools to be used include caliper, temperature, and fluid conductivity logging tools.

After a boring has been logged with the geophysical tools, it will be packer tested by the drilling subcontractor at 10-foot intervals to locate fracture zones. Packer testing is detailed in the QAPP. The packer test and geophysical logging results will be evaluated in the field by ABB-ES to select depths in the boreholes for well screen placement.

2.3.9 Bedrock Monitoring Well Installation and Existing Bedrock Well Reconstruction

Bedrock monitoring wells (MW-101D, MW-102D, MW-105D, MW-106D, MW-108, MW-109, MW-110, MW-111, MW-112, and MW-113) will be constructed in the 10 6-inch ID bedrock borings using 2-inch ID schedule 40 PVC well screen (10-foot long, 0.010 inch slot) and riser. Well construction is detailed in the QAPP. If the well screen is installed above the bottom of the borehole, cement/bentonite grout will backfill the borehole up to the selected screen depth. At the selected well screen depth, a medium graded silica sand filter pack will be installed, extending a minimum of two inches below the well screen to two feet above the well screen. Above the sand filter pack, a two-foot or larger bentonite pellet or slurry seal will be installed. The remaining annulus of the borehole will be backfilled with cement/bentonite grout. The well riser will extend three feet above the ground surface at each bedrock well location. An above ground, locked, protective casing will be installed over the well riser.

The three existing Phase I bedrock monitoring wells (MW-04, MW-05, and MW-06) at the site will be reconstructed to address concerns that the current "open hole" constructions do not provide representative samples and may behave as vertical contaminant migration pathways. ABB-ES will redesign the monitoring wells to sample discrete fractured intervals based on the packer test results in the Phase I RI and on borehole geophysical logging results (see Table 2-1). Reconstruction will begin by removal of the existing stainless well materials from the boreholes by the drilling subcontractor. The materials will be carefully disassembled and steam cleaned for reuse if possible. If the materials are not useable, they will be replaced with PVC. Upon removal of the well materials, the open boreholes will be redeveloped, and then allowed to reequilibrate for a minimum of 72 hours. At that time, the boreholes will be logged using the geophysical tools described in Subsection 2.3.8. Based on results of the Phase I PT results and the Phase II RI geophysical logging, ABB-ES will select depths for well screens. The reconstructed wells will be completed as detailed above for new bedrock monitoring wells.

The drilling subcontractor will install new and reconstructed monitoring wells under the supervision of ABB-ES. Well construction will be performed at dermal personal protection Level C.

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2.3.10 Monitoring Well Development

The 10 new bedrock monitoring wells, three reconstructed bedrock monitoring wells, and seven new shallow monitoring wells will be developed by the drilling subcontractor under the supervision of ABB-ES by pumping and surging techniques no sooner than 24 hours after grout placement. Well development water will be containerized for potential disposal as IDW. Well development will be considered complete when (1) turbidity measurements are 50 nephelometric turbidity units (NTUs) or less; (2) other parameters (temperature, conductivity, and pH) have been stabilized; and (3) a minimum of 1.5 times the volume of water estimated to have been lost during spun-casing drilling is recovered. Well development procedures are detailed in the QAPP.

2.3.11 Monitoring Well/Water Supply Well Sampling

One week after development of the new monitoring wells, ABB-ES will purge and sample for laboratory analysis the new and existing monitoring wells and inactive Becker water supply wells (see Table 2-1). Results of Phase II sampling of the existing wells will be compared to results of the Phase I RI. Shallow and deep bedrock monitoring well results will be evaluated to assess the vertical and horizontal distribution of contamination. Groundwater sampling will be performed as detailed in the QAPP. During purging, field measurements of pH, temperature, dissolved oxygen, conductivity, and turbidity will be performed. The groundwater samples will be analyzed for TCL VOCs. All new shallow wells will also be sampled for TCL SVOCs; all bedrock wells (including abandoned Becker water supply wells) will be sampled for TAL metals; and three selected source area bedrock wells will be analyzed for alkalinity, TSS, BOD, COD, and TOC. Hardness will be calculated from TAL metals results. At this time, one round of water level measurements will be taken from all wells and piezometers. Monitoring well sampling and water level measurements will be undertaken at dermal personal protection Level C.

2.3.12 Hydrogeologic Characterization

After the wells have been developed and sampled, rising and falling head hydraulic conductivity tests will be conducted for each well installed after the Phase I RI. Tests will use a pressure transducer, slug, and data logger. The data generated will be interpreted using Aqtesolv[®] software by a ABB-ES hydrogeologist. Slug testing is detailed in the QAPP.

Besides the initial round of water level measurements obtained during the well sampling effort, two additional rounds of measurements, taken monthly, will be performed to assess fluctuations in groundwater flow directions and gradients. Water level measurements will be conducted as described in the QAPP.

2.3.13 Exploration Location and Elevation Survey

A subcontractor to ABB-ES will conduct the exploration survey after all Task 3 sampling activities have been completed. Locations of all new monitoring wells, piezometers, test pits, and surface water and sediment samples will be surveyed. The exploration locations will be surveyed to the nearest-0.01 foot. Ground elevations will be surveyed to the nearest 0.1 foot. The horizontal positions will be tied into the coordinate system initiated during the Phase I RI; vertical positions are tied to mean sea level (MSL) as determined by the 1929 General Adjustment.

2.3.14 Ecological Characterization

A characterization of the ecological receptors that may be affected by contamination associated with the Becker site will be conducted. This characterization will provide a description of the different biological habitats that comprise the Becker study area, and of the wildlife species expected to be found associated with these habitats. This characterization will include required elements of the "Step 1 - Site Description" component of the "Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites" (NYSDEC, 1991), including the development of a map of the potentially affected habitat and a description of the potentially impacted ecological receptors.

The biological characterization will be based on a site reconnaissance, background information available for the site, literature information on the range and distribution of wildlife species, and interviews with local, state, and/or federal wildlife officials. The site reconnaissance will be performed by ABB-ES ecological assessment personnel during mobilization. The results of the ecological characterization will be used in the RI/RA report to prepare a cover map and a qualitative assessment of site contaminants.

An ecological characterization of the existing on- and off-site areas will be conducted. This characterization, which will include field-based and office-based components, will incorporate development of a covertype map from aerial photographs, and information obtained through contacts with various state and federal agencies, as well

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as during the site reconnaissance. In addition, major vegetative communities, aquatic communities, and their associated fish and wildlife communities will be identified.

This characterization will provide a baseline description of the site. If it is determined through the field biological survey that the identified coverts and fish and wildlife receptors could be impacted, more intensive biological studies will be conducted to evaluate potential adverse impacts. The NYSDEC TAGM "Habitat-Based Assessment Guidance Document for Conducting Environmental Risk Assessments at Hazardous Waste Sites" will be followed in performing the ecological characterization (NYSDEC, 1989).

Aquatic and terrestrial habitats within at least 0.5 miles of the site will be described in terms of habitat type (e.g., shrub swamp, forested upland, stream) and species composition. This description will include identification of typical plant species composition and density in each habitat type and, within aquatic habitats, measurement of chemical and physical parameters (e.g., dissolved oxygen, specific conductance, pH, temperature, stream width, depth, and flow rate, and substrate characteristics).

2.3.15 Miscellaneous Tasks

Miscellaneous tasks to be performed in completion of the RI are: (1) locating and opening the abandoned Becker no. 1 water supply well; (2) closing the three Becker water supply wells upon completing the RI/FS, if they are not part of any remedial plan; and (3) disposing of IDW. Subcontractors will perform these tasks under the direction of ABB-ES.

The abandoned Becker no. 1 water supply well will be located by excavating the water line from the edge of the building back to the well location by the test pit subcontractor under the supervision of ABB-ES. When the well is found, the excavation will be backfilled to the extent access to the well for sampling purposes can be performed. If necessary, a temporary wooden structure will be constructed around the well with a wooden access lid to allow for backfilling.

If required, the three Becker water supply wells will be properly abandoned at the end of Task 3. Well abandonment will be performed by the drilling subcontractor using acceptable procedures described in "Decommissioning Procedures" provided to

ABB-ES by NYSDEC (Malcom Pirnie, Inc., 1993) in accordance with appropriate NYSDEC TAGMS.

At completion of Task 3 sampling activities, all IDW will be disposed. As part of this task, a IDW subcontractor will be identified, and a detailed cost estimate prepared. Disposal of IDW may require additional laboratory analyses. IDW will be manifested for disposal as detailed in Subsection 2.3.1.4.

2.3.16 Laboratory Analysis of Samples and Resultant Data Validation

Laboratory analyses of soil, sediment, surface water, groundwater, and air samples will be performed by a NYSDOH Environmental Laboratory Approval Program certified laboratory subcontractor for CLP categories. This laboratory will adhere to all NYSDEC laboratory requirements, and will be monitored for compliance by an ABB-ES chemist.

Upon receipt of the laboratory analytical data, ABB-ES will validate the data using applicable NYSDEC and USEPA guidelines. The validated data and data useability report prepared by an ABB-ES chemist will be submitted to the NYSDEC for review with the Draft RI report. Analytical data will be summarized into a tabular format for use in the RI Report preparation.

2.3.17 RI/RA Report Preparation

Results of the Phase II RI field activities, a summary of previous activities and site history, a revised contamination assessment, contaminant fate and transport discussion, conceptual site model and the revised RA will be produced as a single document with supporting appendices. The results of the Phase II field investigation will be coupled with the existing Phase I RI data, interim remedial measures completed, IRM subsurface investigation data, and NYSDEC sampling data to prepare a final combined RI/RA Report. This report will assess the extent of source and groundwater contamination, contaminant fate and transport, and risks to receptors. The RI/RA Report will be used to complete the FS for the site.

2.3.17.1 Revised Contamination Assessment. The Phase I RI report will be revised to utilize the Phase II RI data in evaluating the extent of source and groundwater contamination. The revised RI will be prepared using appropriate USEPA and NYSDEC guidance documents. To the extent feasible, the nature and distribution

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of contaminated soil and groundwater will be identified as defined by existing SCGs. As part of the revised RI, contaminant fate and transport will be discussed and used to refine the site conceptual model described in Subsection 1.5 of this Detailed Work Plan.

2.3.17.2 Public Health Risk Assessment. Completion of the RA will be based on revision of the existing RA document prepared during the Phase I RI. Revision of the RA will include:

- assessment of air emissions as they affect on-site remediation workers or future on-site industrial workers (not a current or future residential exposure scenario), using the baseline air sampling results; and
- assessment of subsurface soil (treating the debris pile as "soil," not a unique media) contamination in source areas as it affects remediation workers or future industrial workers.

The public health RA will be a characterization of current and potential risks to the public health that could result if no further remedial action is taken. The public health RA will support the development and evaluation of remedial alternatives.

The public health RA will be prepared in accordance with the USEPA Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (HHEM) (USEPA, 1989) and HHEM Supplemental Guidance "Standard Default Exposure Factors" (USEPA OSWER Directive 9285.603).

The first step in completion of the revised public health RA is review of the chemicals of potential concern for which quantitative risk analyses were performed previously, compared to results of the Phase II RI.

The second step in completion of the public health RA will be reviewed for completeness of the identification and characterization of potential exposure pathways, receptors, and exposure concentrations. Based on available information, important exposure pathways appear to be: (1) direct contact with soil contaminants, and (2) consumption of potentially contaminated groundwater from private or public wells. Another possible route of exposure that will be examined is the inhalation of vapors originating from the site.

The data available should provide most of the exposure point concentrations necessary in the baseline RA; however, some estimation or modeling may be required. Any modeling will be conducted in accordance with RAGS (USEPA, 1989). The exposure concentrations will be compared to the ARARs and SCGs agreed upon with NYSDEC.

Human doses for the chemicals being considered for quantitative RA will be estimated using the exposure point concentration and appropriate standard human exposure assumptions (as provided in the HHEM and HHEM Supplemental Guidance). Other site-specific exposure assumptions as necessary will be developed and discussed with the NYSDOH and the NYSDEC Site Manager. This discussion of exposure pathways and assumptions will take place early in the RA process, to solicit focused NYSDEC and NYSDOH input, and to minimize revisions to the draft RA sections of the RI. The populations exposed will be evaluated, and the information derived from state and local officials regarding activities in the area will be summarized. Reference doses and cancer potency/slope factors will be identified. Target risk levels will be developed from available information and in agreement with NYSDOH and NYSDEC.

For an assessment of non-carcinogenic effects, the overall impact will be evaluated through the use of the Hazard Index (HI) approach described in the HHEM. For chemicals exerting similar toxic effects, the HIs for individual chemicals will be summed to represent the toxicity of the mixture. Non-carcinogenic effects of both systemic toxins and carcinogens will be evaluated.

For potential carcinogens, risks are evaluated as probabilities, as the carcinogenic potency factor represents an upper 95 percent confidence limit on the probability of response per unit intake over a 70 year lifetime. These values multiplied by the chronic daily intake result in an estimated risk at the given level of exposure. Risks associated with exposure to individual chemicals can be summed assuming additivity, to determine a total carcinogenic risk for a given pathway. If certain receptors could be exposed through more than one pathway, the risk associated with each pathway can be combined for the same chemical.

A target level refers to the concentration of a compound, in a particular medium, that is considered protective of public health if long-term exposure were to occur. If necessary, NYSDEC will be contacted regarding the availability and applicability of NYSDEC-generated chemical-specific target concentration levels. Based on

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results of the revised public health RA, preliminary target levels will be developed for contaminants of concern identified at the site. At locations where contaminants exceed their respective target levels, remedial actions may be required.

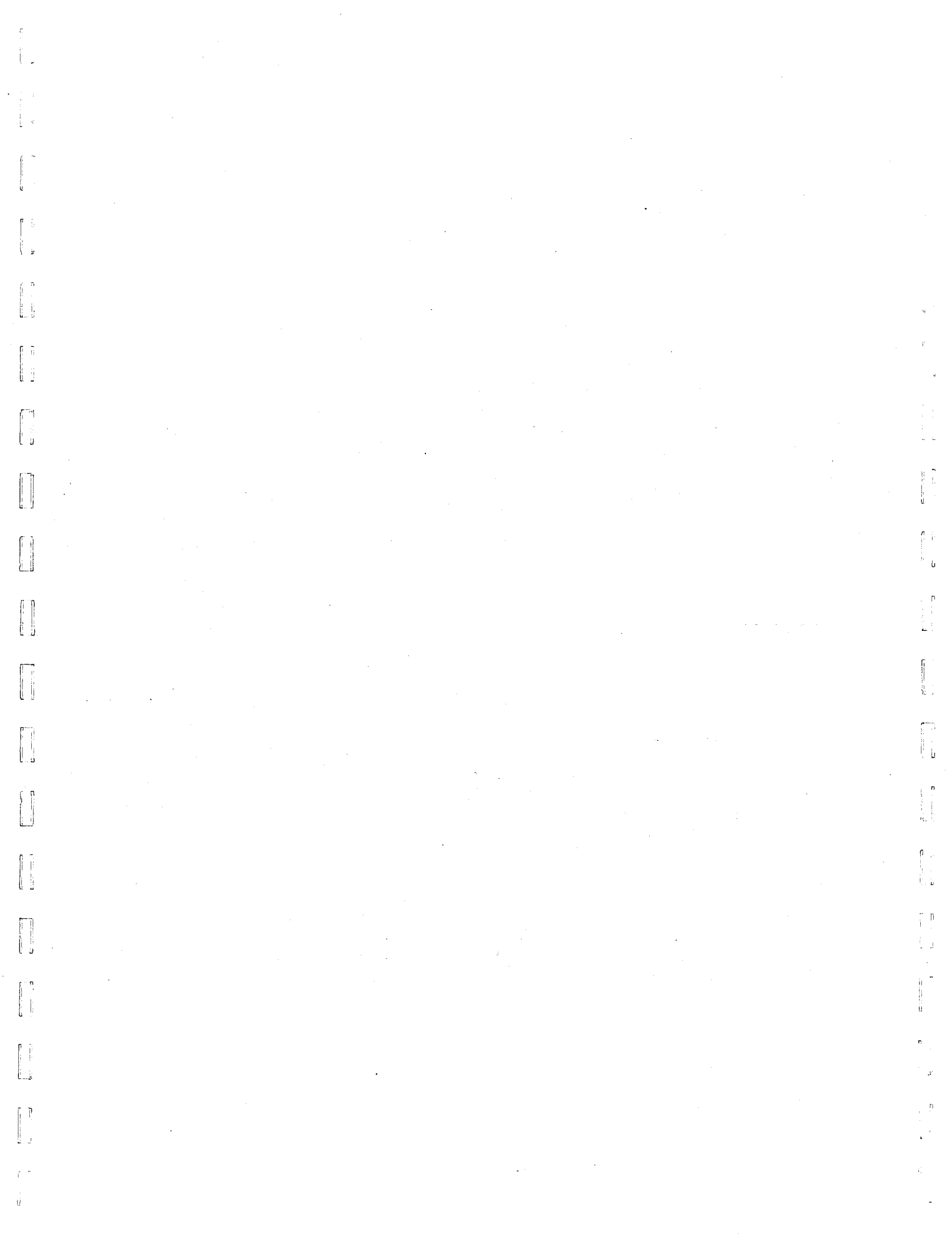
2.3.17.3 Ecological Evaluation. The ecological evaluation for the Becker will consist of preparation of a cover map and a qualitative assessment of site contaminants relative to site flora/fauna tolerance levels based on NYSDEC guidance. Based on discussions with NYSDEC, the Habitat-Based Assessment (HBA) for Becker will incorporate the requirements specified under Step I of the TAGM titled "Habitat-Based Assessment Guidance Document for Conducting Environmental Risk Assessments at Hazardous Waste Sites" (NYSDEC, 1989). Step I is "Description of the Existing Environment." As a change to the scope of this work assignment, Step II, "Hazard Identification", and Step III, "Impact Analysis," may be conducted if hazard thresholds identified in Step I are exceeded; Step IV may also be conducted to address monitoring requirements to be implemented following remediation.

The following scope of work addresses Step I of the HBA for Becker. This section includes a site description, resource characterization, and hazard threshold identification. These tasks will be conducted based on the results of a field biological survey as well as background information. A description of these components is presented below.

Site Description. The site description will include a discussion of the existing ecology of the site and adjacent off-site areas. This section will incorporate a vegetation covertype map, a discussion of special resources, and an assessment of aquatic and terrestrial habitats.

A vegetation covertype map showing New York State Natural Heritage covertypes within at least 0.5 miles of the site will be developed based on information presented in aerial photographs, USGS topographic maps, and other information. The covertypes presented on the map will be verified during the field biological survey of the site.

Special resources within 2 miles of the site and 9 miles downstream from the site will be identified. These include regulated wetlands, streams, lakes, significant or critical habitats, rare, threatened, or endangered species, and wild and scenic rivers. Information sources used to identify special resources will include: the New York



State Natural Heritage Program/Significant Habitat Program; the U.S. Fish and Wildlife Service; NYSDEC staff; and other sources as necessary.

Aquatic and terrestrial habitats within at least 0.5 miles of the site will be described in terms of habitat type (e.g., shrub swamp, forested upland, stream) and species composition. This will include identification of typical plant species composition and density in each habitat type.

Resource Characterization. This section will describe the fish and wildlife species in the habitats identified above, the general quality of the habitat, and any obvious manifestations of stress caused by chemical releases from the site.

The fish and wildlife species occurring within at least 0.5 miles of the site will be identified based on on-site observations of wildlife during the biological field survey, as well as information resources such as the New York Breeding Bird Atlas, discussions with fisheries and wildlife officials, and range and habitat information presented in the scientific literature.

The habitat types identified in the site description will be evaluated qualitatively based on their suitability for providing food and cover and meeting specialized habitat needs for fish and wildlife. Factors that can affect habitat suitability include: the regional and within-basin diversity of plant community types; plant species composition; extent of interspersed open water with vegetation; interspersed wetland types; stream substrate characteristics; and water chemistry and quantity.

Any obvious manifestations of stress related to the release of hazardous chemicals at the site observed during the biological field survey will be recorded. This may include areas of stressed vegetation (e.g., invasion of hardy species, mortality of existing species), or fish or wildlife mortality. It is important to note that, in many cases, effects to vegetation, fish, or wildlife are not obvious or cannot be conclusively correlated with the release of hazardous chemicals to the environment.

Hazard Threshold Identification. In this section, criteria, standards, statutes, regulations, and guidelines applicable to fish and wildlife will be summarized, and compared with conditions at Becker. Concentrations of chemicals reported in groundwater will be compared with Ambient Water Quality Criteria (AWQC) as a means of screening potential hazards to aquatic organisms at the points of

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groundwater discharge. Based on this comparison, a recommendation of whether Step II of the HBA (i.e., the hazard identification phase) is warranted will be made.

2.4 PHASE III FS REPORT PREPARATION (TASK 4)

Following completion of Tasks 2 and 3, ABB-ES and NYSDEC will finalize the list of groundwater remedial alternatives to be analyzed in detail in Task 4. A summary of M&E's prior Phase I and II FS (completed during Task 2 and submitted as a technical memorandum) will be included as a transition to the Phase III Report.

The Phase III FS Report will focus on groundwater remedial alternatives and will include the following: (1) a detailed description of each alternative, (2) an evaluation of each with respect to seven criteria, (3) a comparison of the alternatives to balance relative advantages and disadvantages of each with respect to these criteria, (4) a recommendation of a preferred alternative that best meets these criteria, and (5) a conceptual plan of the preferred alternative.

The following additional areas and media are being investigated further in the RI:

- debris pile area (debris, soil, shallow groundwater)
- septic system no. 2 (the industrial septic system, soil, shallow and bedrock groundwater)
- septic system no. 3 (the sanitary waste septic system, shallow and bedrock groundwater, surface water)
- chemical storage building area (soil, shallow groundwater)
- on-site drainages (surface water, sediment)

For these areas, no remedial alternatives were developed in the Phase I and Phase II FS report because sufficient data were not available. Preliminary remedial action objectives and alternatives will be identified for a source area if results of investigations in these areas indicate that remediation may potentially be required. The alternatives that would likely be evaluated in the FS would be no action and removal alternatives. Based on this preliminary evaluation, a recommendation for

the source area will be provided. Removal of a source area could be pursued as an IRM, if feasible.

Task 4 will be completed according to guidelines in the TAGM titled "Selection of Remedial Actions at Inactive Hazardous Waste Sites," (NYSDEC, 1990) and the USEPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988).

2.4.1 Detailed Analysis of Alternatives

The purpose of the detailed analysis is to present the relevant information required for decision makers to select a site remedy.

In the detailed analysis, ABB-ES will describe and evaluate each alternative. The description of each alternative will include, where appropriate: a site plan; volumes or areas of media affected; process flow diagrams; supporting literature data from bench-, pilot-, and full-scale demonstrations; modeling used to predict the performance of an alternative; projected life of a treatment system; and a projection of the extent to which an alternative will achieve the response objectives. Data collected in the RI will be used in evaluations and calculations for the various technical components of the alternatives. Fracture trace analysis information will be used to assist in locating potential bedrock extraction wells. Slug test data and existing pump test data will be used to determine groundwater pumping rates. These calculations will then be used to size and cost a potential treatment plant and determine the future operation and maintenance costs. Inorganics and other analytical information collected during groundwater sampling and analysis will be used to determine an appropriate metals removal process as a pretreatment step, if required. Other data from the RI will be used as needed. This information will be used to evaluate the feasibility and implementability of constructing and operating a groundwater treatment system. Following the description, each alternative will be evaluated with respect to the following criteria:

- compliance with State Promulgated Standards and Guidance Values (SPSGVs);
- protection of public health and the environment;
- short-term effectiveness;
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume;

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- implementability; and
- cost.

2.4.2 Compare Alternatives

A comparative analysis will be conducted to evaluate the relative performance of each alternative with respect to each evaluation criterion. Factors that discriminate the performance of the alternatives will be identified and balanced with respect to one another. Effectiveness and cost will be the main factors to formulate a preferred alternative, with preference given to alternatives that achieve response objectives at lower cost.

2.4.3 Recommend Remedy

In this subtask, ABB-ES will recommend a remedy from the list of evaluated alternatives. Only those alternatives that comply with SPSSGVs (through compliance or a waiver, if appropriate) and provide protection of public health and the environment will be considered. However, the alternative providing the best mix of advantages and disadvantages with respect to the evaluation criteria that is cost-effective will be considered as a preferred alternative. Preference will be given to alternatives that achieve permanent reduction of toxicity, mobility, or volume of hazardous wastes through treatment.

2.4.4 Prepare Conceptual Plan

Following selection of a remedy, ABB-ES will prepare a Conceptual Plan. This Conceptual Plan will include much of the same description presented in the detailed evaluation, a cost estimate (accuracy of -30 to +50 percent of actual), a proposed implementation schedule, and refinements to the identified alternative that may enhance its performance.

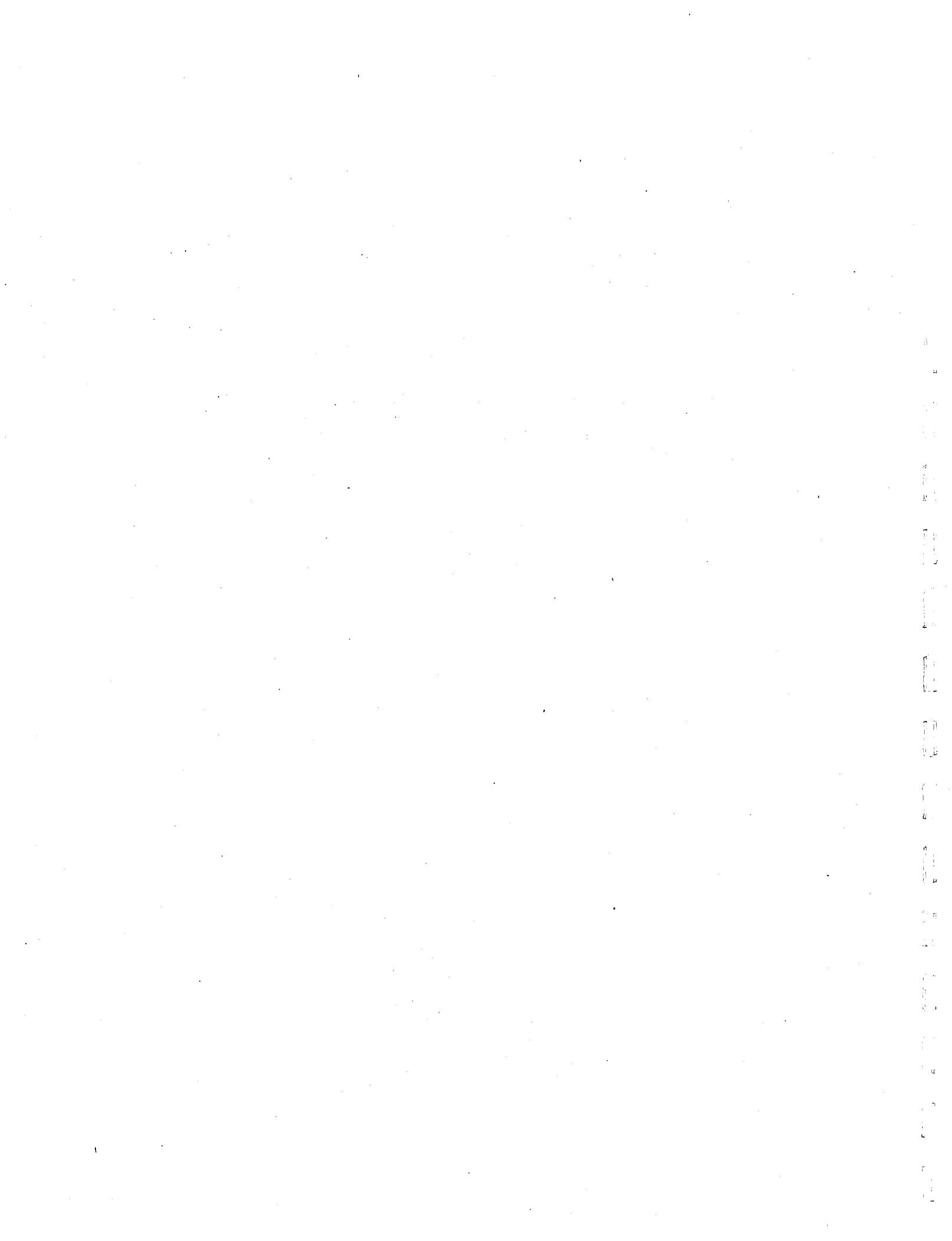
2.5 COMMUNITY RELATIONS SUPPORT (TASK 5)

Before initiating the Phase II RI field program, the NYSDEC will conduct a public meeting to propose the scope of Phase II to the community surrounding the site. To support this public meeting, ABB-ES will prepare graphics or slides as needed for the NYSDEC presentation.

After the draft final RI and FS Reports have been prepared, the NYSDEC will conduct a public meeting to present the findings of the RI and FS. In support of this meeting, ABB-ES will prepare graphics or slides as needed for the NYSDEC presentation. In addition, the ABB-ES Project Manager and FS lead will attend the meeting to support the NYSDEC.

2.6 FINAL RI/FS REPORT PREPARATION (TASK 6)

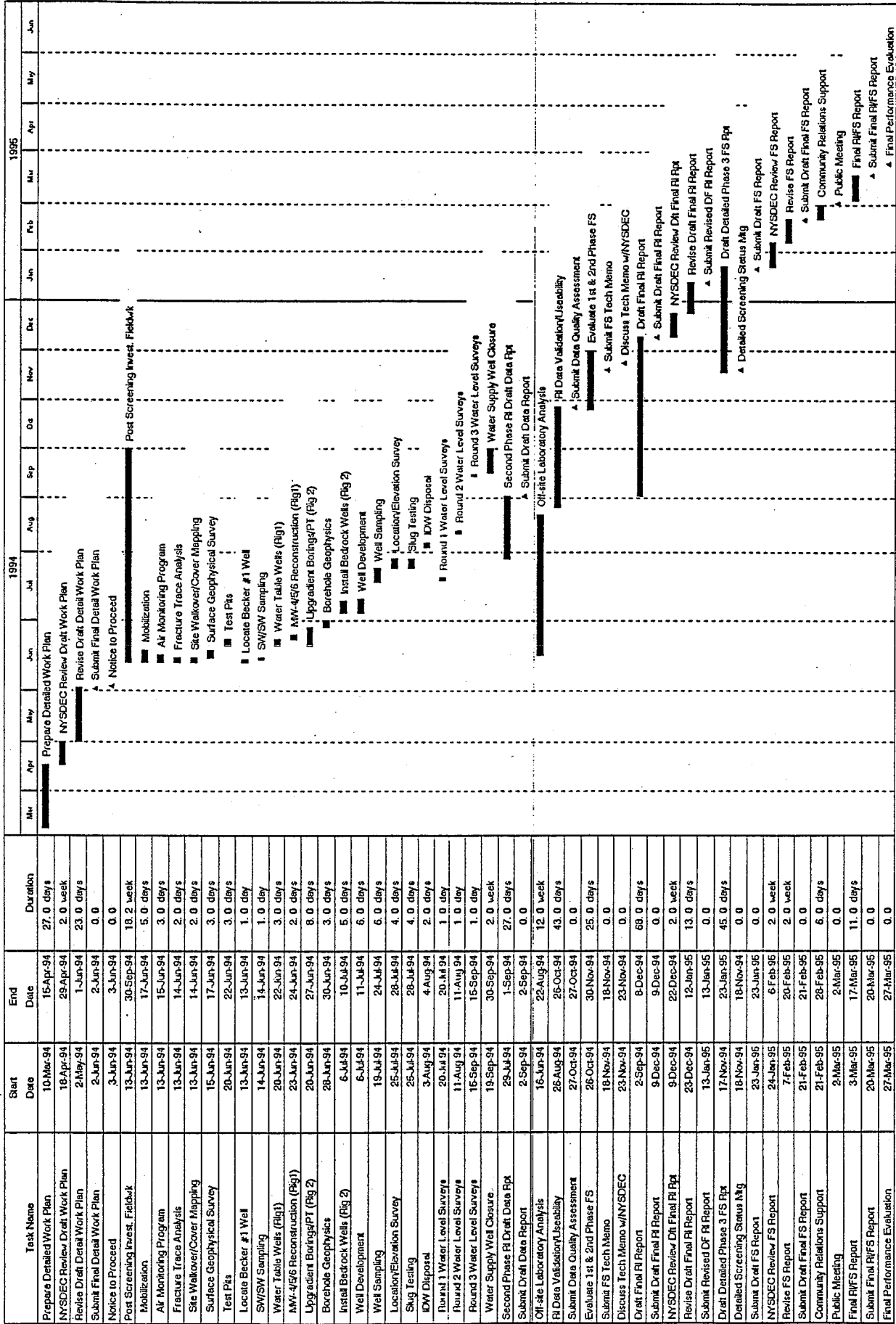
After the draft final RI and FS Reports prepared by ABB-ES have been subject to public review and comment, ABB-ES will finalize the two reports for public distribution.



3.0 PROGRESS SCHEDULE

We have prepared the following schedule (Figure 3-1) considering holidays and weekends and the NYSDEC's request the project be completed prior to May 1995.

FIGURE 3-1
BECKER ELECTRONICS MANUFACTURING SITE
WORK ASSIGNMENT D002472-15
PROGRESS SCHEDULE



4.0 STAFFING PLAN

ABB-ES presents the project organization for the Becker Work Assignment in Figure 4-1, and the proposed team in Table 4-1. In the Detailed Work Plan, we will submit resumes for any project team members not already approved by NYSDEC.

ABB-ES will provide the services from our corporate headquarters in Portland, Maine. Mr. William R. Fisher, P.E., Vice President, is the Corporate Officer directly responsible for all ABB-ES activities for this project. The NYSDEC Program Manager, Robert E. Handy, Jr., P.E., has overall responsibility to organize and set operating procedures with NYSDEC.

Mr. Handy is also the Becker Project Manager responsible for overall day-to-day project administration and is the primary point of contact for NYSDEC. As Project Manager Mr. Handy also:

- initiates project activities;
- identifies project staff, equipment, and other resource requirements;
- communicates with the NYSDEC on cost, contractual, personnel, and other administrative manners;
- monitors task activities and adjusts resources to maintain established budgets, schedules, and work programs;
- conducts regular briefings on the status of the project;
- prepares monthly reports showing both technical progress and cost status;
- maintains project technical and financial records according to the requirements of NYSDEC and ABB-ES; and
- identifies required subcontracting.

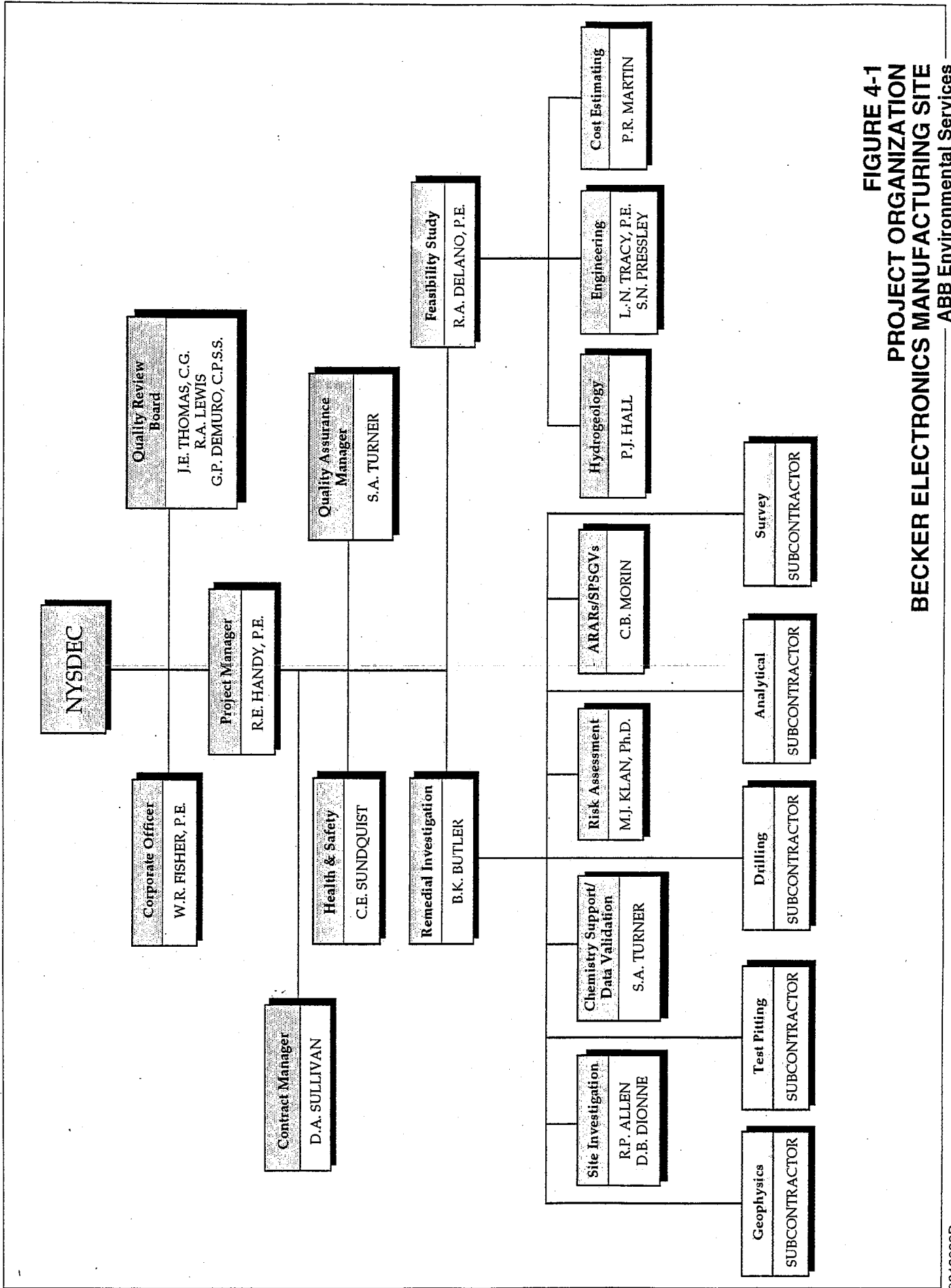


FIGURE 4-1
PROJECT ORGANIZATION
BECKER ELECTRONICS MANUFACTURING SITE
 ABB Environmental Services

**TABLE 4-1
PROJECT TEAM
BECKER ELECTRONICS MANUFACTURING SITE**

ABB ENVIRONMENTAL SERVICES PERSONNEL	JOB RESPONSIBILITY	NSPE GRADE LEVEL
William Fisher	Vice President	9
Richard Allen	Senior Consultant	8
Jerry DeMuro	Division Manager	8
Robert Handy	Senior Project Manager	8
Ronald Lewis	Senior Consultant	8
Elliott Thomas	Senior Consultant	8
William Weber	Senior Project Manager	8
Robert Burger	Senior Scientist	6
Peter Hall	Senior Scientist	6
Philip Martin	Senior Engineer	6
Cynthia Sundquist	Senior Scientist	6
Elizabeth Walter	Senior Scientist	6
Linda Healey	Senior Scientist	5
Mark Klan	Senior Scientist	5
Lyle Tracy	Engineer/Scientist	5
Steve Turner	Senior Scientist	5
Brian Butler	Engineer/Scientist	4
Anthony Delano	Engineer/Scientist	4
David Dionne	Engineer/Scientist	4
Cornelia Morin	Engineer/Scientist	4
Deborah Sullivan	Engineer/Scientist	4
Scott Calkin	Junior Engineer/Junior Scientist	2
Lauren Foster	Junior Engineer/Junior Scientist	2
John Hanley	Senior Technician	2
Thomas Hillman	Senior Technician	2
Shelley Pressley	Junior Engineer/Junior Scientist	2
Jennifer Frank	Technician	1
Bart Furey	Technician	1
Kathryn Lahey	Technician	1
Madeleine Winter	Technician	1

SECTION 4

Functional Task Leaders are responsible for all technical activities on the project, including communicating with the NYSDEC concerning technical matters and supervising the performance of the project staff and field subcontractors. Brian K. Butler is the RI lead and R. Anthony Delano, P.E., is the FS lead.

The Quality Review Board reviews the work as it progresses to provide an independent senior assessment of the completeness, consistency, and overall quality of the data and interpretations. Ronald A. Lewis (Senior Consultant in Hydrogeology), J. Elliott Thomas, C.G. (Senior Consultant in Geology), and Jerry P. DeMuro, C.P.S.S. (Division Manager) comprise the Review Committee.

4.1 COMMUNICATIONS

The ABB-ES PM will be the primary contact for NYSDEC and will be responsible for maintaining project documentation and facilitating communications between the Quality Review Board, the Health and Safety Coordinator, the Task Leaders, and the project staff. Project status reports and related information will be conveyed within ABB-ES' project team and between ABB-ES and NYSDEC by a variety of mechanisms, including status briefings, monthly progress reports, project review meetings, telephone calls, and miscellaneous project-related memoranda.

4.2 SCHEDULE MAINTENANCE

ABB-ES understands the NYSDEC's commitment to complete this project in accordance with a realistic, mutually agreed-upon schedule. This can only be accomplished by establishing realistic task schedules and by frequent schedule maintenance. The frequent project review meetings will facilitate identifying and implementing changes. Adherence to approved work schedules will be the responsibility of the PM. Schedule maintenance will be accomplished by a variety of means, including the following:

- Frequent communications between ABB-ES and NYSDEC to anticipate potential problems, identify and resolve existing problems, and smoothly implement adjustments in work focus or workloads.

- Frequent communications between the PM and the Task Leaders to coordinate work schedules and manpower requirements (this is particularly effective when redirection of effort is desirable).
- Monthly forecasts of staff requirements and manpower availability to make certain that adequate project support will be accessible under a variety of workload scenarios.
- Access to corporate-level and senior technical support as required for rapid problem resolution.

4.2.1 Cost Assignment, Control, and Reporting

To provide adequate cost control, ABB-ES will establish project numbers for each of the six primary tasks of the Becker RI/FS. Costs incurred will be assigned to the appropriate project number. In general, externally-billed non-labor costs (e.g., postage, field subsistence expenses, subcontracting, travel costs, long-distance telephone) are assigned daily; labor costs are assigned weekly; and in-house non-labor costs (e.g., photocopying, equipment rental) are assigned monthly.

Project costs assigned in a given week are available to the PM, typically within three working days of the last work week reported. ABB-ES' computerized project cost accounting system has been used successfully on a variety of project types, ranging in value from a few thousand dollars to over five million dollars.

4.2.2 Quality Assurance

Quality assurance is an essential component of project management and is the responsibility of the PM.

Some of the management-related quality assurance measures to be undertaken on the proposed project include the following:

- The PM will present periodic briefings to the Quality Review Board and other company officials to evaluate project progress and to identify potential problems so that plans can be made to avert them.

SECTION 4

- The PM and Task Leaders will hold frequent project staff meetings to ensure work consistency and completeness and to facilitate information transfer.
- The Quality Review Board and Task Leader will review all project deliverables to evaluate their technical quality.
- The PM and Quality Review Board will meet before (and, as needed, after) all public hearings to discuss ABB-ES' role in the meeting and any subsequent activities.
- NYSDEC will have the opportunity to review deliverables to further verify the quality.
- The PM will maintain a file of all project documentation so that project procedures, decisions, and events can be reconstructed, if needed, after project closeout.

5.0 SUBCONTRACT DEVELOPMENT

5.1 INTRODUCTION

ABB-ES has secured standby subcontracts for the following services: drilling, survey, and analytical laboratory. The process of standby subcontracting has resulted in having available subcontractors who are prequalified for work on Contract No. D002472. All standby subcontract rates and terms and conditions have been prenegotiated between ABB-ES and the subcontractor(s), and reviewed and approved by the NYSDEC. For purchased goods or services where standby subcontractors are not identified, ABB-ES will solicit competitive bids or quotes from qualified subcontractors or vendors. Upon bid receipt, ABB-ES will prepare an evaluation of the bids for cost and technical responsiveness and will submit recommendation of award to NYSDEC's Contract Development Section for concurrence. Subsequently, ABB-ES will execute purchase order agreements with selected firms supplying the purchased goods and services.

It is ABB-ES' intent to work toward its minority business goals by securing minority and women/owned enterprises (M/WBE) services via standby and other subcontract/vendor participation. To that end, ABB-ES has standby subcontracts with drilling, survey, and analytical M/WBEs.

We anticipate involvement on the Becker work assignment by our MBE survey subcontractor, Om Popli. Additionally, Energy & Environmental Engineering, Inc. (E³I) will provide laboratory analyses for water and soil samples; and Tri-State Drilling and Boring, Inc. was selected to provide drilling services based on cost competitiveness. In addition, RFQs were submitted for air sample analytical services, and site investigation equipment rental. ESE, Inc. and Coast-to-Coast Analytical Services, Inc. were selected to perform the air sample laboratory analyses. J.D. Fett Instruments, Inc., Colog, Inc., and Environmental Instrument Services, Inc. were selected as the vendors to provide sampling and geophysical equipment.

5.2 SURVEY SERVICES

Survey services will be provided by Om P. Popli, P.E. (Popli), ABB-ES' standby survey subcontractor. Popli's cost-plus-fixed-fee subcontract has been previously

SECTION 5

reviewed and approved by the NYSDEC. ABB-ES issued to Popli a Statement of Work (SOW) specific to the Becker site. The estimated cost of \$11,200 reflects Popli's response to the SOW.

5.3 DRILLING SERVICES

ABB-ES has established standby drilling subcontracts with the following firms: Tri-State Drilling & Boring, Inc.; American Auger & Ditching, Inc., and Advanced Drilling Investigations. Unit rates and terms and conditions for all firms have been prenegotiated with ABB-ES and preapproved by NYSDEC's Contract Development Section.

For the Becker site, ABB-ES submitted a Request for Quote (RFQ) to the three firms, requesting mobilization/demobilization costs, and unit rates for specialty items not contained in the standby subcontracts. As a result of the responses to RFQs, Tri-State Drilling and Boring, Inc. will serve as the drilling subcontractor at the Becker site, at an estimated cost of \$55,232.

5.4 STANDBY ANALYTICAL SERVICES

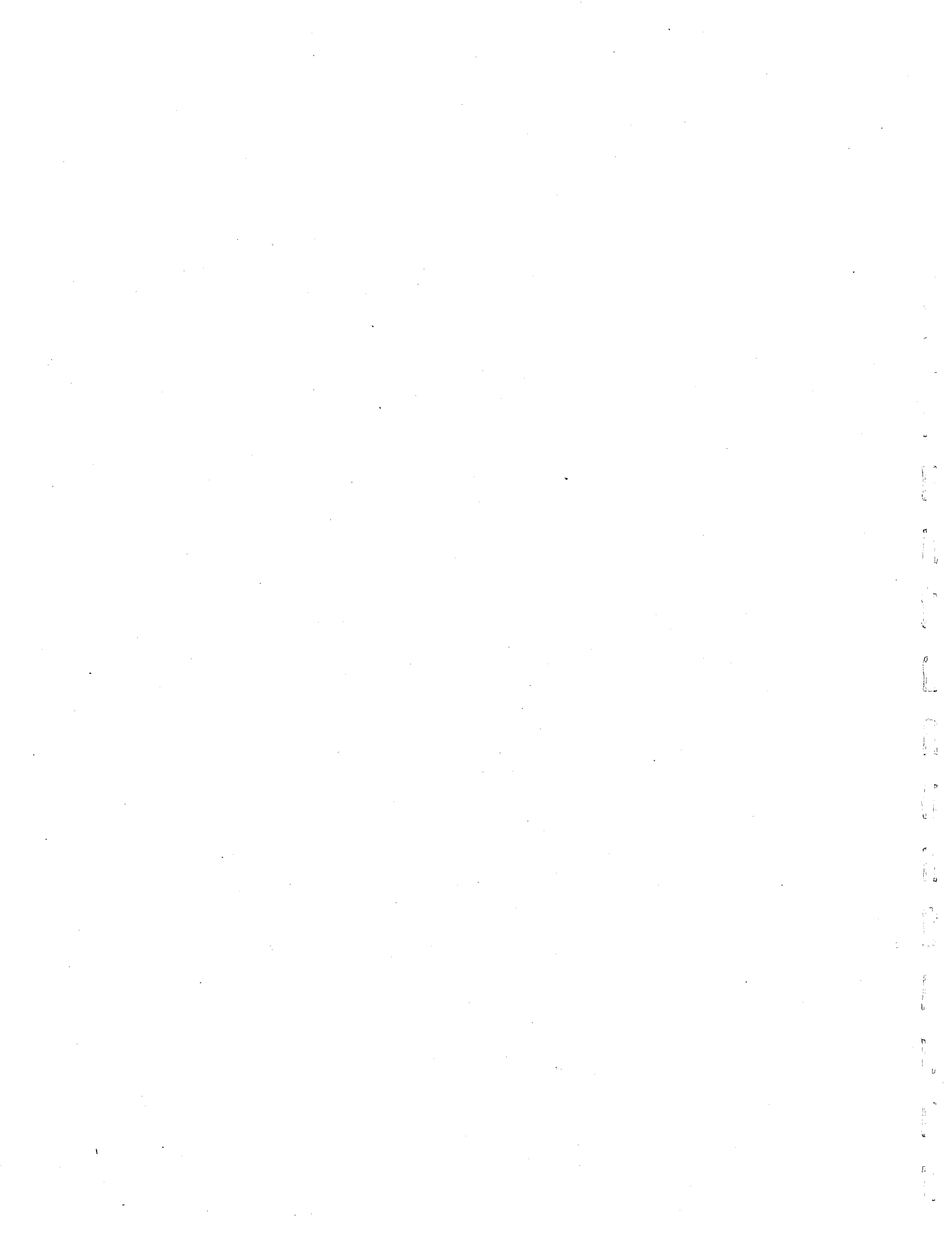
The Standby Analytical Subcontractor, E³I, was selected to provide analytical services at Becker. This was based on a rotation of the three Standby Analytical Subcontractors established with NYSDEC approval. The E³I cost estimate for analytical services for soil and groundwater samples at Becker is \$74,110.

5.5 OTHER ANALYTICAL SERVICES

ABB-ES has received price lists for standard services from non-standby laboratories to perform VOC and SVOC analyses on air samples detailed in Subsection 2.3.2. Based on a review of the price lists, ABB-ES has selected Coast-to-Coast Analytical Services, Inc. to perform the air VOC analytical services at an estimated cost of \$2,280.00. ESE, Inc. was selected to perform the air SVOC analyses at an estimated cost of \$1,560.00.

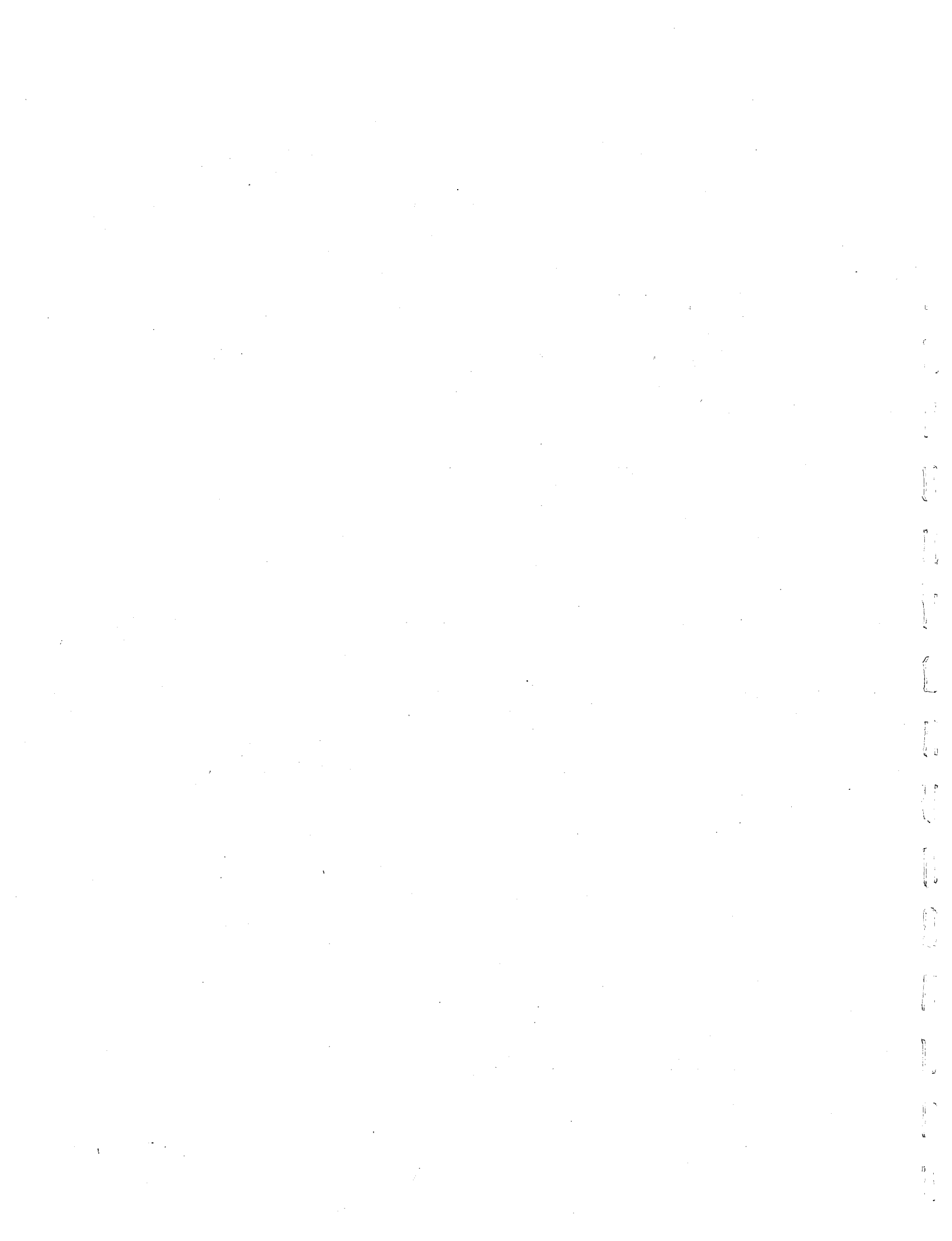
5.6 IDW DISPOSAL SERVICES

IDW disposal services will be subcontracted at the completion of Task 3, when ABB-ES has determined the quantity of IDW to be disposed of. ABB-ES will address this subcontracting effort as a CNM in conformance with Article 14 of the contract between the NYSDEC and ABB-ES.



6.0 PROJECT BUDGET

The budget (see Appendix A) for this WA has been prepared in conformance with contract requirements and supports the scope of work as identified in NYSDEC's November 24, 1993 WA letter from P. David Smith to William Weber; multiple teleconferences between NYSDEC and ABB-ES technical staff; and as described herein. The estimated costs reflect reasonably available facts allowing completion of the WA.



GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AAL	acceptable ambient levels
ABB-ES	ABB Environmental Services
ARARs	applicable or relevant and appropriate requirements
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
Becker	Becker Electronics Manufacturing Corporation
BOD	biological oxygen demand
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CNM	Change Notification Memorandum
COD	chemical oxygen demand
DCA	dichloroethane
DCE	dichloroethene
DOT	U.S. Department of Transportation
ECL	Environmental Conservation Law
EPS	Environmental Products and Services, Inc.
eV	electron volt
E3I	Energy Environmental Engineering, Inc.
GC/MS	gas chromatography/mass spectrometry
gpd	gallons per day
gpm	gallons per minute
GPR	ground-penetrating radar
HASP	Health and Safety Plan
HBA	habitat-based assessments
HHEM	Human Health Evaluation Manual
HI	Hazard Index
ID	inside diameter
IDW	investigation-derived wastes
in. Hg	inches of mercury
IRM	Interim Remedial Measure
M&E	Metcalf & Eddy, Inc.

ABB Environmental Services

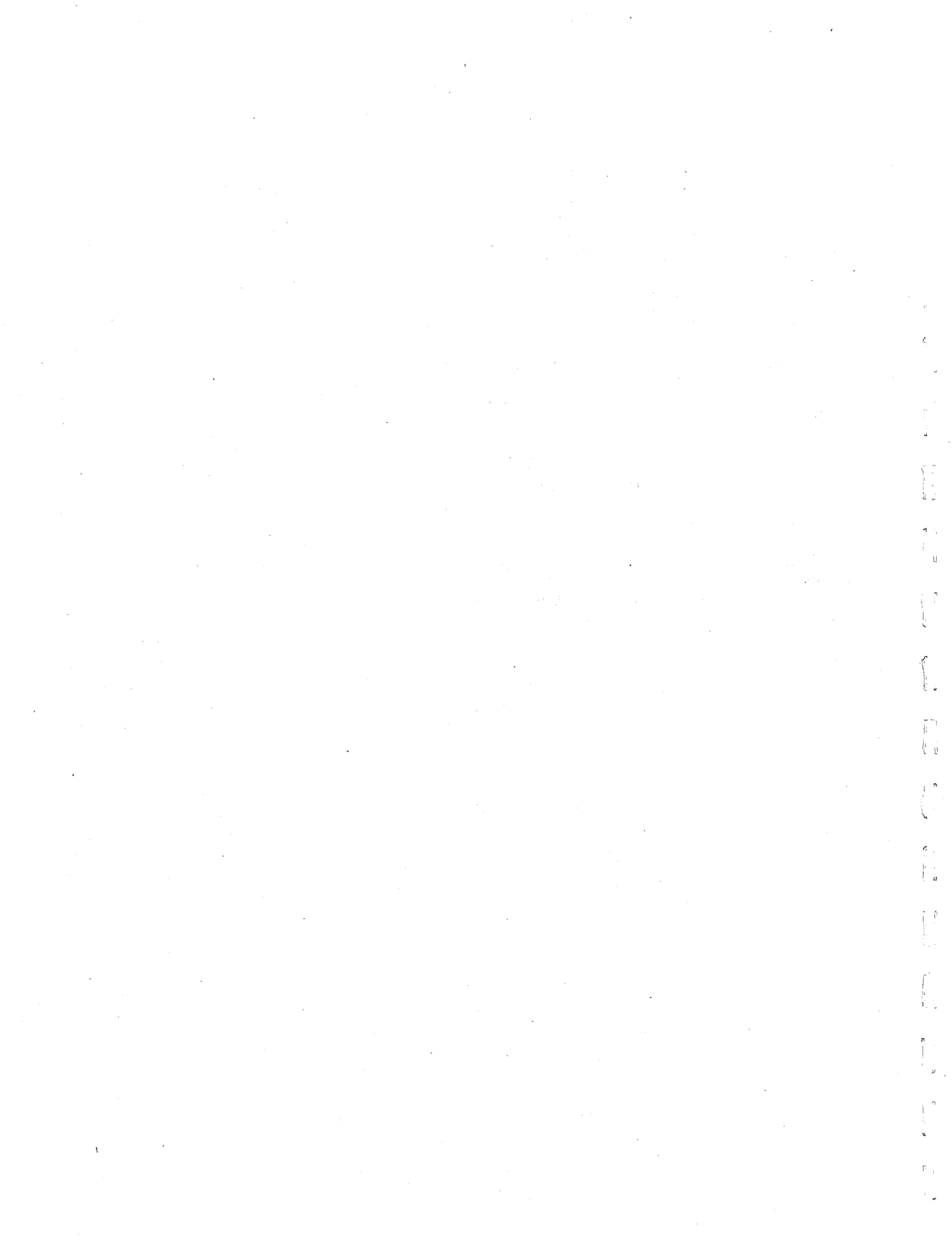
GLOSSARY OF ACRONYMS AND ABBREVIATIONS

met	meteorological monitoring
mg/L	milligrams per liter
MSL	mean sea level
MW	monitoring well
NIOSH	National Institute of Occupational Safety and Health
No., no.	number
NTUs	nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O ₂ /LEL	oxygen/lower explosive limit
OSHA	Occupational Safety Health Administration
PCB	polychlorinated biphenyl
PI	photoionization
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PT	packer test
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPjP	Site-Specific Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
RA	Risk Assessment
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendment and Reauthorization Act
SCGs	Standards, Criteria, and Guidelines
SPDES	State Pollutant Discharge Elimination System
SPSGV	State Promulgated Standards and Guidance Values
SVOC	semivolatile organic compound
TAGM	Technical Administrative Guidance Memorandum

ABB Environmental Services

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

TAL	Target Analyte List
TCA	trichloroethane
TCE	trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TSS	total suspended solids
UFPO	Underground Facilities Protection Organization
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	underground storage tank
VOC	volatile organic compound
WA	Work Assignment
$\mu\text{g/L}$	micrograms per liter
$\mu\text{g/m}^3$	micrograms per cubic meter



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APPENDIX A
WORK ASSIGNMENT BUDGET

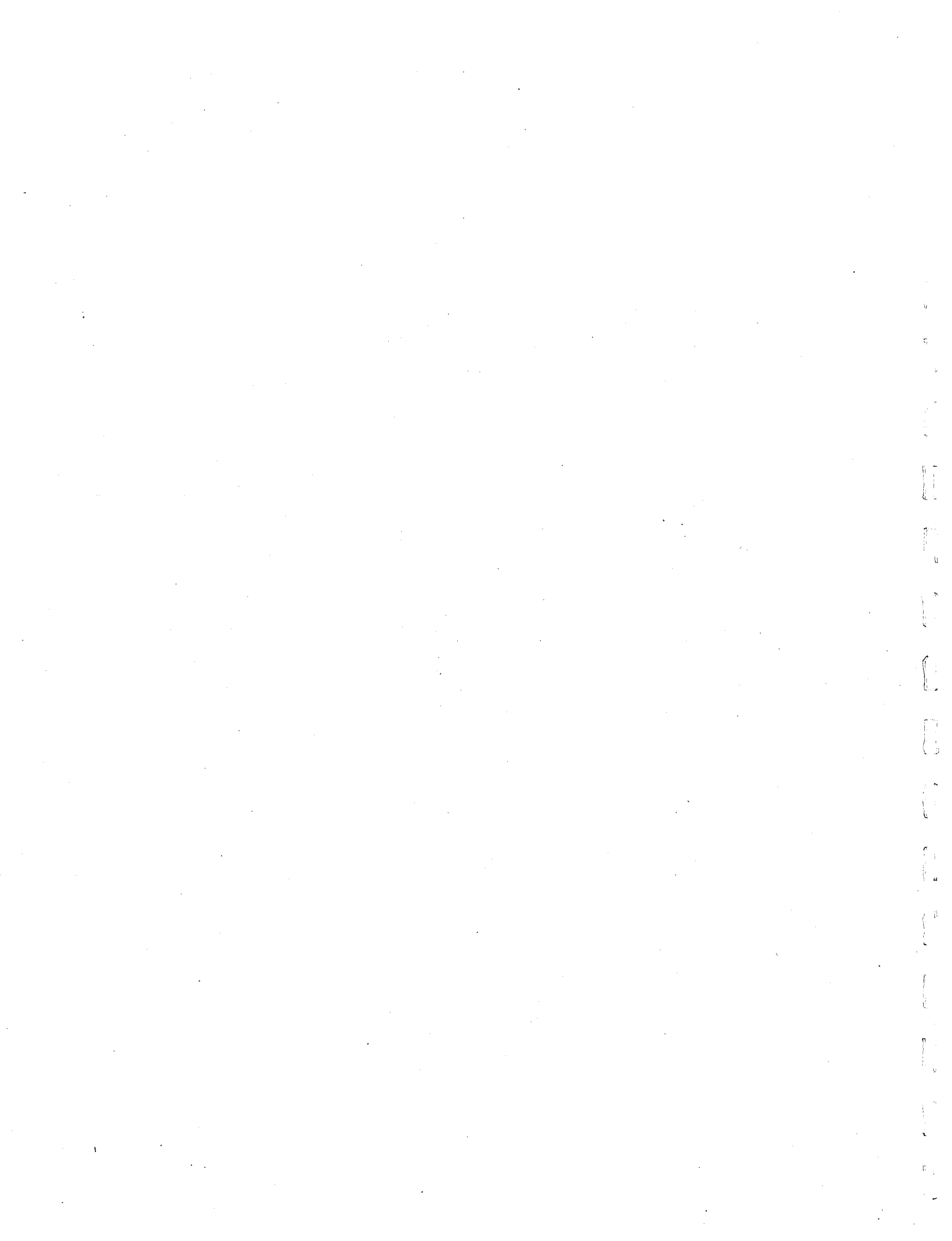
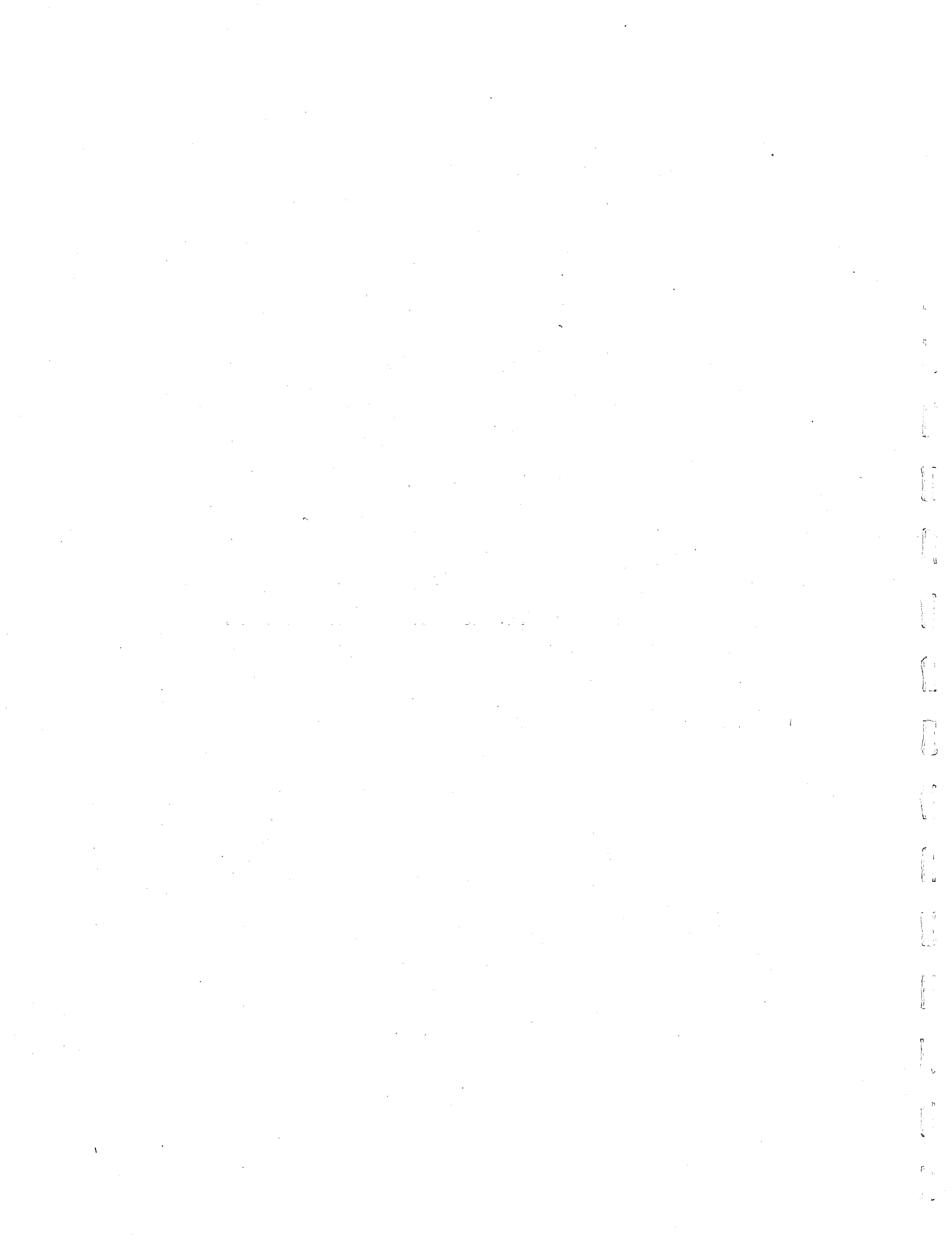


ABB Environmental Services

- Schedule 2.11(a), Summary of Work Assignment Price
- Schedule 2.11(b), Direct Labor Hours Budgeted
- Schedule 2.11(b-1), Direct Administrative Labor Hours Budgeted
- Schedule 2.11(c), Direct Non-Salary Costs
- Schedule 2.11(d) 3, Maximum Reimbursement Rates for Vendor-Rented Equipment
- Schedule 2.11(d) 5, Consumable Supplies
- Schedule 2.11(e), Cost-Plus-Fixed Fee Subcontract - Survey
- Schedule 2.11(f) 1, Unit Price Subcontract - Laboratory
- Schedule 2.11(f) 2, Unit Price Subcontract - Laboratory
- Schedule 2.11(f) 3, Unit Price Subcontract - Laboratory
- Schedule 2.11(f) 4, Unit Price Subcontract - Drilling
- Schedule 2.11(g), Summary of Fiscal Information
- Schedule 2.11(h), Summary of Labor Hours

WORK ASSIGNMENT BUDGET

APPENDIX A



SUMMARY OF WORK ASSIGNMENT PRICE
SITE NAME: BECKER ELECTRONICS MANUFACTURING SITE
WORK ASSIGNMENT NUMBER D-002472-15

1.....	DIRECT SALARY COSTS (Schedules 2.10(a) and 2.11(b))	\$102,819	
2.....	INDIRECT COSTS (Schedule 2.10(g))	\$163,791	
3.....	DIRECT NON-SALARY COSTS (Schedules 2.10(d)(e)(f) and 2.11(c)(d))	\$41,097	
<p>SUBCONTRACT COSTS COST-PLUS-FIXED-FEE SUBCONTRACTS (Schedule 2.10(e) and 2.11(e))</p>			
	NAME OF SUBCONTRACTOR	SERVICES TO BE PERFORMED	SUBCONTRACT PRICE
	OM POPLI	SURVEY	\$11,200
4.....	TOTAL COST-PLUS-FIXED-FEE SUBCONTRACTS		\$11,200
<p>UNIT PRICE SUBCONTRACTS (Schedule 2.10(f) and 2.11(f))</p>			
	NAME OF SUBCONTRACTOR	SERVICES TO BE PERFORMED	SUBCONTRACT PRICE
	COAST TO COAST	ANALYTICAL (VOCS)	\$2,280
	E3I	ANALYTICAL (SOIL)	\$74,110
	ESE, Inc.	ANALYTICAL (AIR-SVOCs)	\$1,560
	TRI-STATE	DRILLING/TEST PITTING	\$55,232
5.....	TOTAL UNIT PRICE SUBCONTRACTS		\$133,182
6.....	SUBCONTRACT MANAGEMENT FEE		\$6,467
7.....	TOTAL SUBCONTRACT COSTS (Lines 4 + 5 + 6)		\$150,849
8.....	FIXED FEE (Schedule 2.10(h))		\$21,329
9.....	TOTAL WORK ASSIGNMENT PRICE (Lines 1 + 2 + 3 + 7 + 8)		\$479,884

Schedule 2.11(b)
 Direct Labor Hours Budgeted
 Becker Electronics Manufacturing Site

No. Task	1993 Rates	1994 Rates	1995 Rates	IX	VIII	VII	VI	V	IV	III	II	1
	\$45.84	\$48.60	\$51.52	\$40.89	\$43.35	\$45.96	\$29.22	\$24.50	\$21.88	\$18.94	\$17.45	\$13.37
				\$32.38	\$34.33	\$36.39	\$30.98	\$25.97	\$23.20	\$20.08	\$18.50	\$14.18
							\$32.84	\$27.53	\$24.60	\$21.29	\$19.61	\$15.04
1 Task 1 - Work Plan Development	0	166	0	0	0	0	0	49	353	37	69	111
2 Task 2 - Review of Phase I & II FS	8	32	0	0	0	0	0	0	140	0	28	38
3 Task 3 - Second Phase RI	38	99	43	0	212	1018	0	0	0	140	879	232
4 Task 4 - Detailed Analysis of Alternative	10	36	50	0	38	302	0	0	0	0	0	220
5 Task 5 - Community Relations Support	0	16	0	0	0	36	0	0	0	0	0	8
6 Task 6 - Final RI/FS Report	1	1	1	0	0	30	0	0	0	0	0	7
Subtotal 1993 Hours	0	81	0	0	0	93	0	29	93	7	9	31
Subtotal 1994 Hours	54	244	89	0	264	1644	0	0	170	967	514	3946
Subtotal 1995 Hours	3	25	5	0	6	142	0	0	0	0	0	71
TOTAL HOURS/UNITS	57	350	94	0	299	1879	0	0	177	976	616	4448
TOTAL DIRECT LABOR COSTS	\$2,779	\$15,038	\$3,237	\$0	\$7,732	\$43,669	\$3,546	\$18,047	\$8,771	\$102,819		

Engineer/Contract #: D002472
 Site Name: Becker Electronics
 Work-Assignment No.: D002472-15

Date Prepared: 06/01/94

TABLE 2.1
 SCHEDULE 2.11 (b-1)
 DIRECT ADMINISTRATIVE LABOR HOURS BUDGETED

NSPE Labor Classification	9	8	7	6	5	4	3	2	1	Total # of Direct Administrative Labor Hours Budgeted
Task 1	1	35	0	0	5	0	0	0	10	51
Task 2	1	2	0	0	0	0	0	0	6	9
Task 3	5	20	0	0	40	0	0	0	36	101
Task 4	2	5	0	0	5	0	0	0	36	48
Task 5	0	2	0	0	0	0	0	0	1	3
Task 6	1	0	0	0	0	0	0	0	1	2
TOTAL HOURS	10	64	0	0	50	0	0	0	90	214

Contract/Project administrative hours would include, but not necessarily be limited to the following activities:

1. Review work assignment (WA) progress
 - Conduct progress reviews
 - Prepare monthly project reports
 - Update WA progress schedule
 - Prepare monthly M/WBE Utilization Report
2. Review work assignment costs
 - Prepare monthly cost control report
 - Cost control reviews
3. CAP Preparation
 - Oversee and prepare monthly CAP
 - Respond to payment issues/disallowances
 - NSPE list updates
4. Develop and manage subcontracts
5. Implement and manage staffing plan
6. Conduct Health and Safety Reviews
7. Word processing and graphic artists
8. Report editing

Contract/Project administration hours would not include activities such as:

1. QA/QC reviews
2. Technical oversight by management

Schedule 2.11(c)
 Direct Non-Salary Costs
 Becker Electronics Manufacturing Site

Item	Maximum Reimbursement Rate	Unit	Estimated Number of Units	Total Estimated Cost
A. In-House Costs				
1. Telephone/Fax	Actual Cost	Actual Cost	1534	\$1,534.00
2. Photocopies	\$0.07	Page	38089	\$2,666.23
3. Postage	Actual Cost	Actual Cost	--	\$4,727.55
4. Computer	\$1.50	Hour	1590	\$2,385.50
Level D Equipment	\$22.50	Day	15	\$337.50
Level C Equipment	\$45.00	Day	79	\$3,555.00
Level B Equipment	\$70.00	Day	0	\$0.00

TOTAL: \$15,205.78

B. Miscellaneous				
Travel				
a. Auto Rental	\$32.00	Day	45.5	\$1,456.00
b. Cargo Van Rental	\$229.00	Week	6	\$1,374.00
c. Minivan Rental	\$42.00	Day	10	\$420.00
d. Misc. (Gas, Parking)	Actual Cost	Actual Cost	--	\$629.00
e. Per Diem	\$94	Day	90	\$8,460.00

TOTAL: \$12,339.00

Schedule 2.11 (d)3
 Maximum Reimbursement Rates for Vendor -- Rented Equipment
 Becker Electronics Manufacturing Site

Item	Maximum Reimbursement Rate	Estimated Usage (Period of Time)	Estimated Rental Cost (Col. 2 x Col. 3)
1. EM-31 Terrain Conductivity Unit	\$51.00	7.5 Days	\$382.50
2. Magnetometer - GSM-19 Gradiometer	\$49.00	7.5 Days	\$367.50
3. Mt. Sorpris MGXWT-Cal-EM	\$165.00	7 Days	\$1,155.00
4. LEL/02 Meter	\$30.00	12 Days	\$360.00
5. LEL/02 Meter	\$350.00	1 Month	\$350.00
6. HNU PI-101/W11.7 EV Lamp	\$50.00	18 Days	\$900.00
7. HNU PI-101/W11.7 EV Lamp	\$35.00	28 Days	\$980.00
8. Draeger Pump Kit	\$5.00	7 Days	\$35.00
9. Draeger Pump Kit	\$3.75	24 Days	\$90.00
10. Water Level Meter	\$13.00	7 Days	\$91.00
11. Water Level Meter	\$8.75	28 Days	\$245.00
12. MIE PDM-3 Dust Monitor	\$39.00	7 Days	\$273.00
13. MIE PDM-3 Dust Monitor	\$425.00	3 Months	\$1,275.00
14. Rediflow-2/Control Box/Hose/Reel/Cable	\$40.00	5 Days	\$200.00
15. Horiba V-10 Water Qual. Checker	\$25.00	23 Days	\$575.00
16. Hermit Transducer, Cable, Datalogger	\$450.00	1 Week	\$450.00
17. Draeger Tubes, (boxes)	\$45.00	2 Each	\$90.00
18. HNU Calib Gases (bottles)	\$35.00	8 Each	\$280.00
19. Horiba Standard	\$14.00	3 Each	\$42.00
20. KCl pH Solution	\$10.00	3 Each	\$30.00
21. Alpha-1 Air Sampling Pump	\$105.00	4 Week	\$420.00
22. Radios	\$330.00	2 Months	\$660.00
23. Telephone, Hook-up	\$53.00	2 Months	\$106.00
24. Office Trailer	\$567.00	2 Months	\$1,134.00
25. Dumpster	\$75.00	2 Months	\$150.00
26. Port-A-John	\$85.00	2 Months	\$170.00
27. Electrician	\$1,042.00	1 Hook-up	\$1,042.00
28. Generator	\$200.00	1 Week	\$200.00

TOTAL: \$12,053.00

Schedule 2.11(d)5
 Consumable Supplies
 Becker Electronics Manufacturing Site

Item	Estimated Quantity	Unit Cost	Total Budget Cost (Col. 2x Col.3)
* Miscellaneous Supplies	--	Lump Sum	\$1,500.00

*Supplies include but are not limited to: Large & Small First Aid Kits, Emergency Horn, Emergency Light, Fire Extinguisher, Eye Wash Station, Dust Mask, Goggles, Rain Gear, Field Books, Topographic Maps, Duct Tape, 2" Tape w/Dispenser, Stainless Steel Spatulas, Stainless Steel Spoons, Tygon Tubing, pH Paper, Thermometer, Squirt Bottles, Stainless Steel Buckets, Stainless Steel Sprayer, Long Handled Brushes, Plastic Tub, Bubble Pack, Ziploc Bags, Ice, Paper Towels, Aluminum Foil, Garbage Bags, Deionized Water W/Jugs, Liquinox, Pens, Marking Pens, Thick Sharpies, Film & Development, Scotch Tape, File Folder, Computer Disks, Gatoraid, Soda, Spray Paint, Flagging, Stakes, Ear Plugs, Filament Tape

Schedule 2.11 (e)
Cost Plus-Fixed-Fee Subcontracts

Becker Electronics
Durham, New York

1. NAME OF SUBCONTRACTOR	SERVICES TO BE PERFORMED	SUBCONTRACT PRICE
OM P. POPLI, PE, LS, PC	Surveying Services	\$11,200.00

A. Direct Salary Costs

Professional Responsibility Level (NSPE)	Labor Classification	Average Reimbursement Rate (\$/hr.)	Maximum Reimbursement Rate(\$/hr.)	Estimated No. of Hours	Total Estimated Direct Salary Cost
VII	Principal Engineer	\$41.69	\$45.44	4	\$166.76
IV	Surveyor	\$22.63	\$24.89	8	\$181.04
I	Surveyor	\$15.51	\$17.37	70	\$1,085.70
I	Surveyor	\$13.09	\$14.66	0	\$0.00
III	Surveyor	\$17.09	\$18.97	90	\$1,538.10
III	CADD Technician	\$17.09	\$18.97	32	\$546.88

TOTAL DIRECT SALARY COSTS:

(A) \$3,518.48

FOOTNOTES:

- 1) These rates will be held firm until December 31, 1994.
- 2) Only those labor classifications indicated with an asterisk (*) will be entitled to overtime.
- 3) Reimbursement will be limited to the maximum reimbursement rate for the professional responsibility of the actual work performed.
- 4) Reimbursement for technical time of principals, owners and officers will be limited to the maximum reimbursement rate of that labor category, the actual hourly labor rate paid, or the State of New York M-5 rate, whichever is lower.
- 5) Maximum reimbursement rates may be exceeded for work assignment activities that are under the jurisdiction of Schedule of Prevailing Wage Rates sent by the New York State Department of Labor.
- 6) Non-prevailing wage rates apply to this project.
- 7) Photogrammetric controls not included in scope of work.
- 8) Random baseline and bench will be used for locating & elevating various site features.
- 9) Boundary or property survey not included.

ESTIMATE OF MANHOURS
 Becker Electronics Manufacturing Site
 Durham New York

Site Acreage Acres

2 - Man Field Crew

Labor Classification NSPE Level	Principal Engineer VII	Surveyor IV	Surveyor II	Surveyor I	Surveyor III	CADD Technician III
PROJECT MANAGEMENT	2	4			4	
FIELD						
Mobilization/Demobilization			20		20	
Health and Safety Meeting			2		2	
Establish Controls (Random)			8		8	
Locate Salient Features			8		8	
Locate and elevate debris			8		8	
Locate Wells, Piezometers (25+/-) Surface Water Sedimentation points (8+/-), test pits (34+/-)			12		12	
Elevate Wells, Piezometers, Surface Water, Sedimentations, Test pits, and spot elevations (80+/-)			12		12	
OFFICE						
Property Research						
Computations/Office					8	
Drafting and Mapping						32
Report	2	4			8	
TOTAL HOURS =	4	8	70	0	90	32

B. Indirect Costs

Indirect costs shall be paid based on a percentage of direct salary costs incurred which shall not exceed a maximum of 117% or the actual rate calculated in accordance with 48 CFR Federal Acquisition Regulation, whichever is lower.

Amount budgeted for indirect costs is $(\$3518.48 \times 1.17)$ **\$4,116.62 (B)**

C. Maximum Reimbursement Rates for Direct Non-Salary Costs

Item	Max. Reimbursement Rate (specify unit)	Est. No. of Units	Total Estimated Cost
1. Travel:			
Lodging & Per Diem	\$79 day	@ 12 mandays =	\$948.00
Survey Van	\$75.00 day	@ 8 days =	\$600.00
Auto CADD Station	\$7.60 hour	@ 40 hours =	\$304.00
HNU	\$60.00 day	@ 3 days =	\$180.00
Tolls, Telephone, Copies, Etc.		L.S. =	\$100.00
2. Supplies			
Level "D" Safety Equipment:			
	\$22.50 /day	@ 12 mandays =	<u>\$270.00</u>
	(per approved ABB Contract)		
Total Direct Non-Salary Costs			\$2,402.00 (C)

D. Fixed Fee

The Fixed Fee is (15% of D.T.L. + Indirect Costs) **\$1,145.27 (D)**
 See Schedule 2.10(h) for how the fixed fee should be claimed.

TOTAL OF A + B + C + D **\$11,182.37**
 Say **\$11,200.00**

Schedule 2.11(f) 1
 Unit Price Subcontracts
 Work Assignment Number D002472-15
 Becker Electronics Manufacturing Site

<u>1. NAME OF CONTRACTOR</u>	<u>SERVICES TO BE PERFORMED</u>	<u>SUBCONTRACT PRICE</u>	<u>MGT FEE</u>
E3I	Laboratory Analysis of Soil, Water Samples	\$74,110	\$3,705.50

<u>Item</u>	<u>Max. Reimbursement Rate (Specify Unit)</u>	<u>Est. No. of Units</u>	<u>Total Estimated Cos</u>
Aqueous Superfund Category			
VOCS 91-1	\$210.00	70	\$14,700.00
SVOCs 91-2	\$430.00	31	\$13,330.00
Metals Superfund CLP	\$220.00	38	\$8,360.00
Non-Aqueous Superfund Category			
VOCs 91-1	\$210.00	37	\$7,770.00
SVOCs 91-2	\$460.00	37	\$17,020.00
Metals Superfund CLP	\$230.00	35	\$8,050.00
Category B			
TCLP Method 1311	\$195.00	3	\$585.00
TCLP VOC 8240	\$215.00	3	\$645.00
TCLP SVOC 8270	\$460.00	3	\$1,380.00
TCLP Metals CLP Superfund	\$220.00	3	\$660.00
TOC 415.1	\$35.00	16	\$560.00
TSS 160.2	\$15.00	10	\$150.00
Alkalinity 310.1	\$15.00	10	\$150.00
BOD5 405.1	\$50.00	10	\$500.00
COD 410.1	\$25.00	10	\$250.00

SUB-TOTAL-SUBCONTRACT PRICE: \$74,110.00

SUBCONTRACT MANAGEMENT FEE: \$3,705.50

TOTAL: \$77,815.50

Schedule 2.11(f) 2
 Unit Price Subcontracts
 Work Assignment Number D002472-15
 Becker Electronics Manufacturing Site

<u>1. NAME OF CONTRACTOR</u>	<u>SERVICES TO BE PERFORMED</u>	<u>SUBCONTRACT PRICE</u>	<u>MGT FEE</u>
ESE, Inc.	Laboratory Analysis of Air Samples for SVOCs	\$1,560	\$0.00

<u>Item</u>	<u>Max. Reimbursement Rate (Specify Unit)</u>	<u>Est. No. of Units</u>	<u>Total Estimated Cost</u>
Laboratory Analysis of Air Samples for SVOCs	\$260.00	6	\$1,560.00

SUB-TOTAL-SUBCONTRACT PRICE:	<u>\$1,560.00</u>
SUBCONTRACT MANAGEMENT FEE:	<u>\$0.00</u>
TOTAL:	<u>\$1,560.00</u>

Schedule 2.11(f) 3
 Unit Price Subcontracts
 Work Assignment Number D002472-15
 Becker Electronics Manufacturing Site

<u>1. NAME OF CONTRACTOR</u>	<u>SERVICES TO BE PERFORMED</u>	<u>SUBCONTRACT PRICE</u>	<u>MGT FEE</u>
CCAS, Inc.	Laboratory Analysis of Air Samples for VOCs	\$2,280	\$0.00

<u>Item</u>	<u>Max. Reimbursement Rate (Specify Unit)</u>	<u>Est. No. of Units</u>	<u>Total Estimated Cost</u>
Laboratory Analysis of Air Samples for VOCs	\$380.00	6	\$2,280.00

SUB-TOTAL-SUBCONTRACT PRICE: \$2,280.00

SUBCONTRACT MANAGEMENT FEE: \$0.00

TOTAL: \$2,280.00

Schedule 2.11(f) 4
Unit Price Subcontracts
Work Assignment Number D002472-15
Becker Electronics Manufacturing Site

<u>1. NAME OF CONTRACTOR</u>	<u>SERVICES TO BE PERFORMED</u>	<u>SUBCONTRACT PRICE</u>	<u>MGT FEE</u>
Tri-State Drilling & Boring	Drilling, Test Pitting, Well Installation	\$55,232	\$2,761.60
<u>Item</u>	<u>Max. Reimbursement Rate (Specify Unit)</u>	<u>Est. No. of Units</u>	<u>Total Estimated Cost</u>
Mobilization	\$2,600.00	1	\$2,600.00
Per Diem	\$85.00	20	\$1,700.00
Modified Level C	\$40.00	20	\$800.00
4.0-Inch ID Casing	\$30.00	165	\$4,950.00
PVC Well Screen (#6 Slot)	\$4.00	110	\$440.00
PVC Well Screen (#10 Slot)	\$4.00	130	\$520.00
PVC Well Riser	\$2.00	842	\$1,684.00
Well Screen Sand Pack	\$5.00	132	\$660.00
Monitoring Well Seal (2")	\$10.00	22	\$220.00
6 Ft. Protective Casing	\$100.00	24	\$2,400.00
55-Gallon Drums w/Pallets	\$55.00	34	\$1,870.00
Transporting, Filling, etc. of Drums	\$45.00	34	\$1,530.00
2" Wells by Pump & Surge	\$50.00	34	\$1,700.00
Decon. of Drill Rigs, Tools, etc.	\$85.00	36	\$3,060.00
0-50' of Air Rotary Drilling	\$9.00	350	\$3,150.00
50-100' of Air Rotary Drilling	\$9.00	150	\$1,350.00
Mob. 1 backhoe w/Operator	\$300.00	1	\$300.00
Daily Rate for Backhoe & Operator	\$600.00	3.5	\$2,100.00
Install 8" ID Spun Flush Joint	\$40.00	150	\$6,000.00
Packer Testing	\$110.00	50	\$5,500.00
Water Supply	\$3,390.00	1	\$3,390.00
Well Screen Sand Pack	\$8.00	156	\$1,248.00
Seal 2" Monitoring Well Set	\$10.00	26	\$260.00
Riser Backfill for 2" Monitoring Well	\$8.00	650	\$5,200.00
Develop 6" borehole (Pump & Surge)	\$50.00	52	\$2,600.00
<u>SUB-TOTAL-SUBCONTRACT PRICE:</u>			<u>\$55,232.00</u>
<u>SUBCONTRACT MANAGEMENT FEE:</u>			<u>\$2,761.60</u>
<u>TOTAL:</u>			<u>\$57,993.60</u>

Engineer: ABB ENVIRONMENTAL SERVICES
 Contract #: D-002472
 Project Name: Becker Electronics Manufacturing
 Work Assignment: D-002472-15
 Task #/Name: ALL TASKS
 Complete: 0.0%

SCHEDULE 2.11(g)
 MONTHLY COST CONTROL REPORT
 SUMMARY OF FISCAL INFORMATION

Page 1 OF 7
 Date Prepared: 06/01/94
 Billing Period:
 Invoice #:

Expenditure Category	A		B		C		D		E		F		G		H	
	Costs Claimed This Period	0.00	Paid To Date	0.00	Total Disallowed To Date	0.00	Total Costs Incurred To Date (A+B+C)	0.00	Estimated Costs To Completion	0.00	Estimated Total Work Assignment Price (A+B+E)	0.00	Approved Budget	102819	Estimated Under/Over (G-F)	0.00
1. Direct Salary Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	102819	0.00	0.00	
2. Indirect Costs 159.3%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	163791	0.00	0.00	
3. Subtotal Direct Salary Costs and Indirect Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	266609	0.00	0.00	
4. Travel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12339	0.00	0.00	
5. Other Non-Salary Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28758	0.00	0.00	
6. Subtotal Direct Non-Salary Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41097	0.00	0.00	
7. Subcontractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	150849	0.00	0.00	
8. Total Contract Cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	458555	0.00	0.00	
9. Fixed Fee 8%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21329	0.00	0.00	
10. Total Contract Price	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	479884	0.00	0.00	

Program Manager _____ Date _____

MONTHLY COST CONTROL REPORT
 SUMMARY OF FISCAL INFORMATION

Engineer: ABB ENVIRONMENTAL SERVICES
 Contract #: D-002472
 Site Name: Becker Electronics Manufacturing Site
 Work Assignment: D-002472-15
 Task #/Name: Task 1 - Work Plan Development
 Complete: 0.0%

Billing Period:
 Invoice #:

Expenditure Category	A	B	C	D	E	F	G	H
	Costs Claimed This Period	Paid To Date	Total Disallowed To Date	Total Costs Incurred To Date (A+B+C)	Estimated Costs To Completion	Estimated Total Work Assignment Price (A+B+E)	Approved Budget	Estimated Under/Over (G-F)
1. Direct Salary Costs	0.00	0.00	0.00	0.00	0.00	0.00	19844	0.00
2. Indirect Costs 138.4%	0.00	0.00	0.00	0.00	0.00	0.00	31612	0.00
Subtotal Direct Salary Costs and Indirect Costs	0.00	0.00	0.00	0.00	0.00	0.00	51457	0.00
4. Travel	0.00	0.00	0.00	0.00	0.00	0.00	184	0.00
5. Other Non-Salary Costs	0.00	0.00	0.00	0.00	0.00	0.00	1075	0.00
6. Subtotal Direct Non-Salary Costs	0.00	0.00	0.00	0.00	0.00	0.00	1259	0.00
7. Subcontractors	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
8. Total Contract Cost	0.00	0.00	0.00	0.00	0.00	0.00	52716	0.00
9. Fixed Fee *	0.00	0.00	0.00	0.00	0.00	0.00	4117	0.00
10. Total Contract Price	0.00	0.00	0.00	0.00	0.00	0.00	56832	0.00

Date

Program Manager

Billing Period: Invoice #:

Expenditure Category	A Costs Claimed This Period	B Paid To Date	C Total Disallowed To Date	D Total Costs Incurred To Date (A+B+C)	E Estimated Costs To Completion	F Estimated Total Work Assignment Price (A+B+E)	G Approved Budget	H Estimated Under/Over (G-F)
1. Direct Salary Costs							6,081	
2. Indirect Costs 138.4%							9,687	
3. Subtotal Direct Salary Costs and Indirect Costs							15,768	
4. Travel							0	
5. Other Non-Salary Costs							372	
6. Subtotal Direct Non-Salary Costs							372	
7. Subcontractors							0	
8. Total Contract Cost							16,139	
9. Fixed Fee *							1,261	
10. Total Contract Price							17,401	

Program Manager _____ Date _____

MONTHLY COST CONTROL REPORT
 SUMMARY OF FISCAL INFORMATION

Engineer: ABB ENVIRONMENTAL SERVICES
 Contract #: D-002472
 Site Name: Becker Electronics Manufacturing
 Work Assignment: D-002472-15
 Task #/Name: Task 3 - Second Phase RI
 Complete: 0.0%

	A	B	C	D	E	F	G	H
Expenditure Category	Costs Claimed This Period	Paid To Date	Total Disallowed To Date	Total Costs Incurred To Date (A+B+C)	Estimated Costs To Completion	Estimated Total Work Assignment Price (A+B+E)	Approved Budget	Estimated Under/Over (G-F)
1. Direct Salary Costs							59,100	
2. Indirect Costs 159.3%							94,147	
3. Subtotal Direct Salary Costs and Indirect Costs							153,247	
4. Travel							11,925	
5. Other Non-Salary Costs							23,406	
6. Subtotal Direct Non-Salary Costs							35,331	
7. Subcontractors							150,849	
8. Total Contract Cost							339,427	
9. Fixed Fee 8%							12,260	
10. Total Contract Price							351,687	

Program Manager _____ Date _____

Engineer: ABB ENVIRONMENTAL SERVICES
 Contract #: D-002472
 Site Name: Becker Electronics Manufacturing Site
 Work Assignment: D-002472-15
 Task #/Name: Task 4 - Detailed Analysis of Alternatives
 Complete: 0.0%

SCHEDULE 2.11(g)
 MONTHLY COST CONTROL REPORT
 SUMMARY OF FISCAL INFORMATION

Page 5 OF 7
 Date Prepared: 06/01/94
 Billing Period:
 Invoice #:

Expenditure Category	A		B		C		D		E		F		G		H	
	Costs Claimed This Period	Paid To Date	Total Disallowed To Date	Total Costs Incurred To Date (A+B+C)	Estimated Costs To Completion	Estimated Total Work Assignment Price (A+B+E)	Approved Budget	Estimated Under/Over (G-F)								
1. Direct Salary Costs											15,075					
2. Indirect Costs 138.4%											24,014					
3. Subtotal Direct Salary Costs and Indirect Costs											39,089					
4. Travel											0					
5. Other Non-Salary Costs											2,806					
6. Subtotal Direct Non-Salary Costs											2,806					
7. Subcontractors											0					
8. Total Contract Cost											41,895					
9. Fixed Fee *											3,127					
10. Total Contract Price											45,022					

Program Manager _____ Date _____

MONTHLY COST CONTROL REPORT
 SUMMARY OF FISCAL INFORMATION

Engineer: ABB ENVIRONMENTAL SERVICES
 Contract #: D-002472
 Site Name: Becker Electronics Manufacturing Site
 Work Assignment: D-002472 - 15
 Task #/Name: Task 5 - Community Relations Support
 Complete: 0.0%

Expenditure Category	A Costs Claimed This Period	B Paid To Date	C Total Disallowed To Date	D Total Costs Incurred To Date (A+B+C)	E Estimated Costs To Completion	F Estimated Total Work Assignment Price (A+B+E)	G Approved Budget	H Estimated Under/Over (G-F)
1. Direct Salary Costs							1,741	
2. Indirect Costs 138.4%							2,774	
3. Subtotal Direct Salary Costs and Indirect Costs							4,515	
4. Travel							230	
5. Other Non-Salary Costs							124	
6. Subtotal Direct Non-Salary Costs							354	
7. Subcontractors							0	
8. Total Contract Cost							4,869	
9. Fixed Fee *							361	
10. Total Contract Price							5,230	

Program Manager _____ Date _____

MONTHLY COST CONTROL REPORT
 SUMMARY OF FISCAL INFORMATION

Engineer: ABB ENVIRONMENTAL SERVICES
 Contract #: D-002472
 Site Name: Becker Electronics Manufacturing Site
 Work Assignment: D-002472-15
 Task #/Name: Task 6 - Final RI/FS Report
 Complete: 0.0%

	A	B	C	D	E	F	G	H
Expenditure Category	Costs Claimed This Period	Paid To Date	Total Disallowed To Date	Total Costs Incurred To Date (A+B+C)	Estimated Costs To Completion	Estimated Total Work Assignment Price (A+B+E)	Approved Budget	Estimated Under/Over (G-F)
1. Direct Salary Costs							977	
2. Indirect Costs 138.4%							1,557	
3. Subtotal Direct Salary Costs and Indirect Costs							2,534	
4. Travel							0	
5. Other Non-Salary Costs							976	
6. Subtotal Direct Non-Salary Costs							976	
7. Subcontractors							0	
8. Total Contract Cost							3,510	
9. Fixed Fee *							203	
10. Total Contract Price							3,712	

Program Manager _____ Date _____

COST CONTROL REPORT
SUBCONTRACTS

Engineer: ABB Environmental Services
 Contract No.: D002472
 Project Name: Becker Electronics
 Work Assignment No.: D002472-15

Page _____ of: _____
 Date Prepared: _____
 Billing Period: _____
 Invoice No. _____

Subcontract Name	A Subcontract Costs Claimed This Application Incl. Resubmittals	B Subcontract Costs Approved For Payment on Previous Applications	C Total Subcontract Costs To Date (A plus B)	D Subcontract Approved Budget	E Management Fee Budget	F Management Fee Paid	G Total Costs To Date (C plus F)
1. Om Popli				\$11,200	\$0		
2. CCAS				\$2,280	\$0		
3. E3I				\$74,110	\$3,705		
4. ESE				\$1,560	\$0		
5. Tri-State				\$55,232	\$2,762		
6.							
7.							
8.							
9.							
10							
11. TOTALS				\$144,382	\$6,467		

Project Manager: _____

Date: _____

NOTES: (1) Costs listed in Columns A, B, C & D do not include any management fee costs.
 (2) Management fee is applicable to only properly procured, satisfactorily completed, unit price subcontracts over \$10,000
 (3) Line 11, Column G should equal Line 7 (Subcontractors), Column D of Summary Cost Control Report.

MONTHLY COST CONTROL REPORT: SCHEDULE 2.11 (h)
 SUMMARY OF LABOR HOURS
 NUMBER OF DIRECT LABOR HOURS EXPENDED TO DATE/
 ESTIMATED NUMBER OF DIRECT LABOR HOURS TO COMPLETION

Engineer: ABB ENVIRONMENTAL SERVICES
 Contract #: D002472-15
 Site Name: Becker Electronics Manufacturing
 Work Assignment #: D002472-15

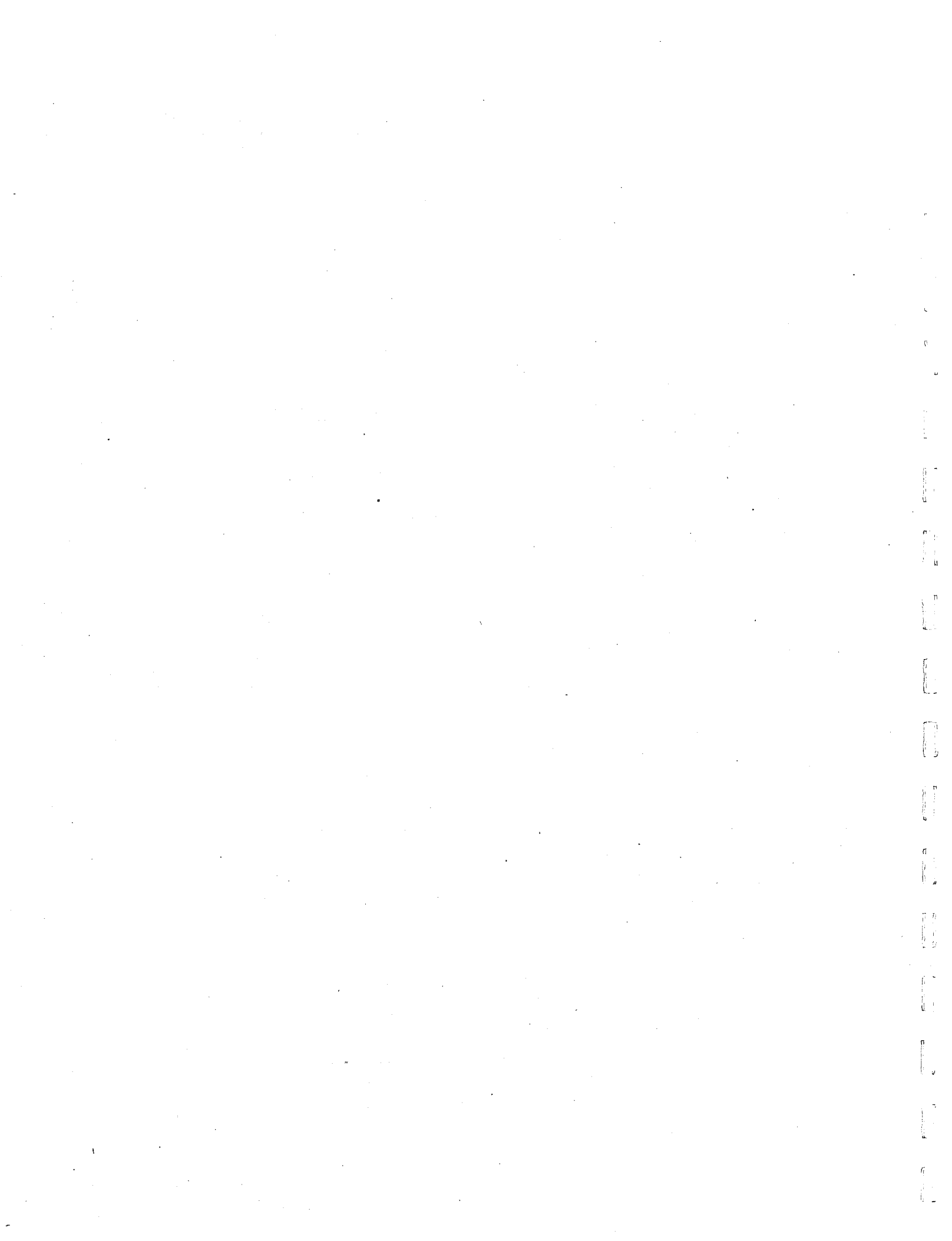
Date Prepared:
 Billing Period:
 Invoice #:

LABOR CLASS.	IX		VIII		VII		VI		V		IV		III		II		I		TOTAL NO. OF DIRECT LABOR HOURS	
	EXP	EST	EXP	EST	EXP	EST	EXP	EST	EXP	EST	EXP	EST	EXP	EST	EXP	EST	EXP	EST	EXP	EST
*1993 SALARY RATE	45.84		40.89		32.38		29.22		24.50		21.88		18.94		17.45		13.37			
Task 1 - Work Plan Development	0.0	0.0	166	0.0	0.0	0.0	0.0	0.0	49	0.0	353	0.0	37	0.0	69	0.0	111	0.0	0.0	785
Task 2 - Review of Phase I & II FS	0.0	8	32	0.0	0.0	0.0	0.0	0.0	0	0.0	140	0.0	0	0.0	28	0.0	38	0.0	0.0	246
Task 3 - Second Phase RI	0.0	38	99	0.0	43	0.0	0.0	0.0	212	0.0	1018	0.0	140	0.0	879	0.0	232	0.0	0.0	2661
Task 4 - Detailed Analysis of Alternatives	0.0	10	36	0.0	50	0.0	0.0	0.0	38	0.0	302	0.0	0	0.0	0	0.0	220	0.0	0.0	656
Task 5 - Community Relations Support	0.0	0	16	0.0	0	0.0	0.0	0.0	0	0.0	36	0.0	0	0.0	0	0.0	8	0.0	0.0	60
Task 6 - Final RI/FS Report	0.0	1	1	0.0	1	0.0	0.0	0.0	0	0.0	30	0.0	0	0.0	0	0.0	7	0.0	0.0	40
TOTAL PROJECT	0.0	57	350	0.0	94	0.0	0.0	0.0	299.0	0.0	1879.0	0.0	177.0	0.0	976.0	0.0	616.0	0.0	0.0	4448

*Labor Rates used for this table also include 1994, and 1995.

Labor Classification Key:
 IX: Principal, Vice President
 VIII: Senior Project Manager, Division Manager, Senior Consultant
 VII: Senior Engineer, Senior Scientist, Project Manager
 VI: Senior Engineer, Senior Scientist
 V: Engineer/Scientist, Senior Scientist
 IV: Engineer/Scientist
 III: Junior Engineer/Junior Scientist
 II: Junior Engineer/Junior Scientist, Senior Technician
 I: Technician

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN (QAPjP)



**BECKER ELECTRONICS MANUFACTURING SITE
QUALITY ASSURANCE PROJECT PLAN
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**

This site-specific Quality Assurance Project Plan (QAPjP) is designed to identify the sections of the Quality Assurance Program Plan (QAPP) (ABB Environmental Services, 1994) that apply to the activities described in the Becker Electronics Manufacturing (Becker) site work plan, to describe any variances to those procedures, and to specify the data quality objectives (DQOs) and laboratory analytical procedures.

General Procedures and Practices. The general procedures used to conduct the Remedial Investigation at the Becker site will be taken from the following sections of the QAPP (ABB Environmental Services, 1994):

Section 2.0	Program Organization and Responsibilities
Section 9.0	Internal Quality Control
Section 10.0	Audits
Section 11.0	Preventive Maintenance
Section 12.0	Data Assessment
Section 13.0	Corrective Action
Section 14.0	Reports to Management

Field Procedures and Sampling. Environmental testing, sampling and analysis at the Becker site will use the following procedures described in the QAPP or Work Plan:

Baseline Air Sampling	Section 2.3.2, Work Plan
Surface Geophysics	Section 4.8.1, QAPP
Fracture Trace Analysis	Section 2.3.4, Work Plan
Surface Water Sampling	Section 4.6.2, QAPP
Sediment Sampling	Section 4.6.3, QAPP
Test Pitting	Section 4.6.4, QAPP
Spun-Casing Drilling	Section 4.6.4, QAPP
Air Rotary Drilling	Section 2.3.8, Work Plan
Monitoring Well Installation	Section 4.7, QAPP
Monitoring Well Development	Section 4.7, QAPP
Borehole Geophysics	Section 2.3.3, Work Plan

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Packer Testing	Section 4.8.2, QAPP
Permeability Testing	Section 4.8.2, QAPP
Water Level Measurements	Section 4.8.2, QAPP
QA/QC Procedures	Sections 3.0, 5.0, 6.0, 7.0, 8.0, and 9.0, QAPP
Sample Identification	QAPjP
IDW Drum Labeling	QAPjP

Decontamination of equipment will follow the procedures described in the QAPP, Section 4.3. All IDW containerization and disposal is described in Section 2.3.1 of the Work Plan. ABB-ES will dispose of the IDW acting as an agent of NYSDEC.

Sampling and Analysis Program. The results of DQO analysis for the Becker site RI/FS activities are summarized in Table B-1. The analytical data requirements were established using the methods described in Section 3.0 of the QAPP. The analytical methods to be used for laboratory analysis are presented in Table B-2.

Sample Identification. Sample identification (ID) will adhere to Section 4.1.1 of the QAPP with the following exceptions and clarifications:

- Digits 1,2 All sample ID will begin with the site designator **BE**
- Digits 3,4 Debris pile samples will be designated sample type **WT**.
Baseline air monitoring samples will be designated sample type **AS**.
- Digits 8,9,10 Depth of samples will remain **XXX** for all surface water, sediment, and air samples.
- Digits 11,12 The event number will be the year the samples were collected **94**.

IDW Drum Labeling. All drums of IDW will be labeled with the following information:

- Drum Contents
- Site Name and NYSDEC site registry number

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- Date drum filling began and date drum was sealed

Upon completion of Task 3 sampling activities, the NYSDEC project manager will be notified in writing as to the location, number, and any relevant information regarding the drums staged on the site. The drums are to be stored on wooden pallets inside the site security fence, at a location agreeable to NYSDEC and ABB-ES. The drum inventory memorandum will be form the basis for a scope of services when a IDW transport and disposal services are subcontracted by ABB-ES.

**TABLE B-1
DATA QUALITY OBJECTIVES
BECKER ELECTRONICS MANUFACTURING SITE**

DATA QUALITY OBJECTIVE ELEMENTS		SITE CHARACTERIZATION		RISK ASSESSMENT		FEASIBILITY STUDY	
OBJECTIVE	<ul style="list-style-type: none"> o Provide additional data to complete assessment of extent of groundwater contamination migrating from site sources o Fill data gaps/collect confirmatory samples from selected subareas to address comments on previous investigations and estimate extent of source contamination (soils and debris) o Assessment of contaminant migration pathways o Provide data necessary to adequately characterize site hydrogeology 	<ul style="list-style-type: none"> o Assess public health risks due to exposure to contaminated groundwater o Assess potential for ecological risks to occur 	<ul style="list-style-type: none"> o Evaluate feasibility of groundwater treatment system o Evaluate potential need for remediation of source material (soil, debris, shallow groundwater) 				
DATA QUALITY FACTORS	<ul style="list-style-type: none"> o Prioritized Data Uses(s) o Media of Concern o Chemical/Physical Data Required 	<ul style="list-style-type: none"> o Contamination Assessment o Fate and Transport Assessment <p>Groundwater, soil, debris, surface water, sediment</p> <p>VOCs, SVOCs, Metals, pH, DO, Specific Conductivity, Eh, Turbidity, Vertical and Horizontal Extent, Water Level Elevation, Hydraulic Conductivity, COD, TOC, BOD, TSS, Bulk Density</p>	<ul style="list-style-type: none"> o Identification of Contaminants of Concern o Identification of Exposure Scenarios o Assessment of Risks <p>Groundwater, surface water, air, soil, debris, sediment</p> <p>VOCs, SVOCs, Metals</p>	<ul style="list-style-type: none"> o Engineering Design of Alternative <p>Groundwater, soil, debris</p> <p>VOCs, SVOCs, Metals, TCLP, pH, DO, Specific Conductivity, Eh, Turbidity, Vertical and Horizontal Extent, Hydraulic Conductivity, BOD, COD, alkalinity, hardness, TSS, Bulk density</p>			
LEVELS OF CONCERN (ARARs) (1)	<p>USEPA MCLs, NYSDEC SCGs: Class GA Groundwater Standards, NYSDEC Class C surface water standards, NYSDOH Air-1 standards</p>	<p>USEPA MCLs, NYSDEC SCGs: Class GA Groundwater Standards, NYSDEC Class C surface water standards, NYSDOH Air-1 standards, AWQC</p>	<p>USEPA MCLs, NYSDEC SCGs: Class GA Groundwater Standards, NYSDEC Class C surface water standards, NYSDOH Air-1 standards</p>				

TABLE B-1
 DATA QUALITY OBJECTIVES
 BECKER ELECTRONICS MANUFACTURING SITE

DATA QUALITY OBJECTIVE ELEMENTS		SITE CHARACTERIZATION		RISK ASSESSMENT		FEASIBILITY STUDY	
REPORTING LIMIT (2)		SQLs	SQLs	SQLs	N/A		
APPROPRIATE ANALYTICAL LEVELS		I,III,IV	III, IV	III, IV	I,III, IV		
CRITICAL SAMPLES/ANALYSES		VOCs (All Samples)	All Samples	All Samples	VOCs, Metals, Alkalinity, BOD, COD, TSS, TOC, DO, pH		
DATA QUALITY NEEDS							
o Sample Collection Procedure	See Section 2.0 of Work Plan and Section 4.0 of QAPP (ABB-ES, 1994)						
o Sample Analysis							
Level I – Field Screening	PI Meter Screening, pH, Eh, DO, Turbidity, Specific Conductivity, temperature					PI Meter Screening, pH, Eh, DO, Turbidity, Specific Conductivity	
Level I – Hardness	Calculated – Standard Methods					Calculated – Standard Methods	
Level I – Well Location and Elevation Survey, debris pile aerial extent and thickness survey	0.01 foot vertical control, 0.1 feet horizontal control (See Section 2.0 of Work Plan)					0.01 foot vertical control, 0.1 feet horizontal control (See Section 2.0 of Work Plan)	
Level I – Water Level Survey	0.01 foot vertical control						
Level I – Hydraulic Conductivity Testing	See Section 4.8 of QAPP for Methodology					See Section 4.8 of QAPP for Methodology	
Level I – Geotechnical Testing							
Bulk Density	Field measured					Field measured	
Level III – Laboratory Analysis							
BOD	See Table A-2					See Table A-2	
COD	See Table A-2					See Table A-2	
TOC	See Table A-2					See Table A-2	
TSS	See Table A-2					See Table A-2	
Alkalinity	See Table A-2					See Table A-2	

**TABLE B-1
DATA QUALITY OBJECTIVES
BECKER ELECTRONICS MANUFACTURING SITE**

DATA QUALITY OBJECTIVE ELEMENTS	SITE CHARACTERIZATION	RISK ASSESSMENT	FEASIBILITY STUDY
Level III and IV - Laboratory Analyses TCL VOCs TCL SVOCs TCLP VOCs/SVOCs/Metals TAL Metals SVOCs (Air-NIOSH)	See Table A-2 See Table A-2 See Table A-2 See Table A-2 See Table A-2	See Table A-2 See Table A-2 See Table A-2 See Table A-2 See Table A-2	See Table A-2 See Table A-2 See Table A-2 See Table A-2 See Table A-2
PARCC PARAMETERS	See QAPP for Acceptance Criteria (ABB-ES, 1994)		

NOTES:

(1) Chemical-Specific Applicable or Relevant and Appropriate Requirements.

(2) CRQLs for Level IV analyses may be used as SQLs.

N/A = Not Applicable

PARCC = Precision, Accuracy, Representativeness, Completeness and Comparability

SQL = Sample Quantitation Limit

USEPA MCLs = USEPA Maximum Contaminant Levels

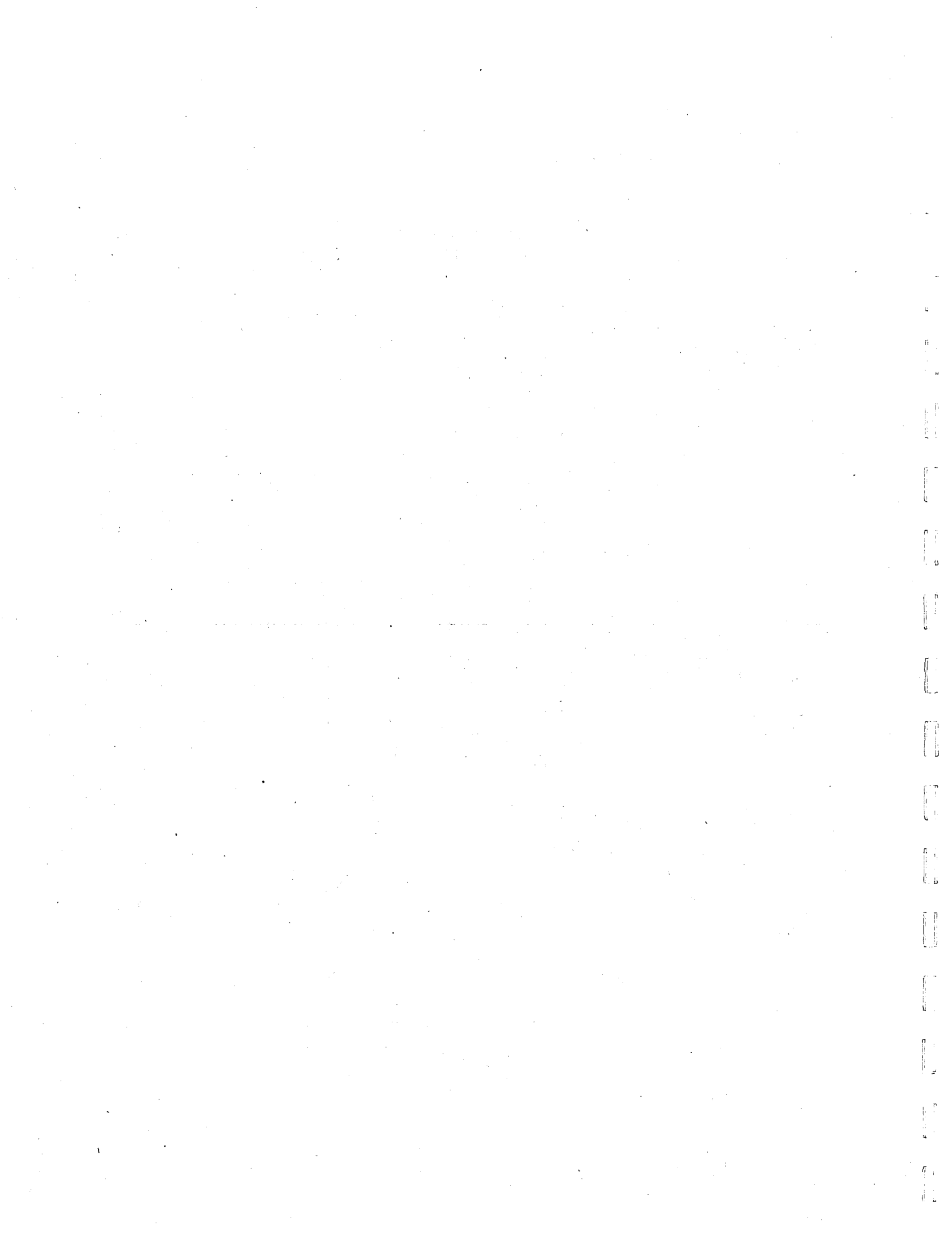
**TABLE B-2
SUMMARY OF ANALYTICAL METHODS
BECKER ELECTRONICS MANUFACTURING SITE**

MEDIA	PARAMETER	METHOD ¹
Water (Surface Water, Groundwater)	TCL VOCs	91-1
	TCL SVOCs	91-2
	TAL Metals	Series 200 CLP-M
	TOC	USEPA 415.1
	Alkalinity	USEPA 310.1
	TSS	USEPA 160.2
	BOD	USEPA 405.1
	COD	USEPA 410.1
Soil/Sediment	TCL VOCs	91-1
	TCL SVOCs	91-2
	TAL Metals	Series 200 CLP-M
Debris/Wastes	TCL VOCs	91-1
	TCL SVOCs	91-2
	TAL Metals	Series 200 CLP-M
	TCLP Extraction	USEPA 1311
	TCLP VOCs	USEPA 8240
	TCLP SVOCs	USEPA 8270
	TCLP Metals	Series 200 CLP-M
Air	TCL VOCs	TO14
	SVOCs	NIOSH 5506

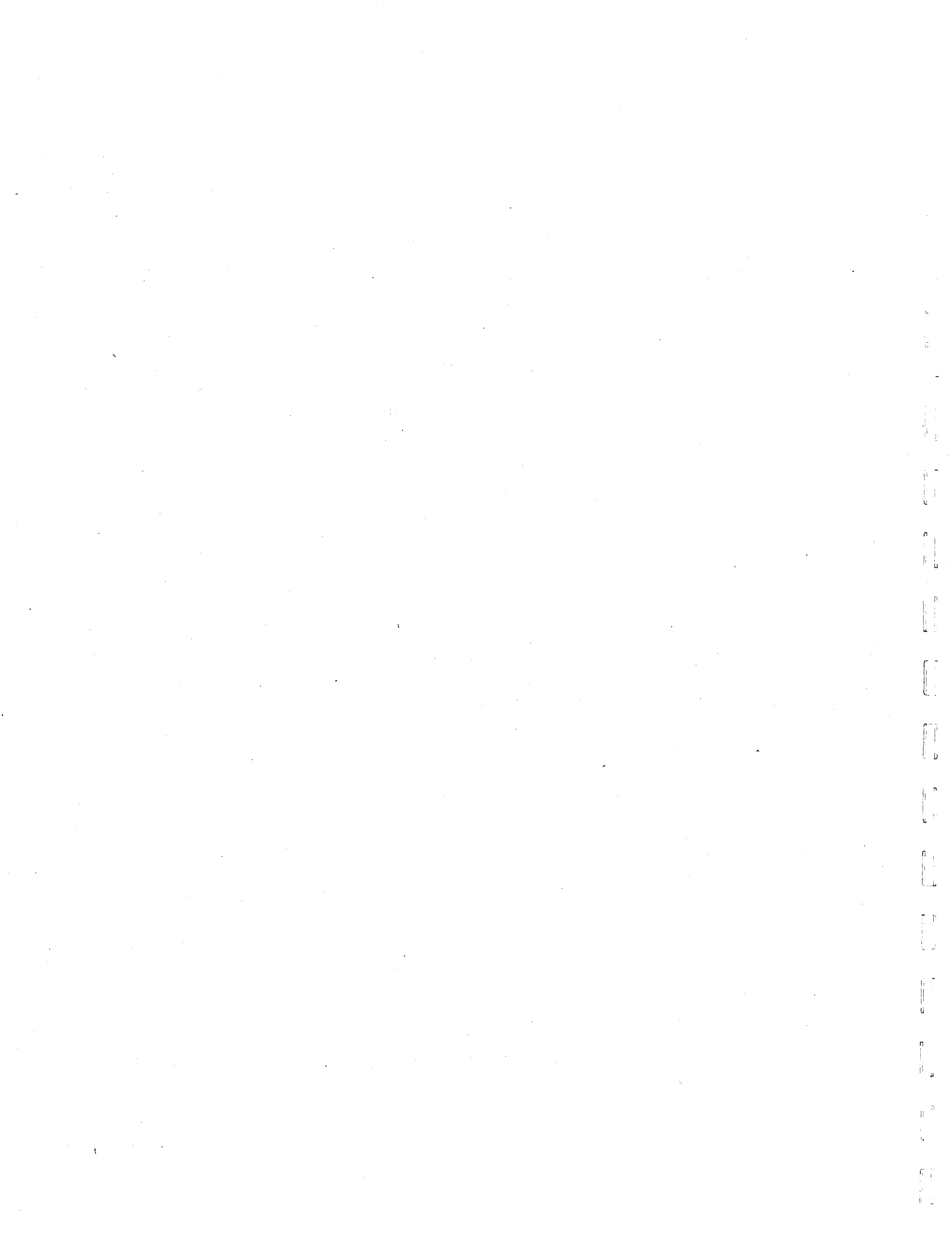
Notes:

¹ NYSDEC Analytical Services Protocol, December, 1991

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APPENDIX C
HEALTH AND SAFETY PLAN



NYSDEC SUPERFUND STANDBY CONTRACT
WORK ASSIGNMENT NO. D002472-15

HEALTH AND SAFETY PLAN
Part I

BECKER ELECTRONICS MANUFACTURING SITE
TOWN OF EAST DURHAM, NEW YORK

Submitted to:

New York State Department of Environmental Conservation
Albany, New York

Submitted by:

ABB Environmental Services
Portland, Maine

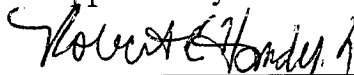
June 1994

Submitted by:

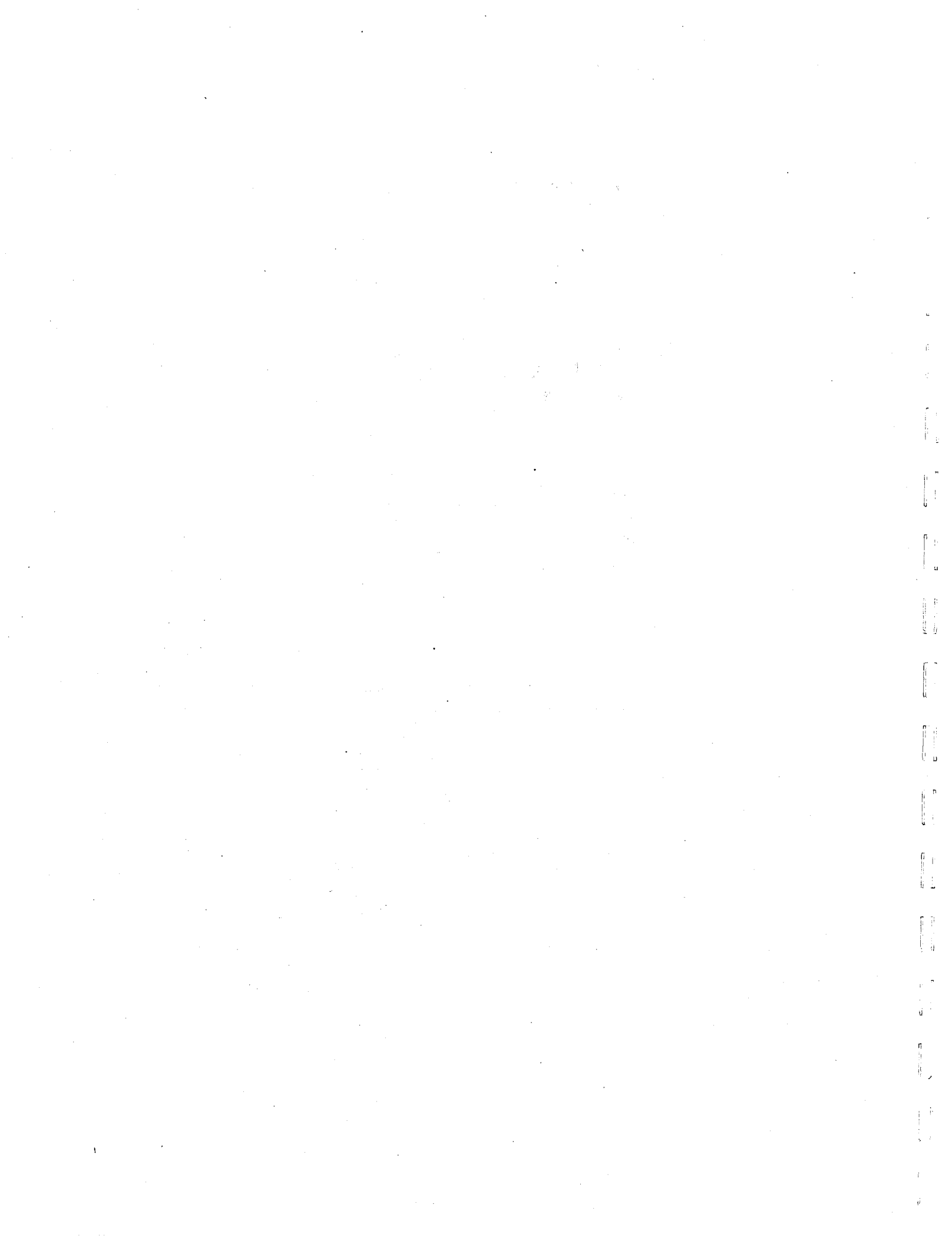


Brian K. Butler
Remedial Investigation Lead
ABB Environmental
Services

Approved by:



Robert E. Handy, Jr., P.E.
Program Manager
ABB Environmental
Services



TOWN OF EAST DURHAM, NEW YORK
HEALTH AND SAFETY PLAN
BECKER ELECTRONICS MANUFACTURING SITE

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TOWN OF EAST DURHAM, NEW YORK
HEALTH AND SAFETY PLAN
BECKER ELECTRONICS MANUFACTURING SITE

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HEALTH AND SAFETY PLAN
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TOWN OF EAST DURHAM, NEW YORK
HEALTH AND SAFETY PLAN
BECKER ELECTRONICS MANUFACTURING SITE

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TOWN OF EAST DURHAM, NEW YORK
HEALTH AND SAFETY PLAN
BECKER ELECTRONICS MANUFACTURING SITE

APPENDICES, Part II

The following appendices are applicable for the work anticipated at the site (see Health and Safety Plan, Part II):

- X A. AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
- X B. TRAINING PROGRAM
- X C. MEDICAL SURVEILLANCE PROGRAM
- X D. ENGINEERING CONTROLS
- X E. PERSONAL PROTECTIVE LEVEL DETERMINATION
- X F. MONITORING EQUIPMENT
- X G. ZONATION
- X H. WORK PRACTICES
- I. CONFINED SPACE ENTRY PROCEDURES
- X J. EXCAVATION AND TRENCHING
- X K. TEMPERATURE EXTREMES
 - X HEAT STRESS
 - COLD STRESS
- X L. DECONTAMINATION
- X M. EMERGENCY PLANNING
- X N. HEALTH AND SAFETY FORMS AND DATA SHEETS
 - X HEALTH AND SAFETY AUDIT FORM

ABB Environmental Services

TOWN OF EAST DURHAM, NEW YORK
HEALTH AND SAFETY PLAN
BECKER ELECTRONICS MANUFACTURING SITE

APPENDICES, Part II
(continued)

- ACCIDENT REPORT FORM
- HSO CHECKLIST FOR FIELD OPERATIONS
- MATERIAL SAFETY DATA SHEETS
 - LIQUINOX
 - ETHYL ALCOHOL (denatured)
 - TRISODIUM PHOSPHATE
- OSHA POSTER
- DAILY HEALTH AND SAFETY AUDIT FORM

- O. RESPIRATORY PROTECTION PROGRAM

- P. OTHER
 - ILLUMINATION
 - SANITATION
 - HEALTH AND SAFETY AUDIT PROCEDURES

- Q. STANDARD OPERATING PROCEDURES
 - STANDARD OPERATING PROCEDURES FOR THE USE OF EXPLOSIVES IN SEISMIC REFRACTION SURVEYS

1.0 GENERAL

1.1 HEALTH AND SAFETY PLAN SCOPE AND PURPOSE

This Health and Safety Plan (HASP) was prepared in conformance with the ABB Environmental Services (ABB-ES), formerly E.C. Jordan (Jordan), Health and Safety Program, and is intended to meet the requirements of 29 CFR 1910.120. Part I is the site-specific HASP. It addresses the activities associated with field program tasks at the Becker Electronics Manufacturing site in the Town of East Durham, New York. Part II is the Jordan corporate HASP. Compliance with both parts of this HASP is required of all ABB-ES personnel, subcontractor personnel, and/or third parties entering the Becker Electronics Manufacturing site.

1.2 PROJECT PERSONNEL

1.2.1 Project Manager

The Project Manager (PM), Mr. Bob Handy, has overall project management responsibilities for the Becker Electronics Manufacturing site. Mr. Bob Handy can be reached at (207) 775-5401, ext. 3638. Those responsibilities, as they relate to health and safety, include provision for the development of this site-specific HASP, (i.e., the necessary resources to meet the HASP requirements), coordination of staff assignments to be sure that personnel assigned to the Becker Electronics Manufacturing field project meet medical and training requirements, and the means necessary to resolve any health and safety issues that are identified or that develop on the project.

1.2.2 Field Operations Leader

The Field Operations Leader (FOL) is either the PM or the PM's designee who is on-site and vested with the authority by the PM to carry out day-to-day site operations, including interfacing with the site Health and Safety Officer (HSO). The designated Field Operations Leader for the Becker Electronics Manufacturing site is Brian Butler ext. 3603.

SECTION 1

1.2.3 Health and Safety Officer

The HSO for the Becker Electronics Manufacturing site, Brian Johnson, has been designated by the PM with concurrence of the Health and Safety Supervisor (HSS), Meg MacLeod, and the Health and Safety Manager (HSM), Cynthia Sundquist. The HSO, or his designee, will report indirectly to the HSM through the HSS, or directly to the HSM, for the duration of his assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the ABB-ES Health and Safety Program. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany U.S. Environmental Protection Agency (USEPA) personnel, Occupational Safety and Health Administration (OSHA) inspectors, or other governmental agency personnel visiting the Becker Electronics Manufacturing site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating or modifying this HASP as site or environmental conditions change.

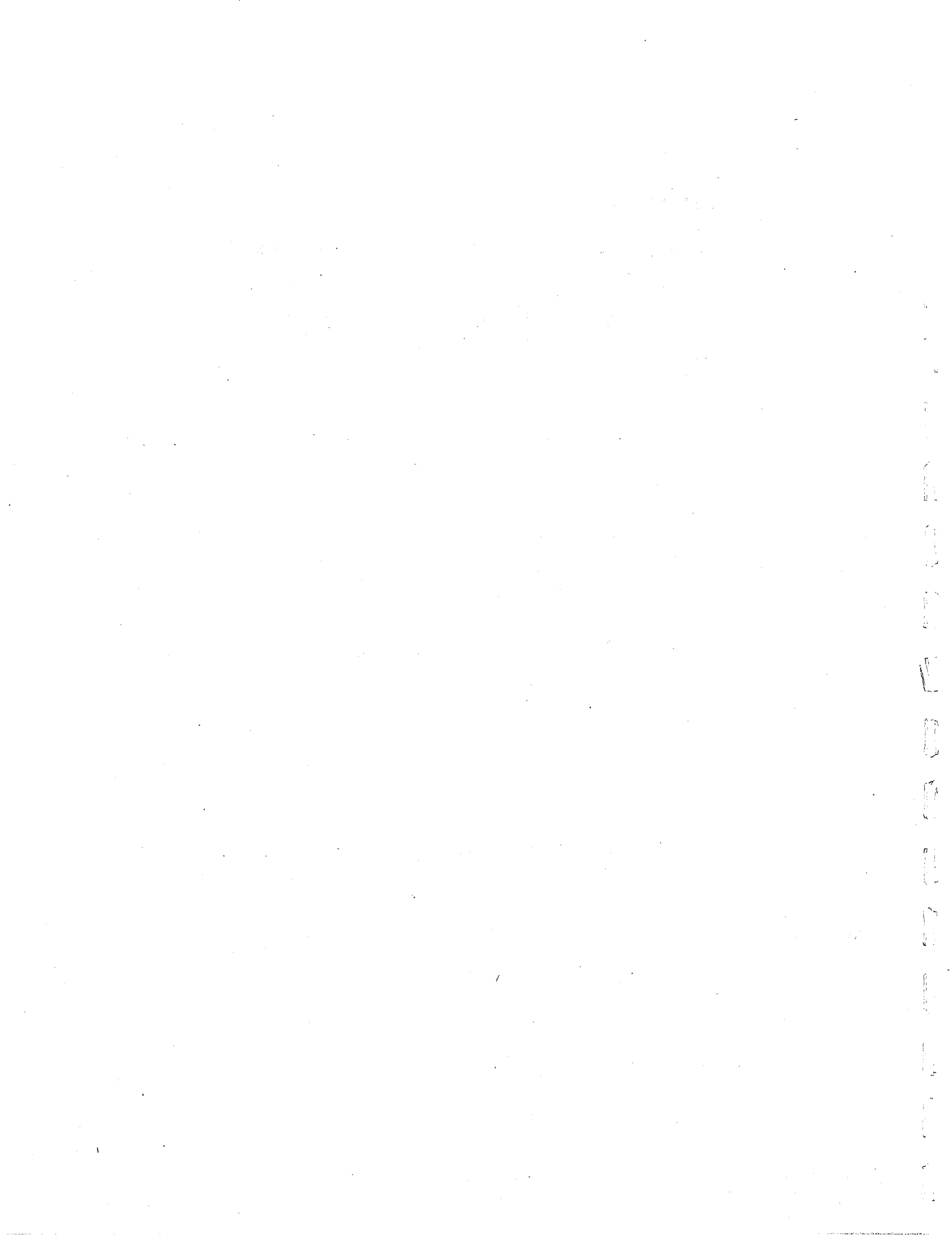
The HSO is vested with the authority to stop site operations (STOP WORK AUTHORITY) if he determines that an imminent health or safety hazard or other potentially dangerous situation exists. The HSO will immediately attempt to notify the HSS or the HSM of any Stop Work Orders issued. The HSO may also recommend to the HSS or HSM that the downrange authorization of individual site personnel be revoked or qualified for health and/or safety reasons.

1.3 TRAINING

Training, as defined in the ABB-ES Health and Safety Program and the requirements of 29 CFR 1910.120, is required for all personnel entering potentially contaminated areas of this site. Personnel without the required training will not be permitted in any downrange position, i.e., an area or position with potential for exposure to toxic substances or harmful physical agents. Appendix B, Part II, further discusses the ABB-ES training requirements.

1.4 MEDICAL SURVEILLANCE

Personnel entering potentially contaminated areas of Becker Electronics Manufacturing site must be medically qualified for site assignment through the medical surveillance program outlined in the ABB-ES Health and Safety Program. Personnel without medical clearance will not be permitted in any downrange position. Appendix C, Part II, further discusses the ABB-ES medical surveillance program.



2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE

The Becker Electronics Manufacturing site (NYSDEC Site No. 4-20-007) is a 13-acre facility and is located in a rural, residential area in the hamlet of East Durham, within the Town of Durham, Greene County, New York. East Durham is located approximately 40 miles southwest of Albany, and 12 miles west of Catskill, New York, (Figure 2-1). The site is in an area of mixed residential and commercial land use (M&E, 1992). Topography surrounding the site is characterized by rolling hills. The site plan is shown in Figure 2-2.

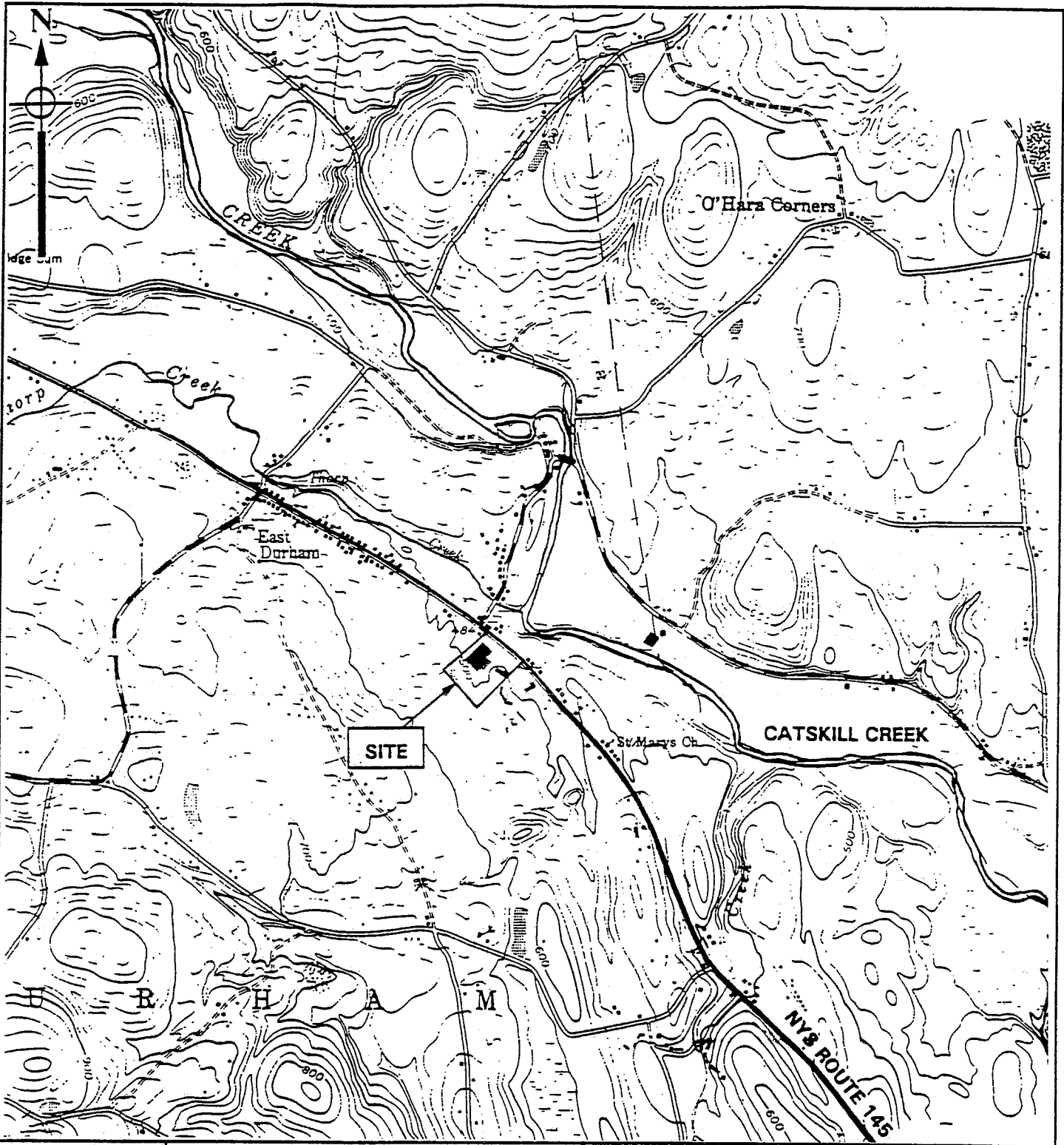
2.2 SITE HISTORY

The Becker Electronics Manufacturing facility was formerly used to manufacture high fidelity speakers and speaker components. As part of the plant operations, 1,1,1-trichloroethane, and possibly other solvents, were used to remove oils from speaker magnet plates and other metal parts, and to degrease mechanical machinery. (M&E, 1992).

The following chronology summarizes previous investigations and other historical information related to the Becker site. ABB-ES personnel reviewed these documents and information to prepare a scope of work in response to the Phase II RI/FS work assignment. Locations of previous sampling locations and existing site features are shown on Figure 1-2.

Industrial Waste Study for Becker Electronics Manufacturing Corporation (Brinnier and Larios, 1981). Documents the source and disposal of industrial wastewater at the site, and summarizes environmental sampling results from 1980 and 1981. Recommends improvements to the industrial wastewater treatment process and cleanup of contamination.

NYSDOH File - Water Supply Well Data from Vicinity of Becker Electronics Site - 1981 to Present. Documents concentrations of groundwater contaminants at water supply well/receptor locations.



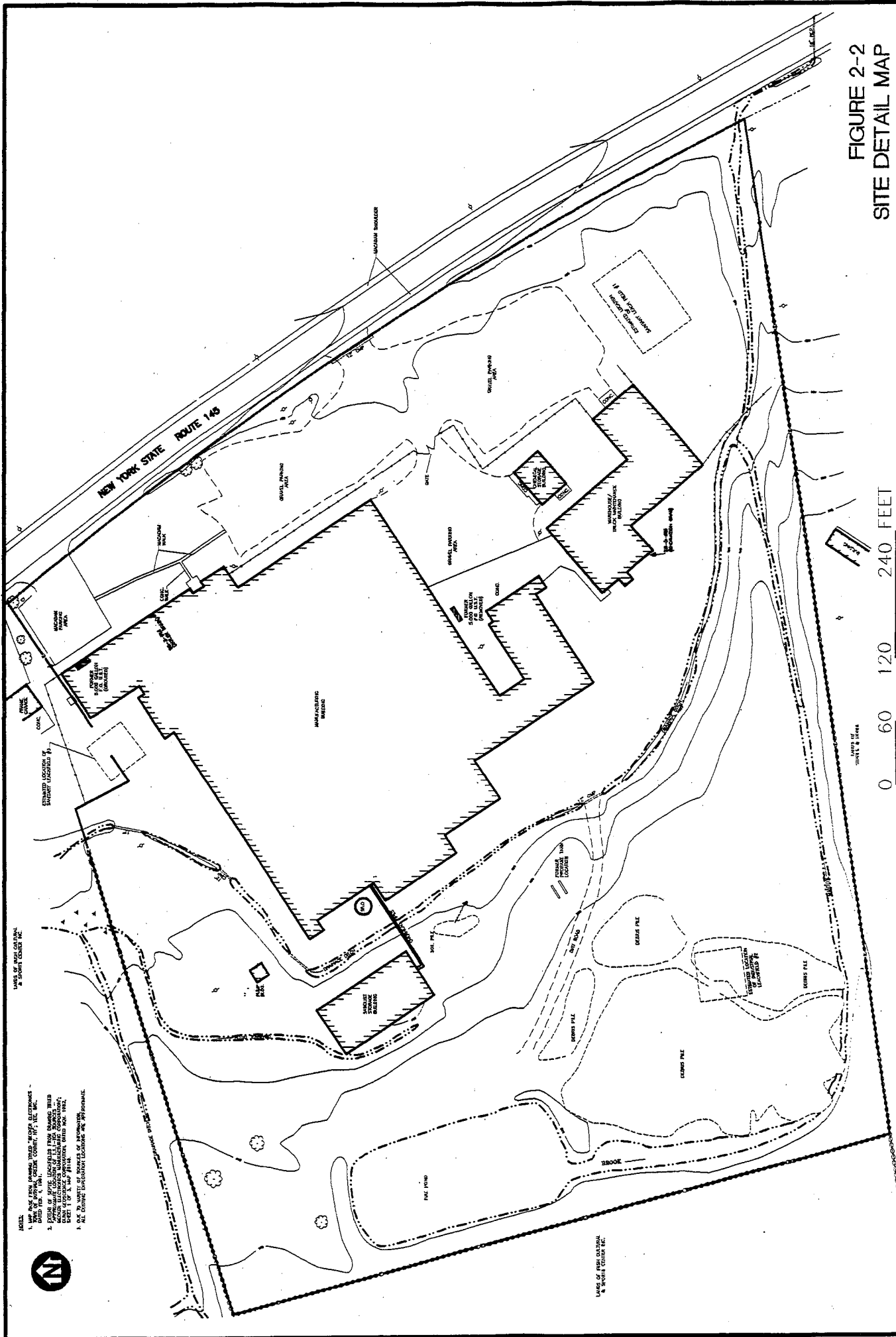
SOURCE: METCALF & EDDY (1992C).



QUADRANGLE LOCATION



FIGURE 2-1
SITE LOCATION MAP
BECKER ELECTRONICS MANUFACTURING SITE
EAST DURHAM, NEW YORK



- INDEX**
1. MAP AREA FROM AERIAL PHOTO, 1970, BY BECKER ELECTRONICS, EAST DURHAM, N. Y.
 2. PERIMETER OF THE FACILITY AS OF 1970, BASED ON THE AERIAL PHOTO, 1970, BY BECKER ELECTRONICS, EAST DURHAM, N. Y.
 3. PERIMETER OF THE FACILITY AS OF 1970, BASED ON THE AERIAL PHOTO, 1970, BY BECKER ELECTRONICS, EAST DURHAM, N. Y.
 4. PERIMETER OF THE FACILITY AS OF 1970, BASED ON THE AERIAL PHOTO, 1970, BY BECKER ELECTRONICS, EAST DURHAM, N. Y.
 5. PERIMETER OF THE FACILITY AS OF 1970, BASED ON THE AERIAL PHOTO, 1970, BY BECKER ELECTRONICS, EAST DURHAM, N. Y.

LANDS OF FISH CULTURE & SPORTS CENTER, INC.

LANDS OF FISH CULTURE & SPORTS CENTER, INC.



FIGURE 2-2
SITE DETAIL MAP
BECKER ELECTRONICS
EAST DURHAM, NEW YORK



SCALE: 1" = 120'

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Map Titled "Location of Proposed Monitoring Wells" (Dunn Geoscience, 1982a). Shows proposed locations for monitoring wells, locations of existing Becker water supply wells number (no.) 1, no. 2, and no. 3, and location of industrial leachfield.

Map Titled "Approximate Location of 1,1,1-TCA Sources" (Dunn Geoscience, 1982b). Shows locations of Becker water supply wells, septic tanks, and leachfields.

Map Titled "Selected Water Sampling Points and Concentrations of 1,1,1-TCA" (Dunn Geoscience, 1982c). Shows results of 1,1,1-TCA analysis of leachfield, septic tank, and Becker water supply well samples.

Interim Report - Hydrogeologic Investigation Preliminary Findings For Becker Electronics (Dunn Geoscience, 1983). Documents results of preliminary sampling and geologic characterization performed by Dunn Geoscience. Indicates on-site bedrock fracture sets trend North 40 degrees East and North 95 degrees East, and illustrates the interpreted extent of groundwater contamination exceeding 50 micrograms per liter ($\mu\text{g/L}$) of 1,1,1-TCA. Indicates spilling and burning of wastes occurred on the ground surface on the north side of the Becker manufacturing building and via the industrial leachfield. Includes a summary of detected 1,1,1-TCA concentrations from on- and off-site sampling points.

NYSDEC State Pollutant Discharge Elimination System Permit - Becker Electronics Manufacturing Site (NYSDEC, 1984). Presents sanitary and industrial waste leachfields discharge permit requirements and accompanying site detail map.

Proposal for Groundwater Contamination Assessment and Remediation Program for Becker Electronics Manufacturing Corporation (Bagdon Environmental Associates, 1986). Prepared for Becker Electronics Manufacturing. Summarizes the existing groundwater problem, and notes that fluctuations in 1,1,1-TCA and dichloroethane (DCA) concentrations occur seasonally, with the highest concentrations in water supply wells occurring in the winter when usage is lowest. Recommends a pump test of the Becker no. 2 water supply well, installation of a pump-and-treat system, and remediation of the septic systems and soil.

Becker Electronics Manufacturing Corporation - Well no. 2 Pump Test Report (Bagdon Environmental Associates, 1987). Details step-drawdown and three-day constant-rate pump test results for the Becker no. 2 water supply well performed in 1987. Estimates a transmissivity of between 2,000 and 5,000 gallons per

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day (gpd)/foot with a maximum pumping rate of 20 to 30 gallons per minute (gpm). Predicts the cone of depression created by pumping this well to be elongated preferential to one of the joint sets identified by Dunn Geoscience.

Hydrogeologic Evaluation of Proposed Remedial Options at the Becker Electronics Site as Related to Human Exposure to a Contaminated Drinking Water Supply (P.A. Rubin, 1987). Provides a detailed review of the Bagdon Associates pump test. Concludes that the pump test was poorly designed and did not provide representative data from which to assess the aquifer characteristics, and recommends another pump test.

Affidavit in Support of Motion for Summary Judgment (State of New York against Becker Electronics Manufacturing Corporation, 1990 - draft). Details a summary of the studies performed to date, with evidence that contamination at the adjacent Weldon House (a resort hotel) originated from the industrial leachfield. Concludes that groundwater contamination will continue as long as sources remain. Recommends an RI/FS to assess the areal extent of contamination. Includes a summary of groundwater data from 1980 to 1988, a summary of on-site surface water and septic system data from 1981 to 1987, and private water supply well data from 1980 to 1989.

Citizen Participation Plan for Becker Electronics Manufacturing Site (NYSDEC Division of Hazardous Waste Remediation, 1992). Encourages communication between the NYSDEC and the community during the RI/FS process for the site. Summarizes the site history, noting that Becker Electronics declared bankruptcy in 1988, and outlines the RI/FS process for the site to be performed by a NYSDEC Superfund standby consultant.

Interim Remedial Measure - Evaluation of Water Treatment Systems for Weldon House (Metcalf & Eddy of New York, Inc. [M&E], 1992b). Details assessment of the water treatment system used at the Weldon House and recommends changes to the system.

Remedial Investigation Report (M&E, 1992c). Describes the activities and results of the first phase of the RI. Provides an initial determination regarding the location and characterization of sources of contamination and begins defining migration pathways, extent of contamination, and exposed populations. Confirms that residual volatile organic compound (VOC) contamination remains in the septic systems

SECTION 2

on-site, in soil at the chemical storage building, and in groundwater throughout the site. Presents transmissivity values calculated from pump test data between 4,000 gpd/foot and 5,000 gpd/foot. Shows on-site bedrock outcrops joint sets trend North 30 degrees East and North 60 degrees West, expressed as the observed bend in nearby Catskill Creek.

Baseline Human Health Risk Assessment and Environmental Risk Assessment (M&E, 1992a). Identifies potential carcinogenic and noncarcinogenic risks associated with source and groundwater contamination. Compares site contaminants in sediment and surface water samples to the NYSDEC Class C surface water standards and sediment cleanup criteria. Recommends that the second phase RI clarify the extent of off-site contamination of surface water and sediment, and identify significant aquatic or wildlife populations potentially exposed to contamination.

Phase I and Phase II Feasibility Study Report (M&E, 1992d). Discusses and identifies remedial technologies for site groundwater and other site media that may require remediation.

Subsurface Investigation (Environmental Products and Services, Inc. [EPS], 1992). Documents a post-IRM investigation of shallow groundwater at the location of a former aboveground waste oil tank where surface spills occurred. Identifies shallow groundwater solvent contamination throughout the vicinity of the truck loading docks and chemical storage building, but no significant groundwater contamination associated with the former tank location.

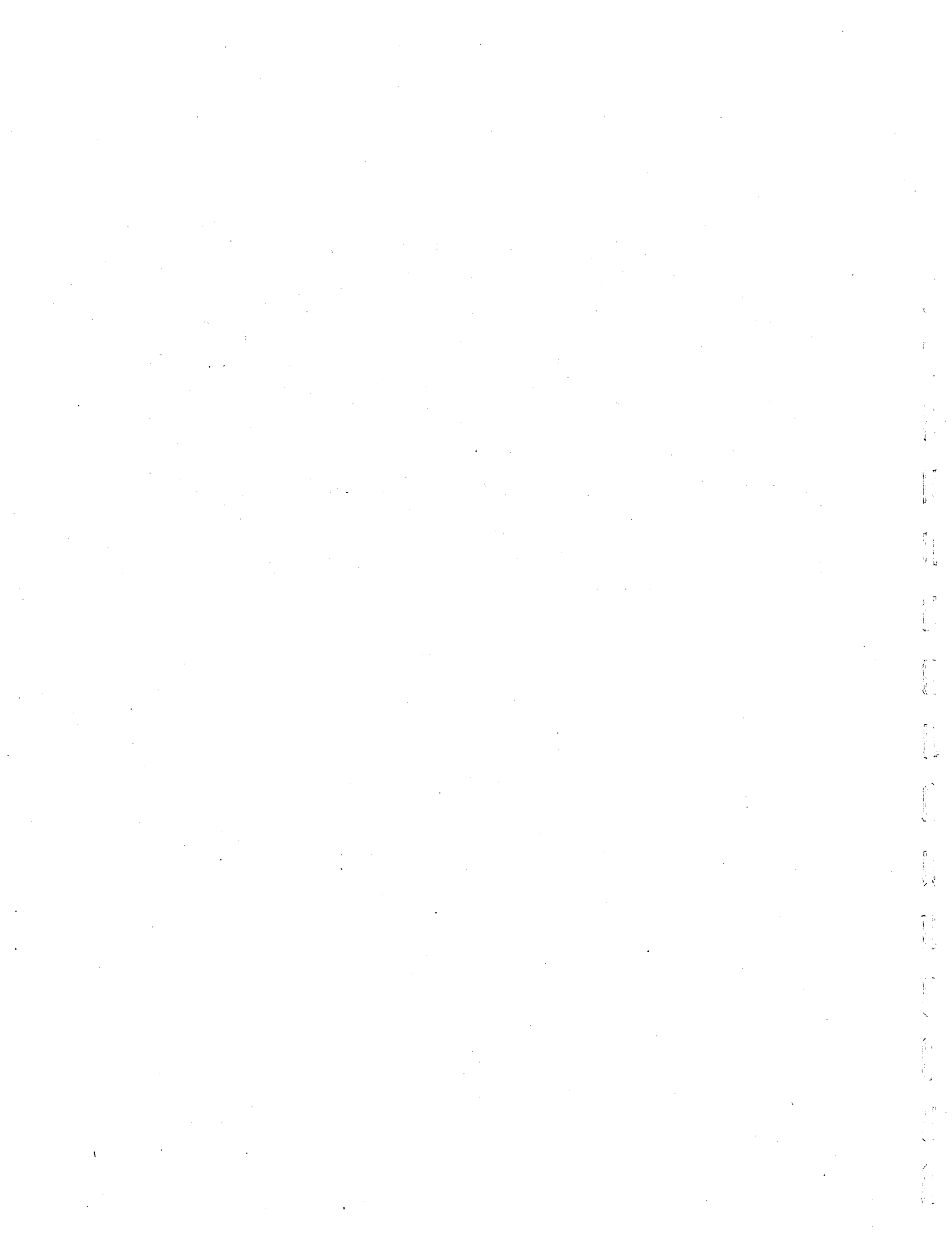
Analytical Report for Becker Site (NYSDEC, 1992b; unpublished). Documents results of the NYSDEC background soil sampling.

Mobile Laboratory Submission (NYSDEC, 1993; unpublished). Documents results of surface soil polychlorinated biphenyl (PCB) screening and surface water and sediment VOC analyses. Shows the site does not have significant PCB contamination, and that VOC contamination currently does not appear to migrate off site via surface water and sediment transport.

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2.3 BECKER ELECTRONICS MANUFACTURING SITE SCOPE OF WORK

In Task 1, ABB-ES recommended that a detailed RI/FS Work Plan, Quality Assurance Plan(QAPP), Quality Assurance Project Plan (QAPjP), and this HASP, be prepared to describe the Task 2,3,4,5, and 6 activities planned for the site. Task 2, Phase I and Phase II FS Review, will evaluate whether the list of groundwater remedial alternatives retained for the detailed evaluation is appropriate and complete. This HASP is for Task 3, Phase II (Post-Screening) RI Activities, which will assess the extent of potential hazardous waste deposition and the significant threat at the Becker Electronics Manufacturing site. The Task 3 activities will consist of baseline air monitoring, surface and borehole geophysical surveys, surface water and sediment sampling, test pitting, water level monitoring well and piezometer installations, bedrock groundwater monitoring wells and piezometer installation and reconstruction, monitoring well and water supply well sampling, hydrogeologic investigations, ecological characterization, miscellaneous tasks, laboratory analysis, and RI/RA report preparation. Task 4 will consist of the preparation of a Phase III FS report.



3.0 TASK ANALYSIS

This Section is separated into general site wide conditions (Section 3.1), and activities associated with Task 2 work activities: site reconnaissance, mobilization, and baseline air monitoring (Section 3.2), surface and borehole geophysical survey (Section 3.3), surface water/sediment sampling (Section 3.4), test pitting (Section 3.5), water table monitoring well/piezometer installation and bedrock groundwater monitoring well installation and reconstruction (Section 3.6), and monitoring well/water supply well sampling and hydrogeologic investigation (Section 3.7).

In general, nonintrusive work is anticipated to be performed at Level D personal protective equipment (PPE) and intrusive work is anticipated to be performed at Level C dermal PPE.

3.1 GENERAL SITE WIDE CONDITIONS

3.1.1 Hazardous Substances/Conditions

Materials disposed of at the site reportedly include: solvents (chlorinated hydrocarbons), semi-volatiles, and metals associated with the manufacture of speakers and speaker components.

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The following compounds may exist in the media at the Becker Electronics Manufacturing site:

**TABLE 3-1
COMPOUNDS DETECTED AT THE BECKER ELECTRONICS
MANUFACTURING SITE**

COMPOUND	EXPOSURE LIMIT (ppm or mg/m ³)	SOURCE OF EXPOSURE LIMIT
<u>VOCs:</u>		
1,1-Dichloroethane	100 ppm	OSHA, PEL
1,1-Dichloroethene	1 ppm	OSHA, PEL
1,2-Dichloroethene (total)	200 ppm	OSHA, PEL
1,1,1-Trichloroethane	350 ppm	OSHA, PEL
2-Butanone	200 ppm	OSHA, PEL
Chloroethane	1,000 ppm	OSHA, PEL
Chloroform	2 ppm	OSHA, PEL
Tetrachloroethene	25 ppm	OSHA, PEL
Toluene	50 ppm	ACGIH, TLV
Trichloroethene	50 ppm	OSHA, PEL
<u>SVOCs:</u>		
1,4-Dichlorobenzene	10 ppm	ACGIH, TLV
4-Nitrophenol	A1	ACGIH, TLV
Benzoic Acid	Not Available	
Benzo(a)anthracene	A2	ACGIH, TLV

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**TABLE 3-1
COMPOUNDS DETECTED AT THE BECKER ELECTRONICS
MANUFACTURING SITE**

COMPOUND	EXPOSURE LIMIT (ppm or mg/m ³)	SOURCE OF EXPOSURE LIMIT
(continued)		
Benzo(a)pyrene	0.2 mg/m ³	OSHA, PEL
Benzo(b)fluoranthene	A2	ACGIH, TLV
Bis(2-ethylhexyl)phthalate	Not Available	
Chrysene	0.2 mg/m ³	OSHA, PEL
Indeno(1,2,3-cd)pyrene	0.2 mg/m ³	OSHA, PEL
Phenol	5 ppm	OSHA, PEL
<u>Metals⁽¹⁾:</u>		
Aluminum	5 ⁽²⁾ mg/m ³	OSHA, PEL
Arsenic	0.5 ⁽³⁾ mg/m ³	OSHA, PEL
Barium	0.5 mg/m ³	OSHA, PEL
Beryllium	0.002 mg/m ³	OSHA, PEL
Cadmium	0.005 mg/m ³	OSHA, PEL
Calcium	Not Available	
Chromium	1 mg/m ³	OSHA, PEL
Cobalt	0.1 ⁽⁴⁾ mg/m ³	OSHA, PEL
Copper	1 mg/m ³	OSHA, PEL
Iron	10 ⁽⁵⁾ mg/m ³	OSHA, PEL

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**TABLE 3-1
COMPOUNDS DETECTED AT THE BECKER ELECTRONICS
MANUFACTURING SITE**

COMPOUND	EXPOSURE LIMIT (ppm or mg/m ³)	SOURCE OF EXPOSURE LIMIT
(continued)		
Lead	0.05 mg/m ³	OSHA, PEL
Magnesium	10 ⁽⁶⁾ mg/m ³	OSHA, PEL
Manganese	5 mg/m ³	ACGIH, TLV
Mercury	0.05 mg/m ³	OSHA, PEL
Nickel	1 mg/m ³	OSHA, PEL
Sodium	Not Available	
Vanadium	0.05 mg/m ³	OSHA, PEL
Zinc	5 ⁽⁷⁾ mg/m ³	OSHA, PEL

- Notes:**
- mg/m³ = milligrams per cubic meter
 - ppm = parts per million
 - OSHA, PEL = OSHA Personnel Exposure Limit, Time Weighted Average
 - ACGIH, TLV = ACGIH, Threshold Limit Value, Time Weighted Average
 - A1 = Confirmed Human Carcinogen
 - A2 = Suspected Human Carcinogen
 - (1) = Values typically represent respirable particulates
 - (2) = Respirable Fraction
 - (3) = Organic Compounds
 - (4) = For Metals, dust & fumes, as Co
 - (5) = As Iron oxide, total particulates
 - (6) = As Magnesium Oxide Fumes, total particulates
 - (7) = As Zinc oxide, respirable dust

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3.1.2 Site Risks

The site wastes are both on the surface and buried. The potential for buried drums exists at the site. Site personnel are cautioned to exercise care when working around sampling equipment and on the site.

3.1.2.1 Health Hazards. Potential health hazards include potential exposure to hazardous compounds via dermal contact, inhalation, and/or ingestion. Potentially hazardous substances that may exist in groundwater, subsurface fill or soil, or in drainage ditch surface waters and sediments include: volatile (primarily chlorinated solvents, and their degradation products), semi-volatile organics, and metals (see Table 3-1).

3.1.2.2 Safety Hazards. Safety hazards include those associated with working in the vicinity of heavy machinery, such as a drill rig. In addition, potential hazards exist when drilling through subsurface materials of unknown content and in the vicinity of potentially unidentified subsurface utilities or structures. Normal safety precautions will be followed by the drilling rig geologists and the sampling crew.

3.1.2.3 Conclusions/Risk Assessment. The overall health risk for the field program for Task 3 is moderate, due to the potential presence of hazardous wastes at the site, especially buried drums. The overall safety risk for the drilling program is moderate, due to the possible presence of buried drums.

3.1.3 Protective Measures

Protective measures will be undertaken to minimize the potential health and safety risks for field personnel. The protective measures discussed in the following sections apply for the indicated work tasks.

3.1.3.1 Engineering Controls. When possible engineering controls will be used at the site for these tasks. Prior to subsurface explorations an attempt will be made at all proposed drilling locations to locate subsurface utilities with facility plans.

To control dust, if required, the surface of the work location will be sprayed with water at each drilling and test pit location.

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3.1.3.2 Levels of Protection. Specific requirements for each work task is provided in the appropriate subsection, which follow. In general, nonintrusive work is anticipated to be performed at Level D dermal PPE and intrusive work is anticipated to be performed at Level C dermal PPE.

Level D dermal shall utilize the following personal protection items:

- coveralls
- gloves (optional)
- boots (chemical-resistant, steel-toed, steel shank)
- boot covers (chemical resistant) (optional)
- hard hat (optional)
- two-way radio (optional)
- escape mask (optional)
- safety glasses, splash goggles, or face shield (optional)

Level C dermal shall utilize the following personal protection items:

- inner and outer chemical-resistant gloves
- hooded chemical resistant clothing (tyvek suit)
- boots (chemical-resistant, steel-toed, steel shank)
- boot covers (chemical resistant) (optional)
- safety glasses or chemical-splash goggles
- hardhat (optional)
- two-way radio
- face shield (if splash protection is needed)
- rubber boots or disposable overboots

Level C respiratory shall utilize all the PPE for Level C dermal plus an air purifying respirator with a combination organic vapor, dust, and mist cartridges.

Personal protective items have been selected based on the compounds known to exist at the site; additional items may be added as necessary. Disposable protective clothing, gloves, and other equipment, exclusive of respirators, will be used when feasible to minimize risks during decontamination and possible cross-contamination during sample handling.

Disposable personal protective equipment, such as gloves and Tyvek suits, shall be changed at least twice a day or more if necessary to avoid cross-contamination during sampling events.

Should site conditions present a threat to ABB-ES personnel, its subcontractors, or other on-site representatives and/or should site conditions warrant an upgrade from Level C dermal personal protection, work will be stopped and the situation reevaluated by NYSDEC and ABB-ES.

3.1.4 Monitoring

Monitoring of the work environment will be undertaken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring during invasive events will include evaluations for oxygen-deficient environments and hazardous concentrations of airborne contaminants.

3.1.4.1 Air Monitoring/Action Levels. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Data will be used to provide confidence in the adequacy of the levels of protection being employed at the site, and may be used as the basis for reevaluation of site conditions by ABB-ES and NYSDEC.

Selected items from the following list of air monitoring equipment will be used as appropriate for the field program tasks at the Becker Electronics Manufacturing site. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- HNU IS101 Photoionization Detector (PID). The PID operates on the basis of ionization of the contaminant, which results in a meter deflection proportional to the concentration of the contaminant. In the PID, ionization is caused by an Ultra Violet (UV) light source. The strength of the UV light source, which is measured in electron volts (eV), determines which contaminants can be ionized. The HNU can use three different strength UV sources, including 9.6-, 10.2-, and 11.7-eV, although only the 10.2- and 11.7-eV probes are currently available for field use. Calibration and maintenance are performed in accordance with the manufacturer's instructions. An HNU meter will be used to monitor air quality during all invasive

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activities at the Becker Electronics Manufacturing site and will have a 11.7-eV lamp.

- ISD Dual Detector. This meter monitors for combustible gases and oxygen. It can be used to determine: (1) if an area contains concentrations of combustible gases with readings in percentage of the Lower Explosive Limit (LEL); and (2) the percentage of oxygen. This instrument is calibrated in accordance with the manufacturer's instructions.
- MIE Miniram, particulate monitor: This meter measures the particulates (dust, smoke, fumes, and mists) in the air. The instrument has a range from 0.01 to 100 mg/m³, for particles from 0.1 to 0.5 microns, and takes automatic readings every 10 seconds. It can be setup to record time weighted average concentrations over any period, up to 8 hours. This instrument is calibrated in accordance with the manufacturer's instructions.
- Detector Tubes (Draeger): A colorimetric detector tube is a direct-reading instrument consisting of a glass tube impregnated with an indicating chemical, which is connected to a piston cylinder or bellow-type pump. A known volume of air is drawn through the glass tube. The airborne contaminant, if present, reacts with the indicator chemical, produces a stain the length of which is proportional to the contaminant's concentration. The Draeger tubes selected for use at the Becker Electronics Manufacturing site are: Chloroform 2/a and Vinyl chloride 0.5/a

Prior to conducting the activities described in the following subsection, ABB-ES personnel will use a PID to assess the air quality at the sample locations prior to working in that area. A PID will also be used periodically to monitor the breathing zone of the site workers.

3.1.4.2 Personal Monitoring. No personal monitoring will be done during site activities.

3.2 SITE RECONNAISSANCE, MOBILIZATION, AND BASE LINE AIR MONITORING

Work tasks to be performed will include: mobilization and setup of an on-site field trailer, decontamination pad construction, selecting and staking of sampling locations, utilities clearances, and base line air monitoring. Each of these tasks will be nonintrusive in nature.

3.2.1 Hazardous Substances/Conditions

The materials listed in Table 3-1 represent materials reportedly disposed of at the site and include: solvents (chlorinated hydrocarbons), semi-volatiles, and metals associated with the manufacture of speakers and speaker components.

3.2.2 Site Risks

The site wastes are both on the surface and buried. The potential for buried drums exists at the site. Site personnel are cautioned to exercise care when working around the site.

3.2.2.1 Health Hazards. Potential health hazards include potential exposure to hazardous compounds via dermal contact, inhalation, and/or ingestion. Potentially hazardous substances in the drainage ditch surface waters and sediments may include: volatile (primarily chlorinated solvents, and their degradation products), semivolatile organics, and metals (see Table 3-1).

3.2.2.2 Safety Hazards. Safety hazards include those associated with the set up of the field trailer and construction of the decontamination pad. These hazards include the lifting of heavy equipment and potential for falls due to uneven terrain or housekeeping problems. Normal safety precautions will be followed by all site personnel.

3.1.2.3 Conclusions/Risk Assessment. The overall health risk these work tasks are low, due to the nonintrusive nature of the work.

3.2.3 Protective Measures

Protective measures will be undertaken to minimize the potential health and safety risks for field personnel. The protective measures discussed below pertain

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to these work task: mobilization and setup of an on-site field trailer, decontamination pad construction, selecting and staking of sampling locations, and utilities clearances.

3.2.3.1 Engineering Controls. It is not anticipated that engineering controls will be required at the site for these tasks.

3.2.3.2 Levels of Protection. Work is anticipated to be performed at Level D PPE.

Should site conditions present a threat to ABB-ES, its subcontractors, or other on-site representatives and/or should site conditions warrant an upgrade from Level D PPE, work will be stopped and the situation reevaluated by NYSDEC and ABB-ES.

3.2.4 Monitoring

During selecting and staking of sampling locations, utility clearance activities, and base line air monitoring, monitoring of the work environment will be under taken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring during invasive events will include evaluations for hazardous concentrations of airborne contaminants.

3.2.4.1 Air Monitoring/Action Levels. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Data will be used to provide confidence in the adequacy of the levels of protection being employed at the site, and may be used as the basis for reevaluation of site conditions by ABB-ES and NYSDEC.

The following list of air monitoring equipment will be used during the selection and staking of sampling locations and utility clearance activities. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- HNU IS101 Photoionization Detector (PID).

Work will be conducted at Level D PPE, provided the following conditions are satisfied:

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- PID readings in the site worker's breathing zone do not exceed background levels;

If PID readings in the site worker's breathing zone are greater than background, work will be stopped and the situation will be reevaluated by ABB-ES and NYSDEC.

3.2.4.2 Personal Monitoring. No personal monitoring will be done during site activities.

3.3 SURFACE AND BOREHOLE GEOPHYSICAL SURVEY

Work tasks to be performed will consist of two types of geophysical methods: surface geophysical surveys (i.e., magnetometry and terrain conductivity); and borehole geophysical logging.

3.3.1 Hazardous Substances/Conditions

The materials listed in Table 3-1 represent materials reportedly disposed of at the site and include: solvents (chlorinated hydrocarbons), semi-volatiles, and metals associated with the manufacture of speakers and speaker components.

3.3.2 Site Risks

The site wastes are both on the surface and buried. The potential for buried drums exists at the site. Site personnel are cautioned to exercise care when working around sampling equipment and on the site.

3.3.2.1 Health Hazards. Potential health hazards include potential exposure to hazardous compounds via dermal contact, inhalation, and/or ingestion. Potentially hazardous substances may exist in drainage ditch surface waters and sediments include: volatile (primarily chlorinated solvents, and their degradation products), semivolatile organics, and metals (see Table 3-1).

3.3.2.2 Safety Hazards. For *surface geophysical logging* activities safety hazards include lifting heavy or awkward pieces of equipment and falls due to walking on uneven terrain. For *borehole geophysical survey* activities an additional safety

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hazard exists due to the potential for contact with contaminated groundwater. Normal safety precautions will be followed by the work crews.

3.3.2.3 Conclusions/Risk Assessment. For *surface geophysical logging* activities the overall health risk is low due to the nonintrusive nature of the work. For *borehole geophysical survey* activities the overall health risk this work task is moderate, due to the intrusive nature of the work.

3.3.3 Protective Measures

Protective measures will be undertaken to minimize the potential health and safety risks for field personnel.

3.3.3.1 Engineering Controls. It is not anticipated that engineering controls will be used at the site for these tasks. Ventilation of the top of the borehole may be used to prevent upgrade to Level C respiratory protection during *borehole geophysical survey* activities.

3.3.3.2 Levels of Protection. *Surface geophysical* activities are anticipated to be performed at Level D PPE. *Borehole geophysical survey* activities are anticipated to be performed at Level C dermal PPE.

Should site conditions present a threat to ABB-ES, its subcontractors, or other on-site representatives and/or should site conditions warrant an upgrade from Level D or C dermal personal protection, work will be stopped and the situation reevaluated by NYSDEC and ABB-ES.

3.3.4 Monitoring

During *surface geophysical survey* activities real time monitoring of the work environment will be under taken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for hazardous concentrations of airborne contaminants with a PID.

During *borehole geophysical survey* activities real time monitoring of the work environment will be under taken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for

explosive environments (with an LEL/O₂ meter) and hazardous concentrations of airborne contaminants (with a PID).

3.3.4.1 Air Monitoring/Action Levels. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Data will be used to provide confidence in the adequacy of the levels of protection being employed at the site, and may be used as the basis for reevaluation of site conditions by ABB-ES and NYSDEC.

Surface Geophysical Survey:

The following list of air monitoring equipment will be used during *surficial geophysical survey* activities. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- Photovac TIP or HNU IS101 Photoionization Detector (PID).

Work will be conducted at Level C dermal PPE, provided the following conditions are satisfied:

- PID readings in the site worker's breathing zone do not exceed 5 ppm in the breathing zone;

If PID readings in the site worker's breathing zone are greater than background, work will be stopped and the situation will be reevaluated by ABB-ES and NYSDEC.

Borehole Geophysical Survey:

The following list of air monitoring equipment will be used during *borehole geophysical survey* activities. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- HNU IS101 Photoionization Detector (PID).
- ISD Dual Detector (LEL/O₂).

SECTION 3

- Draeger detector tubes:

Vinyl Chloride 0.5/a
Chloroform 2/a

Work will be conducted at Level C dermal PPE, provided the following conditions are satisfied:

- PID readings in the site worker's breathing zone do not exceed 5 ppm in the breathing zone;
- If, at any time, LEL readings exceed 10 percent, the field crew will stop work and the HSO will evaluate the situation. Work can continue if proper measures are used, (e.g., non-sparking tools, intrinsically safe equipment, and spark arresters). If, at any time, LEL readings exceed 20 percent, the field crew will stop work, shut down the rig, and withdraw from the work zone immediately. No work can be conducted at LEL levels above 20 percent.
- If, draeger tubes indicate no contaminants above the following levels:

Vinyl Chloride 0.5/a, (10 pumps):

Above background and below 0.5 ppm: Maintain Level C dermal and continue to monitor the breathing zone.

Chloroform 2/a (10 pumps):

Above background and below 1 ppm: Maintain Level C dermal and continue to monitor the breathing zone.

Upgrade to Level C respiratory protection may be done only with NYSDEC and ABB-ES approval. Upgrade to Level C respiratory protection will be required if any of the following occur:

ABB Environmental Services

- If PID readings in the site worker's breathing zone are greater than 5 ppm but less than 250 ppm, and Draeger tubes indicate non-detect.
- If Draeger tubes indicate the following:

Vinyl Chloride 0.5/a, (10 pumps):

Greater than 0.5 ppm: STOP WORK, upgrade to Level B may be required.

Chloroform 2/a (10 pumps):

Greater than 2 ppm: STOP WORK, upgrade to Level B will be required.

3.3.4.2 Personal Monitoring. No personal monitoring will be done during site activities.

3.4 SURFACE WATER/SEDIMENT SAMPLING

Work tasks to be performed will consist of the collection of four previously sampled surface water/sediment locations and one surface water/sediment sample from a low wetland area.

3.4.1 Hazardous Substances/Conditions

The materials listed in Table 3-1 represent materials reportedly disposed of at the site and include: solvents (chlorinated hydrocarbons), semi-volatiles, and metals associated with the manufacture of speakers and speaker components.

3.4.2 Site Risks

The site wastes are both on the surface and buried. Site personnel are cautioned to exercise care when working around sampling equipment and on the site.

SECTION 3

3.4.2.1 Health Hazards. Potential health hazards include potential exposure to hazardous compounds via dermal contact, inhalation, and/or ingestion. Potentially hazardous substances may exist in the drainage ditch surface waters and sediments which include: volatile (primarily chlorinated solvents, and their degradation products), semivolatile organics, and metals (see Table 3-1).

3.4.2.2 Safety Hazards. Safety hazards include falls when walking on uneven terrain or slippery rocks, mud or other surfaces. Normal safety precautions will be followed by the sampling crew.

3.4.2.3 Conclusions/Risk Assessment. The overall health risk this work task is low, due to the nonintrusive nature of the work.

3.4.3 Protective Measures

Protective measures will be undertaken to minimize the potential health and safety risks for field personnel. The protective measures discussed below pertain to this task, surface water/sediment sampling.

3.4.3.1 Engineering Controls. It is not anticipated that engineering controls will be used at the site for these tasks.

3.4.3.2 Levels of Protection. Work is anticipated to be performed at Level C dermal PPE. Should site conditions present a threat to ABB-ES, its subcontractors, or other on-site representatives and/or should site conditions warrant an upgrade from Level C dermal PPE, work will be stopped and the situation reevaluated by NYSDEC and ABB-ES.

3.4.4 Monitoring

During collection of surface water and sediment samples real time monitoring of the work environment will be undertaken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for hazardous concentrations of airborne contaminants (with a PID).

3.4.4.1 Air Monitoring/Action Levels. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Data will be used to provide confidence in the adequacy of the

levels of protection being employed at the site, and may be used as the basis for reevaluation of site conditions by ABB-ES and NYSDEC.

The following list of air monitoring equipment will be used during the collection of baseline air samples. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- HNU IS101 Photoionization Detector (PID).

When test pits are not anticipated to encounter bulk buried wastes, work will be conducted at Level C dermal PPE, provided the following conditions are satisfied:

- PID readings in the site worker's breathing zone do not exceed 5 ppm in the breathing zone.

If PID readings in the site worker's breathing zone are greater than background, work will be stopped and the situation will be reevaluated by ABB-ES and NYSDEC.

3.4.4.2 Personal Monitoring. No personal monitoring will be done during site activities.

3.5 TEST PITTING

Work tasks to be performed will consist of excavations in the waste pile, the septic system no. 2 leachfield, and chemical storage building areas. Test pits may be targeted at magnetic anomalies, suspected to be drums or other possible buried wastes.

3.5.1 Hazardous Substances/Conditions

The materials listed in Table 3-1 represent materials reportedly disposed of at the site and include: solvents (chlorinated hydrocarbons), semi-volatiles, and metals associated with the manufacture of speakers and speaker components.

SECTION 3

3.5.2 Site Risks

The site wastes are both on the surface and buried. The potential for buried drums exists at the site. Site personnel are cautioned to exercise care when working around excavation equipment and on the site. If test pits target suspected drums, extreme care shall be used during excavation.

3.5.2.1 Health Hazards. Potential health hazards include potential exposure to hazardous compounds via dermal contact, inhalation, and/or ingestion. The possible presence of buried drums at the site pose a moderate health risk during test pitting. Potentially hazardous substances may exist in subsurface soils and groundwater include: volatile (primarily chlorinated solvents, and their degradation products), semivolatile organics, and metals (see Table 3-1, Section 3.1.1 above).

3.5.2.2 Safety Hazards. Care shall be taken when working with heavy equipment during test pitting to reduce the safety hazards. Excavations will be performed slowly, with an additional observer watching the advancement of the pit, with particular attention paid to possible drums. Workers will stand well clear of the swing of the bucket and edge of the excavation. Normal safety precautions will be followed by the geologists and the sampling crew.

3.5.2.3 Conclusions/Risk Assessment. The overall health risk this work task is moderate, due to the intrusive nature of the work, and the possible presence of buried drums.

3.5.3 Protective Measures

Protective measures will be undertaken to minimize the potential health and safety risks for field personnel. The protective measures discussed below pertain to this task, test pitting.

3.5.3.1 Engineering Controls. It is not anticipated that engineering controls will be used at the site for this task.

3.5.3.2 Levels of Protection. Work is anticipated to be performed at a minimum of Level C dermal PPE. If test pits are targeted at suspected drums, work will be initiated at Level C respiratory protection.

Should site conditions present a threat to ABB-ES, its subcontractors, or other on-site representatives and/or should site conditions warrant an upgrade from Level C dermal personal protection, work will be stopped and the situation reevaluated by NYSDEC and ABB-ES.

3.5.4 Monitoring

During test pitting real time monitoring of the work environment will be undertaken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for explosive and oxygen deficient atmosphere (LEL/O₂ meter) and hazardous concentrations of airborne contaminants (PID and Miniram).

3.5.4.1 Air Monitoring/Action Levels. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Data will be used to provide confidence in the adequacy of the levels of protection being employed at the site, and may be used as the basis for reevaluation of site conditions by ABB-ES and NYSDEC.

The following list of air monitoring equipment will be used during test pitting activities. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- HNU IS101 Photoionization Detector (PID).
- ISD Dual Detector (LEL/O₂).
- Miniram, particulate Monitor.
- Draeger detector tubes:

Vinyl Chloride 0.5/a
Chloroform 2/a

When test pits are not anticipated to encounter bulk buried wastes, work will initially be conducted at Level C dermal PPE, provided the following conditions are satisfied:

SECTION 3

- PID readings in the site worker's breathing zone do not exceed background levels;
- If, at any time, LEL readings exceed 10 percent, the field crew will stop work and the HSO will evaluate the situation. Work can continue if proper measures are used, (e.g., non-sparking tools, intrinsically safe equipment, and spark arresters). If, at any time, LEL readings exceed 20 percent, the field crew will stop work, shut down the rig, and withdraw from the work zone immediately. No work can be conducted at LEL levels above 20 percent.

- If, draeger tubes indicate no contaminants above the following levels:

Vinyl Chloride 0.5/a, (10 pumps):

Above background and below 0.5 ppm: Maintain Level C dermal and continue to monitor the breathing zone.

Chloroform 2/a (10 pumps):

Above background and below 2 ppm: Maintain Level C dermal and continue to monitor the breathing zone.

- If miniram indicates less than $2.5 \mu\text{g}/\text{m}^3$ in work zone.

Test pitting activities which are intended to investigate magnetic anomalies will initially be conducted using Level C respiratory protection, provided the following conditions are met. Downgrade will not be allowed until the test pit has been excavated, logged, and samples collected.

Upgrade to Level C respiratory protection may be done only with NYSDEC and ABB-ES approval. Upgrade to Level C respiratory protection will be required if any of the following occur:

- If PID readings in the site worker's breathing zone are greater than 5 ppm but less than 250 ppm, and Draeger tubes indicate non-detect.

SECTION 3

3.6.2.1 Health Hazards. Potential health hazards include potential exposure to hazardous compounds via dermal contact, inhalation, and/or ingestion. Potentially hazardous substances may exist in subsurface soils and groundwater include: volatile (primarily chlorinated solvents, and their degradation products), semivolatile organics, and metals (see Table 3-1, Section 3.1.1 above).

3.6.2.2 Safety Hazards. Safety hazards include working around heavy machinery, lifting heavy/awkward items and falls due to walking over uneven terrain. Normal safety precautions will be followed by the drilling rig geologists and the sampling crew.

3.6.2.3 Conclusions/Risk Assessment. The overall health risk this work task is moderate, due to the intrusive nature of the work.

3.6.3 Protective Measures

Protective measures will be undertaken to minimize the potential health and safety risks for field personnel. The protective measures discussed below pertain to this task, monitoring well and piezometer installation.

3.6.3.1 Engineering Controls. If an upgrade to respiratory PPE is required, engineering controls may be used at the site for these tasks.

3.6.3.2 Levels of Protection. Work is anticipated to be performed at Level C dermal PPE.

Should site conditions present a threat to ABB-ES, its subcontractors, or other on-site representatives and/or should site conditions warrant an upgrade from Level C dermal personal protection, work will be stopped and the situation reevaluated by NYSDEC and ABB-ES.

3.6.4 Monitoring

During collection of the well and piezometer installation real time monitoring of the work environment will be under taken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for explosive or oxygen deficient atmospheres (LEL/O₂) and hazardous concentrations of airborne contaminants (PID and Miniram).

- If Draeger tubes indicate the following:

Vinyl Chloride 0.5/a, (10 pumps):

Greater than 0.5 ppm: STOP WORK, upgrade to Level B may be required.

Chloroform 2/a (10 pumps):

Greater than 2 ppm: STOP WORK, upgrade to Level B will be required.

- If miniram, particulate monitor indicates greater than 2.5 mg/m³ but less than 15 mg/m³, upgrade to Level C respiratory protection.

3.5.4.2 Personal Monitoring. No personal monitoring will be done during site activities.

3.6 WATER TABLE AND BEDROCK MONITORING WELL/PIEZOMETER INSTALLATION

Work tasks to be performed will consist drilling, installing and developing monitoring wells and piezometers in overburden and bedrock.

3.6.1 Hazardous Substances/Conditions

The materials listed in Table 3-1 represent materials reportedly disposed of at the site and include: solvents (chlorinated hydrocarbons), semi-volatiles, and metals associated with the manufacture of speakers and speaker components.

3.6.2 Site Risks

The site wastes are both on the surface and buried. The potential for buried drums exists at the site. Site personnel are cautioned to exercise care when working around drilling equipment and on the site.

3.6.4.1 Air Monitoring/Action Levels. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Data will be used to provide confidence in the adequacy of the levels of protection being employed at the site, and may be used as the basis for reevaluation of site conditions by ABB-ES and NYSDEC.

The following list of air monitoring equipment will be used during drilling, well installation and development activities. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- HNU IS101 Photoionization Detector (PID).
- ISD Dual Detector (LEL/O₂).
- Miniram, particulate Monitor.
- Draeger detector tubes:

Vinyl Chloride 0.5/a
Chloroform 2/a

Work will initially be conducted at Level C dermal PPE, provided the following conditions are satisfied:

- PID readings in the site worker's breathing zone do not exceed 5 ppm in the breathing zone.
- If, at any time, LEL readings exceed 10 percent, the field crew will stop work and the HSO will evaluate the situation. Work can continue if proper measures are used, (e.g., non-sparking tools, intrinsically safe equipment, and spark arresters). If, at any time, LEL readings exceed 20 percent, the field crew will stop work, shut down the rig, and withdraw from the work zone immediately. No work can be conducted at LEL levels above 20 percent.
- If, draeger tubes indicate no contaminants above the following levels:

SECTION 3

Vinyl Chloride 0.5/a, (10 pumps):

Above background and below 0.5 ppm: Maintain Level C dermal and continue to monitor the breathing zone.

Chloroform 2/a (10 pumps):

Above background and below 2 ppm: Maintain Level C dermal and continue to monitor the breathing zone.

Upgrade to Level C respiratory protection may be done only with NYSDEC and ABB-ES approval. Upgrade to Level C respiratory protection will be required if any of the following occur:

- PID readings in the site worker's breathing zone are greater than 5 ppm but less than 250 ppm and Draeger tubes indicate non-detect.
- If Draeger tubes indicate the following:

Vinyl Chloride 0.5/a, (10 pumps):

Greater than 0.5 ppm: STOP WORK, upgrade to Level B may be required.

Chloroform 2/a (20 pumps):

Greater than 1 ppm: STOP WORK, upgrade to Level B will be required.

- If miniram indicates greater than 2.5 mg/m³, but less than 15 mg/m³, upgrade to level C respiratory protection.

3.6.4.2 Personal Monitoring. No personal monitoring will be done during site activities.

3.7 MONITORING WELL/WATER SUPPLY WELL SAMPLING AND HYDROGEOLOGIC INVESTIGATION

Work tasks to be performed will consist sampling of new and existing wells and inactive Becker water supply wells, and hydrogeologic investigative activities. The hydrogeologic investigation will consist of performing slug testing, and groundwater measurements.

3.7.1 Hazardous Substances/Conditions

The materials listed in Table 3-1 represent materials reportedly disposed of at the site and include: solvents (chlorinated hydrocarbons), semi-volatiles, and metals associated with the manufacture of speakers and speaker components.

3.7.2 Site Risks

The site wastes are both on the surface and buried. The potential for buried drums exists at the site. Site personnel are cautioned to exercise care when working around sampling equipment and on the site.

3.7.2.1 Health Hazards. Potential health hazards include potential exposure to hazardous compounds via dermal contact, inhalation, and/or ingestion. Potentially hazardous substances may exist in groundwater include: volatile (primarily chlorinated solvents, and their degradation products), semivolatile organics, and metals (see Table 3-1).

3.7.2.2 Safety Hazards. Safety hazards include lifting heavy or awkward items and falls due to walking over uneven or slippery terrain. Normal safety precautions will be followed by the sampling crew.

3.7.2.3 Conclusions/Risk Assessment. The overall health risk this work task is low.

3.7.3 Protective Measures

Protective measures will be undertaken to minimize the potential health and safety risks for field personnel. The protective measures discussed below pertain to this task, well sampling and slug testing.

SECTION 3

3.7.3.1 Engineering Controls. It is not anticipated that engineering controls will be used at the site for this task.

3.7.3.2 Levels of Protection. Work is anticipated to be performed at Level C dermal PPE. Should site conditions present a threat to ABB-ES, its subcontractors, or other on-site representatives and/or should site conditions warrant an upgrade from Level C dermal personal protection, work will be stopped and the situation reevaluated by NYSDEC and ABB-ES.

3.7.4 Monitoring

During collection of the well and piezometer installation real time monitoring of the work environment will be under taken to be sure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for hazardous concentrations of airborne contaminants (PID).

3.7.4.1 Air Monitoring/Action Levels. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Data will be used to provide confidence in the adequacy of the levels of protection being employed at the site, and may be used as the basis for reevaluation of site conditions by ABB-ES and NYSDEC.

The following list of air monitoring equipment will be used during drilling, well sampling activities. Refer to Appendix F, Part II for information on calibration and maintenance of the equipment.

- HNU IS101 Photoionization Detector (PID).

Work will be conducted at Level C dermal PPE, provided the following conditions are satisfied:

- PID readings in the site worker's breathing zone do not exceed background levels;

3.7.4.2 Personal Monitoring. No personal monitoring will be done during site activities.

4.0 DATA SHEETS

- (1) 1,1-Dichloroethane
- (2) 1,1-Dichloroethene (Vinylidene Chloride)
- (3) 1,2-Dichloroethene
- (4) 1,1,1-Trichloroethane (Trichloroethane)
- (5) 2-Butanone (Methyl Ethyl Ketone)
- (6) Chloroethane (Ethyl Chloride)
- (7) Chloroform
- (8) Tetrachloroethene
- (9) Toluene
- (10) Trichloroethene
- (11) 4-Nitrophenol
- (12) Benzoic Acid
- (13) Benzo(a)anthracene
- (14) Benzo(b)pyrene
- (15) Benzo(b)fluoranthene
- (16) Indeno(1,2,3-cd)pyrene
- (17) Phenol
- (18) Aluminum
- (19) Arsenic
- (20) Barium
- (21) Beryllium
- (22) Cadmium
- (23) Calcium
- (24) Chromium
- (25) Cobalt
- (26) Copper
- (27) Iron
- (28) Lead
- (29) Magnesium
- (30) Manganese
- (31) Mercury
- (32) Nickel
- (33) Sodium
- (34) Vanadium
- (35) Silver
- (36) Zinc

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1,1-DICHLOROETHANE


DCH

Common Synonyms Ethylene chloride Ethylene dichloride Chlorinated hydrochloric ether		Oily liquid Colorless Chloroform like etheral
Sinks and mixes with water.		
Wear goggles, self-contained breathing apparatus, and rubber overclothing. Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Avoid contact with liquid. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	Flammable. POISONOUS GAS MAY BE PRODUCED IN FIRE OR WHEN HEATED. Containers may explode in fire. Wear goggles and self-contained breathing apparatus. Extinguish with alcohol foam, carbon dioxide, or dry chemical. Water may be ineffective on fire.	
Exposure	CALL FOR MEDICAL AID. LIQUID If swallowed may cause nausea, vomiting and faintness. Irritating to skin and eyes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS have victim drink water or milk and induce vomiting.	
Water Pollution	Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability. Restrict access. Chemical and physical treatment.		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: C ₂ H ₂ Cl ₂ 3.3 IMO/UN Designation: Not listed 3.4 DOT ID No.: 2362 3.5 CAS Registry No.: 75-34-3		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Oily liquid 4.2 Color: Colorless 4.3 Odor: Chloroform
5. HEALTH HAZARDS		
5.1 Personal Protective Equipment: In areas of poor ventilation or high concentration, a self-contained breathing apparatus with full face mask should be worn. Chemical workers goggles, rubber gloves, and protective clothing should be worn. 5.2 Symptoms Following Exposure: INHALATION: Irritation of respiratory tract. Salivation, sneezing, coughing, dizziness, nausea, and vomiting. EYES: Irritation, lacrimation, and reddening of conjunctiva. SKIN: Irritation. Prolonged or repeated skin contact can produce a slight burn. INGESTION: Ingestion incidental to industrial handling is not considered to be a problem. Swallowing of substantial amounts could cause nausea, vomiting, faintness, drowsiness, cyanosis, and circulatory failure. 5.3 Treatment of Exposure: Call a doctor. INHALATION: Remove from contaminated area; keep warm and quiet. If breathing has stopped, give artificial respiration. Administer oxygen. EYES: Flush with large amounts of water or weak bicarbonate of soda solution. SKIN: Dilute with large amounts of water. Remove contaminated clothing. INGESTION: Attempt to empty stomach; dilute by administering fluids (tap water, soapy water, salt water, or milk). 5.4 Threshold Limit Value: 200 ppm. 5.5 Short Term Inhalation Limits: 250 ppm. 5.6 Toxicity by Ingestion: Grade 2; LD ₅₀ = 0.5 to 5 g/kg (rat). 5.7 Late Toxicity: Chronic exposure may cause liver damage and dermatitis. Animal experimentation has shown this compound to be slightly embryo-toxic and to retard fetal development. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 4,000 ppm		

6. FIRE HAZARDS 6.1 Flash Point: 57°F O.C. = 22°F C.C. 6.2 Flammable Limits in Air: 5.6% to 11.4% 6.3 Fire Extinguishing Agents: Alcohol foam, water, foam, CO ₂ , dry chemical, carbon tetrachloride 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: When heated to decomposition emits highly toxic fumes to phosgene. 6.6 Behavior in Fire: Explosion hazard 6.7 Ignition Temperature: 856°F 6.8 Electrical Hazard: Data not available 6.9 Burning Rate: Data not available 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-P-Q-R-S								
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Data not available 7.3 Stability During Transport: Data not available 7.4 Neutralizing Agents for Acids and Caustics: Data not available 7.5 Polymerization: Data not available 7.6 Inhibitor of Polymerization: lable Data not available 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 36		11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Not listed 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Category</td> <td style="text-align: right;">Classification</td> </tr> <tr> <td style="text-align: right;">Health Hazard (Blue)</td> <td style="text-align: right;">2</td> </tr> <tr> <td style="text-align: right;">Flammability (Red)</td> <td style="text-align: right;">3</td> </tr> <tr> <td style="text-align: right;">Reactivity (Yellow)</td> <td style="text-align: right;">0</td> </tr> </table>	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
Category	Classification									
Health Hazard (Blue)	2									
Flammability (Red)	3									
Reactivity (Yellow)	0									
8. WATER POLLUTION 8.1 Aquatic Toxicity: TL ₅₀ (Marine pinperch) 250 to 275 mg/l 24-hour TL ₅₀ Brine shrimp: 320 mg/l 24-hour TL ₅₀ Pinperch: 160 mg/l 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Percent, 0.05 g/g for 10 days Percent, 0.002 g/g for 5 days 8.4 Food Chain Concentration Potential: Data not available		12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 98.97 12.3 Boiling Point at 1 atm: 135.14°F = 57.3°C = 330.5°K 12.4 Freezing Point: -143.32°F = -97.4°C = 175.75°K 12.5 Critical Temperature: 502.7°F = 261.5°C = 534.65°K 12.6 Critical Pressure: 734.8 psia = 50 atm = 5,065 MN/m ² 12.7 Specific Gravity: 1.174 at 20°C 12.8 Liquid Surface Tension: 24.75 dynes/cm = 0.02475 N/m at 20°C 12.9 Liquid Water Interfacial Tension: Data not available 12.10 Vapor (Gas) Specific Gravity: 3.42 12.11 Ratio of Specific Heats of Vapor (Gas): 1.136 at 20°C (68°F) 12.12 Latent Heat of Vaporization: 131.6 Btu/lb = 73.1 cal/g = 3.06 X 10 ⁴ J/kg 12.13 Heat of Combustion: -4,774 Btu/lb = -2,652 cal/g = -111 X 10 ⁴ J/kg 12.14 Heat of Decomposition: Data not available 12.15 Heat of Solution: Data not available 12.18 Heat of Polymerization: Data not available 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 7.35 psia								
9. SHIPPING INFORMATION 9.1 Grades of Purity: Data not available 9.2 Storage Temperature: Cool 9.3 Inert Atmosphere: Data not available 9.4 Venting: Data not available		NOTES								

VINYLDENE CHLORIDE

VCI

Common Synonyms 1,1-Dichloroethylene vinylm-Dichloroethylene	Wettable liquid 	Colorless	Sweet odor
Sinks in water. Flammable, irritating vapor is produced. Boiling point is 80°F.			

Avoid contact with liquid and vapor. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Evacuate area in case of large discharge. Isolate and remove discharged material. Notify local health and pollution control agencies.

Fire	<p>FLAMMABLE. POISONOUS GAS IS PRODUCED IN FIRE. Containers may explode in fire. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Combat fire from safe distance or protected location. Extinguish with dry chemical, foam, or carbon dioxide. Cool exposed containers with water.</p>
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Exposure	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose, and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will burn skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>
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Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.
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<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area.</p>	<p>2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3</p>
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<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Vinyl halides 3.2 Formula: CH₂=CCl₂ 3.3 IMO/UN Designation: 3.1/1303 3.4 DOT ID No.: 1303 3.5 CAS Registry No.: 75-35-4</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Sweet; like carbon tetrachloride or chloroform</p>
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5. HEALTH HAZARDS	
5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; rubber gloves and boots.	
5.2 Symptoms Following Exposure: Vapor can cause dizziness and drunkenness; high levels cause anesthesia. Liquid irritates eyes and skin.	
5.3 Treatment of Exposure: INHALATION: If any illness develops, remove person to fresh air promptly, keep warm and quiet, and get medical attention; if breathing stops, start artificial respiration. INGESTION: not likely a problem; no known antidote; treat symptomatically. EYES OR SKIN: flush with plenty of water for at least 15 min; get medical attention for eyes; remove contaminated clothing and wash before reuse.	
5.4 Threshold Limit Value: 10 ppm	
5.5 Short Term Inhalation Limit: Data not available	
5.6 Toxicity by Ingestion: Grade 3; Oral LD ₅₀ = 24 hr = 84 mg/kg (adrenalectomized rat)	
5.7 Lethal Toxicity: Data not available	
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.	
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.	
5.10 Odor Threshold: Data not available	
5.11 IDLH Value: Data not available	

6. FIRE HAZARDS	
6.1 Flash Point: 0°F O.C.	
6.2 Flammable Limits in Air: 7.3%-16.0%	
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical	
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.	
6.5 Special Hazards of Combustion Products: Toxic hydrogen chloride and phosgene are generated in fire.	
6.6 Behavior in Fire: May explode in fire due to polymerization. Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.	
6.7 Ignition Temperature: 955-1031°F	
6.8 Electrical Hazard: Not pertinent	
6.9 Burning Rate: 2.7 mm/min.	
6.10 Adiabatic Flame Temperature: Data not available	

7. CHEMICAL REACTIVITY	
7.1 Reactivity With Water: No reaction	
7.2 Reactivity With Common Materials: Copper and aluminum can cause polymerization.	
7.3 Stability During Transport: Stable	
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent	
7.5 Polymerization: Can occur if exposed to sunlight, air, copper, aluminum, heat.	
7.6 Inhibitor of Polymerization: 200 ppm methyl ether of hydroquinone; 0.8-0.8% phenol	
7.7 Molar Ratio (Reactant to Product): Data not available	
7.8 Reactivity Group: 35	

8. WATER POLLUTION	
8.1 Aquatic Toxicity: Data not available	
8.2 Waterfowl Toxicity: Data not available	
8.3 Biological Oxygen Demand (BOD): Data not available	
8.4 Food Chain Concentration Potential: None	

9. SHIPPING INFORMATION	
9.1 Grades of Purity: 99%	
9.2 Storage Temperature: Ambient	
9.3 Inert Atmosphere: Padded	
9.4 Venting: Pressure-vacuum	

6. FIRE HAZARDS (Continued)	
6.11 Stoichiometric Air to Fuel Ratio: Data not available	
6.12 Flame Temperature: Data not available	

10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X-Y-Z	
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11. HAZARD CLASSIFICATIONS	
11.1 Code of Federal Regulations: Flammable liquid	
11.2 NAS Hazard Rating for Bulk Water Transportation:	
Category	Risk
Fire	
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	
Water Pollution	
Human Toxicity	
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	
Water	
Self Reaction	
11.3 NFPA Hazard Classification:	
Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	
Reactivity (Yellow)	

12. PHYSICAL AND CHEMICAL PROPERTIES	
12.1 Physical State at 16°C and 1 atm: Liquid	
12.2 Molecular Weight: 96.95	
12.3 Boiling Point at 1 atm: 88.9°F = 31.6°C = 304.8°K	
12.4 Freezing Point: -187.5°F = 122.0°C = 151.2°K	
12.5 Critical Temperature: Not pertinent	
12.6 Critical Pressure: Not pertinent	
12.7 Specific Gravity: 1.21 at 20°C (liquid)	
12.8 Liquid Surface Tension: 24 dynes/cm = 0.024 N/m at 15°C	
12.9 Liquid Water Intercfacial Tension: 37 dynes/cm = 0.037 N/m at 20°C	
12.10 Vapor (Gas) Specific Gravity: 3.3	
12.11 Ratio of Specific Heats of Vapor (Gas): Data not available	
12.12 Latent Heat of Vaporization: 130 Btu/lb = 72 cal/g = 3.0 X 10 ⁶ J/kg	
12.13 Heat of Combustion: -4880 Btu/lb = -2700 cal/g = -113.0 X 10 ⁶ J/kg	
12.14 Heat of Decomposition: Not pertinent	
12.15 Heat of Solution: Not pertinent	
12.16 Heat of Polymerization: -333 Btu/lb = -185 cal/g = -7.75 X 10 ⁶ J/kg	
12.25 Heat of Fusion: Data not available	
12.26 Limiting Value: Data not available	
12.27 Reid Vapor Pressure: 18.3 psia	

OHS26500

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 540-59-0
RTECS NUMBER: KV9360000

SUBSTANCE: 1,2-DICHLOROETHYLENE

TRADE NAMES/SYNONYMS:

SYM-DICHLOROETHYLENE; DIOFORM; ACETYLENE DICHLORIDE; 1,2-DICHLOROETHENE;
ETHYLENE, 1,2-DICHLORO-; ETHENE, 1,2-DICHLORO-; U079; STCC 4909145; C2H2CL2;
OHS26500

CHEMICAL FAMILY:

Halogen compound, aliphatic

CREATION DATE: 09/07/84

REVISION DATE: 01/15/94

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : 1,2-DICHLOROETHYLENE
CAS NUMBER: 540-59-0
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE.

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=2 FIRE=3 REACTIVITY=2 PERSISTENCE=1
NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=2

EMERGENCY OVERVIEW:

Colorless liquid with ether-like odor, slightly acrid.

Causes respiratory tract, skin and eye irritation. May affect the central nervous system. Flammable liquid and vapor. May cause flash fire. May react dangerously with water. May form explosive peroxides on standing.

Keep away from all ignition sources. Do not allow water to get in container. Avoid breathing vapor or mist. Avoid contact with eyes, skin and clothing. Do not allow to evaporate or distill to dryness. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include

nauses, vomiting, weakness, drowsiness, drunkenness, twitching and unconsciousness.

LONG TERM EFFECTS: May cause lack of appetite.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May cause drunkenness.

LONG TERM EFFECTS: No information available on significant adverse effects.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Remove by gastric lavage or emesis. Maintain blood pressure and airway. Give oxygen if respiration is depressed. Do not perform gastric lavage or emesis if victim is unconscious. Get medical attention immediately (Dreisbach, Handbook of Poisoning, 12th Ed.). Administration of gastric lavage or oxygen should be performed by qualified medical personnel.

NOTE TO PHYSICIAN

ANTIDOTE:

No specific antidote. Treat symptomatically and supportively.

SECTION 5

FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Dangerous fire hazard when exposed to heat or flame.

Vapor-air mixtures are explosive above flash point.

Vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back.

EXTINGUISHING MEDIA:

Dry chemical, carbon dioxide, water spray or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, use water spray, fog or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 27).

Extinguish only if flow can be stopped; use flooding amounts of water as a fog, solid streams may be ineffective. Cool containers with flooding amounts of water, apply from as far a distance as possible. Avoid breathing vapors, keep upwind.

Water may be ineffective except as a blanket (NFPA 325M, Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, 1984)

FLASH POINT: 36 F (2 C) (CC)

LOWER FLAMMABLE LIMIT: 9.7%

UPPER FLAMMABLE LIMIT: 12.8%

AUTOIGNITION: 860 F (460 C)

FLAMMABILITY CLASS(OSHA): IB

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products may include highly toxic fumes of phosgene, toxic and corrosive fumes of chlorides, and oxides of carbon.

SECTION 6

ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL:

Shut off ignition sources. Stop leak if you can do it without risk. Use water spray to reduce vapors. For small spills, take up with sand or other absorbent material and place into containers for later disposal. For larger spills, di-

far ahead of spill for later disposal. No smoking, flames or flares in hazard area. Keep unnecessary people away; isolate hazard area and restrict entry.

SECTION 7

HANDLING AND STORAGE

Observe all federal, state and local regulations when storing this substance.

Store in accordance with 29 CFR 1910.106.

Bonding and grounding: Substances with low electroconductivity, which may be ignited by electrostatic sparks, should be stored in containers which meet the bonding and grounding guidelines specified in NFPA 77-1983, Recommended Practice on Static Electricity.

Store in a cool, dry area with proper ventilation. Keep apart from air, light, heat, strong oxidizers materials. (NFPA 49, Hazardous Chemicals Data, 1991)

Store away from incompatible substances.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

200 ppm (793 mg/m³) OSHA TWA

200 ppm (793 mg/m³) ACGIH TWA

200 ppm (793 mg/m³) NIOSH recommended TWA

200 ppm (793 mg/m³) DFG MAK TWA;

400 ppm (1586 mg/m³) DFG MAK 30 minute peak, average value, 4 times/shift

Measurement method: Charcoal tube/carbon disulfide; gas chromatography with flame ionization detection; (NIOSH Vol. III # 1003, Halogenated Hydrocarbons).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

VENTILATION:

Provide local exhaust or general dilution ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentrations of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance.

Emergency wash facilities:

Where there is any possibility that an employee's eyes and/or skin may be exposed to this substance, the employer should provide an eye wash fountain and quick drench shower within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH pocket guide to chemical hazards or NIOSH criteria documents; or Department of Labor, 29CFR1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place and be jointly approved by the National Institute of Occupational Safety and Health and the Mine Safety and Health Administration

1,2-DICHLOROETHYLENE (ALL ISOMERS):

1000 ppm- Any powered, air-purifying respirator with organic vapor cartridge(s).

Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).

4000 ppm- Any supplied-air respirator operated in a continuous-flow mode
Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.

Escape- Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister.
Any appropriate escape-type, self-contained breathing apparatus

For firefighting and other immediately dangerous to life or health conditions

Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode.

Supplied-air respirator with full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

SECTION 9PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Colorless liquid with ether-like odor, slightly acrid.

MOLECULAR WEIGHT: 96.94

MOLECULAR FORMULA: C₂H₂CL₂

BOILING POINT: 119 F (48 C)

MELTING POINT: -113 F (-81)

VAPOR PRESSURE: 400 mmHg @ 87 F

VAPOR DENSITY: 3.4

SPECIFIC GRAVITY: 1.282

WATER SOLUBILITY: 0.35-0.63%

ODOR THRESHOLD: 0.085 ppm

SOLVENT SOLUBILITY: Alcohol, ether and most other organic solvents

SECTION 10STABILITY AND REACTIVITY

REACTIVITY:

May form explosive peroxides in air.
Unless inhibited, gradual decomposition by air, light, ultraviolet light and moisture may release corrosive hydrogen chloride.

CONDITIONS TO AVOID:

Avoid contact with heat, sparks, flames, or other sources of ignition. Vapor may be explosive. Avoid overheating of containers; containers may violently rupture in heat of fire. Avoid contamination of water sources.

INCOMPATIBILITIES:**1,2-DICHLOROETHYLENE (ALL ISOMERS):**

CAUSTIC ALKALIES (SOLID OR CONCENTRATED SOLUTIONS): May form explosive, spontaneously flammable chloroacetylene.

COPPER OR COPPER ALLOYS: May form explosive, spontaneously flammable chloroacetylene.

DIFLUOROMETHYLENE DIHYPOFLUORITE (WITH TRANS-ISOMER): Violent explosion at room temperature.

FREE RADICAL INITIATOR: Oxidation forms corrosive chloroacetyl chloride epoxide intermediates.

METAL (HOT): Gradual decomposition with release of corrosive hydrogen chloride.

NITROGEN TETROXIDE: Explosive, especially when shocked.

OXIDIZERS (STRONG): Fire and explosion hazard.

OZONE: Form explosive product.

PERCHLORYL FLUORIDE: Explosive reaction on heating.

POTASSIUM HYDROXIDE (SOLID OR CONCENTRATED SOLUTION): May form explosive, spontaneously flammable chloroacetylene.

PLASTICS, RUBBER AND COATINGS: May be attacked.

SODIUM: May form explosive, spontaneously flammable chloroacetylene.

SODIUM HYDROXIDE (SOLID OR CONCENTRATED SOLUTION): May form explosive, spontaneously flammable chloroacetylene.

SULFURIC ACID (CONCENTRATED): Oxidation forms corrosive chloroacetyl chloride via epoxide intermediates.

STRONG OXIDIZERS: Vigorous reaction or possible fire and explosion hazard.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products may include highly toxic fumes of phosgene, toxic and corrosive fumes of chlorides, and oxides of carbon.

POLYMERIZATION:

Slightly susceptible to polymerization, but not likely unless the material becomes contaminated. Both isomers dimerize to tetrachlorobutene in the presence of organic peroxides. The polymerization reaction is not vigorous.

SECTION 11**TOXICOLOGY INFORMATION**

1,2-DICHLOROETHYLENE:

IRRITATION DATA: 100 mg/24 hours skin-rabbit moderate.

TOXICITY DATA: 117 mg/m³/1 hour inhalation-frog LCLo; 770 mg/kg oral-rat LD50
2 gm/kg intraperitoneal-mouse LD50.

CARCINOGEN STATUS: None.

LOCAL EFFECTS: Irritant- inhalation, skin, eye.

ACUTE TOXICITY LEVEL: Moderately toxic by ingestion.

TARGET EFFECTS: Central nervous system depressant. Poisoning may affect the lung, liver and kidneys.

AT INCREASED RISK FROM EXPOSURE: Persons with chronic respiratory disease.

ADDITIONAL DATA: Stimulants such as epinephrine and ephedrine may enhance the toxicity of some halogenated hydrocarbons.

HEALTH EFFECTS

INHALATION:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

IRRITANT/NARCOTIC. 4000 ppm Immediately Dangerous to Life or Health.

ACUTE EXPOSURE- Vapor exposure may cause mucous membrane irritation, nausea, vomiting, dizziness, weakness, tremor, and epigastric cramps. Higher levels may cause central nervous system depression ranging from drowsiness to unconsciousness. The cis- and trans- isomers together have been used as an anesthetic in man. A human death has been reported from industrial exposure. An 8 hour exposure to the trans- isomer at 200 ppm lowered the leukocyte count in rats; 1000 ppm caused a fall in the blood serum albumin, urea nitrogen, alkaline phosphatase activity, and the number of erythrocytes. Narcosis was not produced at these levels. 3000 ppm produced fibrous swelling of the cardiac muscle and hyperemia which persisted for 14 hours after exposure. The cis- isomer did not anesthetize rats in 4 hours at 8000 ppm, but at 16,000 ppm they were anesthetized in 8 minutes and killed in 4 hours. Reversible superficial corneal turbidity has been observed in some anesthetized dogs.

CHRONIC EXPOSURE- Variations in data exist on the chronic toxicity of the cis- and trans- isomers. Rats exposed to 200 ppm of the trans- isomer for 8 hours/day, 5 days/week for 16 weeks showed histological evidence of slight to severe fatty degeneration of liver lobules and kupffer cells, marked pulmonary hyperemia, alveolar septal distension and fibrous swelling of the cardiac muscle. Similar exposures with rats, guinea pigs, rabbits and dogs exposed to 500 ppm or 1000 ppm 7 hours/day, 5 days/week for 6 months to a mixture of 60% cis- and 40% trans- isomers resulted in no adverse effects detected. Cats and rabbits were repeatedly exposed to vapor concentrations of 0.16-0.19% in air. The cis- isomer caused anorexia, decreased body weight and pathological changes in the lungs, liver, and kidneys. The trans- isomer caused anorexia and some respiratory irritation, but no histopathological changes in organs.

SKIN CONTACT:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

IRRITANT.

ACUTE EXPOSURE- Direct contact may cause irritation. Skin absorption may occur due to lipid solubility.

CHRONIC EXPOSURE- Repeated or prolonged contact may cause dermatitis.

EYE CONTACT:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

IRRITANT.

ACUTE EXPOSURE- Direct contact, or the vapor in sufficient concentration, may cause irritation. The trans- isomer caused burning of the eyes at 200 ppm. Reversible superficial corneal turbidity has been reported as a systemic effect in dogs following inhalation exposure.

CHRONIC EXPOSURE- Repeated or prolonged contact with irritants may cause conjunctivitis.

INGESTION:

1,2-DICHLOROETHYLENE (ALL ISOMERS):

NARCOTIC.

ACUTE EXPOSURE- Depending on exposure, symptoms may vary from slight central nervous system depression to deep narcosis.

CHRONIC EXPOSURE- Used as a low temperature extracting agent for heat sensitive substances such as caffeine in coffee, perfumes, and oils and fats from fish and meat. Mice exposed to 22 mg/kg or 220 mg/kg of trans-1,2 dichloroethylene by gavage for 14 consecutive days showed a trend toward suppression of the humoral immune response, but no effect on the cell-mediated immune response.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

ION

TRICHLOROETHANE

TCE

Common Synonyms 1,1,1-Trichloroethane Methylchloroform Aerothane Chlorothane		Watery liquid Colorless Sweet odor Sinks in water. Irritating vapor is produced.
Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.	
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, may produce nausea. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent
3. CHEMICAL DESIGNATIONS 3.1 CO Competibility Class: Halogenated hydrocarbon 3.2 Formula: CH ₂ Cl ₃ 3.3 IBC/UM Designations: Not listed 3.4 DOT ID No.: 2831 3.5 CAS Registry No.: 71-55-6		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Chloroform-like; sweetish
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Organic vapor-air gas canister; self-contained breathing apparatus for emergencies; neoprene or polyvinyl-alcohol-type gloves; chemical safety goggles and face shield; neoprene safety shoes (or leather safety shoes plus neoprene footwear); neoprene or polyvinyl alcohol suit or apron for splash protection. 5.2 Symptoms Following Exposure: INHALATION: symptoms range from loss of equilibrium and incoordination to loss of consciousness; high concentration can be fatal due to simple asphyxiation combined with loss of consciousness. INGESTION: produces effects similar to inhalation and may cause some feeling of nausea. EYES: slightly irritating and lachrymatory. SKIN: delaying action may cause dermatitis. 5.3 Treatment of Exposure: Get medical attention for all eye exposures and any other serious exposures. Do NOT administer adrenalin or epinephrine; otherwise, treatment is symptomatic. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting. EYES: flush thoroughly with water. SKIN: remove contaminated clothing and wash exposed area thoroughly with soap and warm water. 5.4 Threshold Limit Value: 350 ppm 5.5 Short Term Inhalation Limits: 1,000 ppm for 60 min. in man 5.6 Toxicity by Ingestion: Grade 1; LD ₅₀ = 5 to 15 g/kg (rat, mouse, rabbit, guinea pig) 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 100 ppm 5.11 IDLH Value: 1,000 ppm		

6. FIRE HAZARDS

6.1 Flash Point: Data not available
 6.2 Flammable Limits in Air: 7%-16%
 6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
 6.5 Special Hazards of Combustion Products: Toxic and irritating gases are generated in fire.
 6.6 Behavior in Fire: Not pertinent
 6.7 Ignition Temperature: 932°F
 6.8 Electrical Hazard: Not pertinent
 6.9 Burning Rate: (est.) 2.9 mm/min.
 6.10 Adiabatic Flame Temperature: Data not available
 6.11 Stoichiometric Air to Fuel Ratio: Data not available
 6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts slowly, releasing corrosive hydrochloric acid.
 7.2 Reactivity with Common Materials: Corrodes aluminum, but reaction is not hazardous.
 7.3 Stability During Transport: Stable
 7.4 Neutralizing Agents for Acids and Bases: Not pertinent
 7.5 Polymerization: Not pertinent
 7.6 Inhibitor of Polymerization: Not pertinent
 7.7 Molar Ratio (Reactant to Product): Data not available
 7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: 75-150 ppm/**/pinfish/TL₅₀/salt water
 *Time period not specified.
 8.2 Waterfowl Toxicity: Data not available
 8.3 Biological Oxygen Demand (BOD): Data not available
 8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Uninhibited; inhibited; industrial inhibited; white room; cold cleaning
 9.2 Storage Temperature: Ambient
 9.3 Inert Atmosphere: No requirement
 9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE
 (See Hazard Assessment Handbook)
A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
 11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0


12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
 12.2 Molecular Weight: 133.41
 12.3 Boiling Point at 1 atm: 185°F = 74°C = 347°K
 12.4 Freezing Point: <-36°F = <-33°C = <234°K
 12.5 Critical Temperature: Not pertinent
 12.6 Critical Pressure: Not pertinent
 12.7 Specific Gravity: 1.31 at 20°C (liquid)
 12.8 Liquid Surface Tension: 25.4 dynes/cm = 0.0254 N/m at 20°C
 12.9 Liquid Water Interfacial Tension: (est.) 45 dynes/cm = 0.045 N/m at 20°C
 12.10 Vapor (Gas) Specific Gravity: 4.8
 12.11 Ratio of Specific Heats of Vapor (Gas): 1.104
 12.12 Latent Heat of Vaporization: 100 Btu/lb = 58 cal/g = 2.4 X 10⁶ J/kg
 12.13 Heat of Combustion: (est.) 4700 Btu/lb = 2600 cal/g = 110 X 10⁴ J/kg
 12.14 Heat of Decomposition: Not pertinent
 12.15 Heat of Solution: Not pertinent
 12.16 Heat of Polymerization: Not pertinent
 12.17 Heat of Fusion: Data not available
 12.25 Limiting Value: Data not available
 12.27 Reid Vapor Pressure: 4.0 psia

NOTES

METHYL ETHYL KETONE

MEK

<p>Common Synonyms</p> <p>MEK 2-Butanone Ethyl methyl ketone</p>		<p>Liquid</p>  <p>Colorless</p> <p>Sweet odor</p> <p>Floats and mixes with water. Flammable, irritating vapor is produced.</p>
<p>Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
<p>Fire</p>	<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemical, alcohol foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>	
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will burn eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>	
<p>Water Pollution</p>	<p>Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Disperse and flush</p>	<p>2. LABEL</p> <p>2.1 Category: Flammable liquid 2.2 Class: 3</p>	
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 CG Compatibility Class: Ketone 3.2 Formula: CH₃COCH₂CH₃ 3.3 IMO/IUN Designation: 3.2/1193 3.4 DOT ID No.: 1193 3.5 CAS Registry No.: 78-93-3</p>	<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like acetone; pleasant; pungent</p>	
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Organic canister or air pack; plastic gloves; goggles or face shield. 5.2 Symptoms Following Exposure: Liquid causes eye burn. Vapor irritates eyes, nose, and throat; can cause headache, dizziness, nausea, weakness, and loss of consciousness. 5.3 Treatment of Exposure: INHALATION: remove victim to fresh air; if breathing is irregular or has stopped, start resuscitation and administer oxygen. EYES: wash with plenty of water for at least 15 min. and call physician. 5.4 Threshold Limit Value: 200 ppm 5.5 Short Term Inhalation Limit: 290 mg/m³ for 60 min. 5.6 Toxicity by Ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg (rat) 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 10 ppm 5.11 IDLH Value: Data not available</p>		

6. FIRE HAZARDS

6.1 Flash Point: 20°F C.C.; 22°F O.C.
6.2 Flammable Limits in Air: 1.8%-11.5%
6.3 Fire Extinguishing Agents: Alcohol foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 961°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 4.1 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 18

8. WATER POLLUTION

8.1 Aquatic Toxicity: 5640 mg/l/48 hr/bluegill/TL₅₀/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 21%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grade of Purity: 99.5+-%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE
(See Hazard Assessment Handbook)
A-P-Q-R-S

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAB Hazard Rating for Bulk Water Transportation:

Category	Ref
Fire	
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	
Water Pollution	
Human Toxicity	
Aquatic Toxicity	1
Aesthetic Effect	1
Reactivity	
Other Chemicals	
Water	
Self Reaction	

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	
Flammability (Red)	
Reactivity (Yellow)	


12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 72.11
12.3 Boiling Point at 1 atm: 175.3°F = 79.6°C = 352.8°K
12.4 Freezing Point: -123.3°F = -86.3°C = 186.9°K
12.5 Critical Temperature: 504.5°F = 262.5°C = 535.7°K
12.6 Critical Pressure: 603 psia = 41.0 atm = 4.15 MN/m²
12.7 Specific Gravity: 0.806 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 2.5
12.11 Ratio of Specific Heats of Vapor (Gas): 1.075
12.12 Latent Heat of Vaporization: 191 Btu/lb = 106 cal/g = 4.44 X 10⁵ J/kg
12.13 Heat of Combustion: -13,480 Btu/lb = -7491 cal/g = -313.6 X 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution (sat.): -9 Btu/lb = -5 cal/g = -0.2 X 10⁵ J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.5 psia

NOTES

ETHYL CHLORIDE

ECL

<p>Common Synonyms Chloroethane Ether, hydrochloric Monochloroethane</p>		<p>Liquid  Colorless Pleasant odor</p> <p>Floats and may boil on water. Flammable, irritating vapor is produced. Boiling point is 54°F.</p>	
<p>Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Avoid contact with liquid. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>			
<p>Fire</p>		<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Stop flow of gas or liquid if possible. Cool exposed containers and men effecting shut-off with water. Let fire burn.</p>	
<p>Exposure</p>		<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. Will cause frostbite. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. DO NOT RUB AFFECTED AREAS.</p>	
<p>Water Pollution</p>		<p>Not harmful to aquatic life. May be dangerous if it enters water intakes. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Restrict access Evacuate area</p>		<p>2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3</p>	
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: C₂H₅Cl 3.3 IMO/IUN Designation: 2.0/1037 3.4 DOT ID No.: 1037 3.5 CAS Registry No.: 75-00-3</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Etheral; pungent, etheral; ether-like</p>	
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Neoprene rubber clothing where liquid contact is likely; chemical worker's goggles. RESPIRATORY PROTECTION: for 1000 ppm to 2% for 1/2 hr or less, full face mask and organic vapor canister; for greater levels, self-contained breathing apparatus or equivalent.</p> <p>5.2 Symptoms Following Exposure: Vapor causes drunkenness, anesthesia, possible lung injury. Liquid may cause frostbite on eyes and skin.</p> <p>5.3 Treatment of Exposure: INHALATION: get person to fresh air, keep warm and quiet. Get medical attention. SKIN: treat frostbite.</p> <p>5.4 Threshold Limit Value: 1000 ppm 5.5 Short Term Inhalation Limits: Data not available 5.6 Toxicity by Ingestion: Not pertinent 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 20,000 ppm</p>			

6. FIRE HAZARDS

6.1 Flash Point: -58°F C.C., -45°F O.C.
6.2 Flammable Limits in Air: 3.6%-12%
6.3 Fire Extinguishing Agents: Water fog, carbon dioxide, dry chemical. For large fires it is best to allow material to burn while cooling surrounding equipment. Stop flow of ethyl chloride.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion: Products: Toxic and irritating gases are generated in fire.
6.6 Behavior in Fire: Containers may explode.
6.7 Ignition Temperature: 966°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 3.5 mm/min.
6.10 Adiabatic Flame Temperature: Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterway Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical: 98-100%; USP: 100%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Safety relief

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: 6.383 (Est.)
6.12 Flame Temperature: Data Not Available

10. HAZARD ASSESSMENT CODE
(See Hazard Assessment Handbook)
A-B-C-D-E-F-G

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations:
Flammable liquid

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	4
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	0
Aquatic Toxicity	1
Aesthetic Effect	1
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Gas
12.2 Molecular Weight: 64.52
12.3 Boiling Point at 1 atm: 54.0°F = 12.2°C = 285.4°K
12.4 Freezing Point: -213°F = -136°C = 137°K
12.5 Critical Temperature: 369°F = 187.2°C = 460.4°K
12.6 Critical Pressure: 758 psia = 51.6 atm = 5.23 MN/m²
12.7 Specific Gravity: 0.906 at 12.2°C (liquid)
12.8 Liquid Surface Tension: 19.5 dynes/cm = 0.0195 N/m at 20°C
12.9 Liquid Water Interfacial Tension: (est.) 40 dynes/cm = 0.04 N/m at 0°C
12.10 Vapor (Gas) Specific Gravity: 2.2
12.11 Ratio of Specific Heats of Vapor (Gas): 1.155
12.12 Latent Heat of Vaporization: 163 Btu/lb = 90.6 cal/g = 3.79 X 10⁵ J/kg
12.13 Heat of Combustion: -8100 Btu/lb = -4500 cal/g = -188.4 X 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 16.49 cal/g
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 34.5 psia

CHLOROFORM

CRF

<p>Common Synonyms Trichloromethane</p>	<p>Watery liquid Colorless Sweet odor</p> <p>Sinks in water. Irritating vapor is produced.</p>
<p>Avoid contact with liquid and vapor. Stay upwind. Wear goggles and self-contained breathing apparatus. Stop discharge if possible. Keep people away. Notify local health and pollution control agencies.</p>	
<p>Fire</p>	<p>Not flammable. POISONOUS AND IRRITATING GASES ARE PRODUCED WHEN HEATED. Wear goggles and self-contained breathing apparatus.</p>
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause headache, nausea, dizziness, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS AND HAVING CONVULSIONS, do nothing except keep victim warm.</p>
<p>Water Pollution</p>	<p>Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and pollution control officials. Notify operators of nearby water intakes.</p>
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-air contaminant Restrict access Should be removed</p>	<p>2. LABEL 2.1 Category: None 2.2 Class: Not pertinent</p>
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Competibility Class: Halogenated hydrocarbon 3.2 Formula: CHCl₃ 3.3 IMO/UN Designation: 9.0/1888 3.4 DOT ID No.: 1888 3.5 CAS Registry No.: 67-66-3</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pleasant, sweet; ethereal</p>
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Chemical goggles, 50 ppm to 2%; suitable full-face gas mask. Above 2%; suitable self-contained system.</p> <p>5.2 Symptoms Following Exposure: Headache, nausea, dizziness, drunkenness, narcosis.</p> <p>5.3 Treatment of Exposure: INHALATION: if ill effects develop, get victim to fresh air, keep him warm and quiet, and get medical attention. If breathing stops, start artificial respiration. INGESTION: induce vomiting and get medical attention. No known antidote; treat symptoms. EYES: flush with plenty of water for at least 15 minutes and get medical attention. SKIN: wash with soap and water, remove contaminated clothing and free of chemical.</p> <p>5.4 Threshold Limit Value: 10 ppm</p> <p>5.5 Short Term Inhalation Limits: 50 ppm for 10 min.</p> <p>5.6 Toxicity by Ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg</p> <p>5.7 Late Toxicity: None</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smearing and reddening of the skin.</p> <p>5.10 Odor Threshold: 205-307 ppm</p> <p>5.11 IDLH Value: 1,000 ppm</p>	

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flammable 6.3 Fire Extinguishing Agents: Not pertinent 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Poisonous and irritating gases are produced when heated. 6.6 Behavior in Fire: Decomposes, producing toxic gases 6.7 Ignition Temperature: Not flammable 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not flammable 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X</p>																																				
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 35</p>	<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: OSM-A</p> <p>11.2 HAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>1</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>2</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>2</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self Reaction</td> <td>0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>0</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire	1	Health		Vapor Irritant	2	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	2	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	0	Reactivity (Yellow)	0
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<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: Data not available 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: None</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Liquid</p> <p>12.2 Molecular Weight: 119.39</p> <p>12.3 Boiling Point at 1 atm: 142°F = 61.2°C = 334.4°K</p> <p>12.4 Freezing Point: -82.3°F = -63.5°C = 209.7°K</p> <p>12.5 Critical Temperature: 506°F = 263.2°C = 536.4°K</p> <p>12.6 Critical Pressure: 790 psia = 54 atm = 5.5 MN/m²</p> <p>12.7 Specific Gravity: 1.49 at 20°C (liquid)</p> <p>12.8 Liquid Surface Tension: 27.1 dynes/cm = 0.0271 N/m at 20°C</p> <p>12.9 Liquid Water Interfacial Tension: 32.8 dynes/cm = 0.0328 N/m at 20°C</p> <p>12.10 Vapor (Gas) Specific Gravity: 4.1</p> <p>12.11 Ratio of Specific Heats of Vapor (G_v): 1.145</p> <p>12.12 Latent Heat of Vaporization: 106.7 Btu/lb = 59.3 cal/g = 2.483 X 10³ J/kg</p> <p>12.13 Heat of Combustion: Not pertinent</p> <p>12.14 Heat of Decomposition: Not pertinent</p> <p>12.15 Heat of Solution: Not pertinent</p> <p>12.16 Heat of Polymerization: Not pertinent</p> <p>12.25 Heat of Fusion: 17.62 cal/g</p> <p>12.26 Limiting Value: Data not available</p> <p>12.27 Reid Vapor Pressure: 6.39 psia</p>																																				
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Technical, USP 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open</p>	<p>NOTES</p>																																				

TETRACHLOROETHYLENE

TTE

Common Synonyms Tetracop Perclene Perchloroethylene Park		Watery liquid: Sinks in water. Irritating vapor is produced.	Colorless	Sweet odor
Stop discharge if possible. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire		Not flammable. Poisonous gases are produced when heated.		
Exposure		CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.		
Water Pollution		Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed. Chemical and physical treatment		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent		
3. CHEMICAL DESIGNATIONS 3.1 CG Competibility Class: Not listed 3.2 Formula: C_2Cl_4 3.3 IMO/UN Designation: 9.0/1897 3.4 DOT ID No.: 1897 3.5 CAS Registry No.: 127-18-4		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Etheral; like chloroform; mildly sweet		
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: For high vapor concentrations use approved canister or air-supplied mask; chemical goggles or face shield; plastic gloves. 5.2 Symptoms Following Exposure: Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury. 5.3 Treatment of Exposure: INHALATION: If illness occurs, remove patient to fresh air, keep him warm and quiet, and get medical attention. INGESTION: induce vomiting only on physician's recommendation. EYES AND SKIN: flush with plenty of water and get medical attention if irritation or injury occurs. 5.4 Threshold Limit Value: 50 ppm 5.5 Short Term Inhalation Limit: 100 ppm for 60 min. 5.6 Toxicity by Ingestion: Grade 2; LD ₅₀ = 0.5 to 5 g/kg 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or throat if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 5 ppm 5.11 IDLH Value: 500 ppm				

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
 6.2 Flammable Limits in Air: Not flammable
 6.3 Fire Extinguishing Agents: Not pertinent
 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
 6.5 Special Hazards of Combustion
 Products: Toxic, irritating gases may be generated in fires.
 6.6 Behavior in Fire: Not pertinent
 6.7 Ignition Temperature: Not flammable
 6.8 Electrical Hazard: Not pertinent
 6.9 Burning Rate: Not flammable
 6.10 Adiabatic Flame Temperature:
 Data not available
 6.11 Stoichiometric Air to Fuel Ratio:
 Data not available
 6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
 7.2 Reactivity with Common Materials: No reaction
 7.3 Stability During Transport: Stable
 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
 7.5 Polymerization: Not pertinent
 7.6 Inhibitor of Polymerization:
 Not pertinent
 7.7 Molar Ratio (Reactant to Product): Data not available
 7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
 8.2 Waterfowl Toxicity: Data not available
 8.3 Biological Oxygen Demand (BOD):
 None
 8.4 Food Chain Concentration Potential:
 None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Dry cleaning and industrial grades: 95+ %
 9.2 Storage Temperature: Ambient
 9.3 Inert Atmosphere: No requirement
 9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE
 (See Hazard Assessment Handbook)
A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations:
 ORM-A

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 NFPA Hazard Classification:
 Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm:
 Liquid

12.2 Molecular Weight: 165.83

12.3 Boiling Point at 1 atm:
 250°F = 121°C = 394°K

12.4 Freezing Point:
 -8.3°F = -22.4°C = 250.8°K

12.5 Critical Temperature:
 657°F = 347°C = 620°K

12.6 Critical Pressure: Not pertinent

12.7 Specific Gravity:
 1.63 at 20°C (liquid)

12.8 Liquid Surface Tension:
 31.3 dynes/cm = 0.0313 N/m at 20°C

12.9 Liquid Water Interfacial Tension:
 44.4 dynes/cm = 0.0444 N/m at 25°C

12.10 Vapor (Gas) Specific Gravity:
 Not pertinent

12.11 Ratio of Specific Heats of Vapor (Gas):
 1.116

12.12 Latent Heat of Vaporization:
 90.2 Btu/lb = 50.1 cal/g =
 2.10 X 10⁵ J/kg

12.13 Heat of Combustion: Not pertinent
 12.14 Heat of Decomposition: Not pertinent
 12.15 Heat of Solution: Not pertinent
 12.16 Heat of Polymerization: Not pertinent
 12.25 Heat of Fusion: Data not available
 12.26 Limiting Value: Data not available
 12.27 Reid Vapor Pressure: Data not available

NOTES

TOLUENE

TC

<p>Common Synonyms</p> <p>Toluol Methylbenzene Methylbenzol</p>	<p>Watery liquid Colorless Pleasant odor</p> <p>Floats on water. Flammable, irritating vapor is produced.</p>
<p>Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
<p>Fire</p>	<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyes open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>
<p>Water Pollution</p>	<p>Dangerous to aquatic life in high concentrations. Foaming to shorelines. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area</p>	<p>2. LABEL</p> <p>2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C₇H₈ 3.3 IMO/UN Designation: 3.2/1294 3.4 DOT ID No.: 1294 3.5 CAS Registry No.: 106-98-3</p>	<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant</p>
<p>5. HEALTH HAZARDS</p>	
<p>5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves. 5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. 5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limit: 600 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg 5.7 Late Toxicity: Kidney and liver damage may follow ingestion. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm 5.11 IDLH Value: 2,000 ppm</p>	

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 40°F O.C.; 55°F O.C. 6.2 Flammable Limits in Air: 1.27%-7% 6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires. 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 967°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.7 mm/min. 6.10 Adiabatic Flame Temperature: Data not available</p> <p style="text-align: right;"><i>(Continued)</i></p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U</p>																																				
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32</p>	<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Category</th> <th style="text-align: center;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td></td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td></td> </tr> <tr> <td>Poisons</td> <td></td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td></td> </tr> <tr> <td>Aquatic Toxicity</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Aesthetic Effect</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td></td> </tr> <tr> <td>Water</td> <td></td> </tr> <tr> <td>Self Reaction</td> <td style="text-align: right;">0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Category</th> <th style="text-align: center;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td></td> </tr> <tr> <td>Flammability (Red)</td> <td></td> </tr> <tr> <td>Reactivity (Yellow)</td> <td></td> </tr> </tbody> </table>	Category	Rating	Fire		Health		Vapor Irritant	1	Liquid or Solid Irritant		Poisons		Water Pollution		Human Toxicity		Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity		Other Chemicals		Water		Self Reaction	0	Category	Classification	Health Hazard (Blue)		Flammability (Red)		Reactivity (Yellow)	
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<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL₅₀/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 8 days 8.4 Food Chain Concentration Potential: None</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 92.14 12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K 12.4 Freezing Point: -139°F = -95.0°C = 178.2°K 12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K 12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m² 12.7 Specific Gravity: 0.867 at 20°C (liquid) 12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor: 1.089 12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 X 10⁴ J/kg 12.13 Heat of Combustion: -17,430 Btu/lb = -9686 cal/g = -406.5 X 10³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 17.17 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 1.1 psia</p>																																				
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Research, reagent, nitration-all 99.8 + %; Industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum</p>	<p>6. FIRE HAZARDS (Continued)</p> <p>6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>																																				

TRICHLOROETHYLENE

TCL

<p>Common Synonyms</p> <p>Trichloroethylene Triclene; Alkyten Chlorylan Gemaigene Tredylene Trichloran; Trilene</p>		<p>Watery liquid</p> <p>Sinks in water. Irritating vapor is produced.</p>	<p>Colorless</p>	<p>Sweet odor</p>
<p>Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>				
<p>Fire</p>	<p>Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.</p>			
<p>Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>			
<p>Water Pollution</p>	<p>Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>			
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed Chemical and physical treatment</p>		<p>2. LABEL</p> <p>2.1 Category: None 2.2 Class: Not pertinent</p>		
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: $\text{CHCl}_2 = \text{CCl}_2$ 3.3 IMO/IUN Designation: 9.0/1710 3.4 DOT ID No.: 1710 3.5 CAS Registry No.: 79-01-6</p>		<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Chloroform-like; ethereal</p>		
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.</p> <p>5.2 Symptoms Following Exposure: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and flaccid disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.</p> <p>5.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.</p> <p>5.4 Threshold Limit Value: 50 ppm 5.5 Short Term Inhalation Limit: 200 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; $\text{LD}_{50} = 50$ to 500 mg/kg 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 50 ppm 5.11 IDLH Value: 1,000 ppm</p>				

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 90°F C.C.; practically nonflammable 6.2 Flammable Limits in Air: 8.0%-10.5% 6.3 Fire Extinguishing Agents: Water fog 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations. 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: 770°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not pertinent 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X-Y</p>																																				
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 36</p>	<p>11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: OSM-A 11.2 MAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>1</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>2</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self Reaction</td> <td>1</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>1</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire	1	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	2	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self Reaction	1	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	1	Reactivity (Yellow)	0
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<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: 600 mg/l/40 hr/daphnia/kil/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 131.39 12.3 Boiling Point at 1 atm: 186°F = 87°C = 300°K 12.4 Freezing Point: -122.5°F = -86.4°C = 186.8°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.46 at 20°C (liquid) 12.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 34.5 dynes/cm = 0.0345 N/m at 24°C 12.10 Vapor (Gas) Specific Gravity: 4.5 12.11 Ratio of Specific Heats of Vapor (Gas): 1.116 12.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4 X 10⁵ J/kg 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 2.5 psia</p>																																				
<p>9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Technical; dry cleaning; degreasing; extraction 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum</p>	<p>NOTES</p>																																				

4-NITROPHENOL

NPH

Common Synonyms p-Nitrophenol 4-Hydroxynitrobenzene PNP		Solid Yellow to brown Sweet odor Sinks and mixes with water.
Stop discharge if possible. Keep people away. Avoid contact with solid and dust. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	Combustible. POISONOUS GASES MAY BE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with water, dry chemicals, foam, or carbon dioxide.	
Exposure	CALL FOR MEDICAL AID. DUST Irritating to eyes, nose and throat. If inhaled will cause headache or loss of consciousness. If in eyes, hold eyelids open and flush with plenty of water. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. SOLID Irritating to skin and eyes. If swallowed will cause headache, nausea, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
Water Pollution	Effect of low concentration on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-water contaminant. Should be removed. Chemical and physical treatment		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Not listed 3.2 Formula: 1,4-HOC ₆ H ₄ NO ₂ 3.3 IMO/IUN Designation: 6.1/1663 3.4 DOT ID No.: 1663 3.5 CAS Registry No.: 100-02-7		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: Yellow to brown 4.3 Odor: Slight characteristic, sweet
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Butyl rubber gloves; side-shield safety glasses; dust mask or self-contained breathing apparatus. 5.2 Symptoms Following Exposure: Inhalation or ingestion causes headache, drowsiness, nausea, and blue color in lips, ears, and fingernails (cyanosis). Contact with eyes or skin causes irritation; can be absorbed through skin to give same symptoms as for inhalation. 5.3 Treatment of Exposure: INHALATION or INGESTION: remove victim to fresh air; give artificial respiration; call a doctor if symptoms persist. EYES: flush with water for at least 15 minutes; get medical attention. SKIN: flush with water and wash well with soap and water. 5.4 Threshold Limit Value: Data not available. 5.5 Short Term Inhalation Limit: Data not available. 5.6 Toxicity by Ingestion: Grade 3; LD ₅₀ = 50-500 mg/kg 5.7 Late Toxicity: Data not available. 5.8 Vapor (Gas) Irritant Characteristics: Data not available. 5.9 Liquid or Solid Irritant Characteristics: Data not available. 5.10 Odor Threshold: Odorless 5.11 IDLH Value: Data not available		

6. FIRE HAZARDS 6.1 Flash Point: Not pertinent (combustible solid) 6.2 Flammable Limits in Air: Not pertinent 6.3 Fire Extinguishing Agents: Water, foam, dry chemical, carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Data not available 6.5 Special Hazards of Combustion Products: Toxic oxides of nitrogen and fumes of unburned material may form in fire. 6.6 Behavior in Fire: Decomposes violently at 279°C and will burn even in absence of air. 6.7 Ignition Temperature: Data not available. 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not pertinent 6.10 Adiabatic Flame Temperature: Data not available (Continued)	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II-SS
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Data not available. 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: ORM-E 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue)..... 3 Flammability (Red)..... 1 Reactivity (Yellow)..... 0
8. WATER POLLUTION 8.1 Aquatic Toxicity: Data not available 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 139.1 12.3 Boiling Point at 1 atm: Not pertinent (decomposes) 12.4 Freezing Point: 235°F = 113°C = 386°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.48 at 20°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: -8,870 Btu/lb = -4,930 cal/g = -206 x 10 ⁶ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 41.70 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available
9. SHIPPING INFORMATION 9.1 Grades of Purity: Technical; Pure 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open	
6. FIRE HAZARDS (Continued) 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	

BENZOIC ACID

BZA

<p>Common Synonyms Benzenecarboxylic acid Carboxybenzene Diacrylic acid</p>		<p>Solid crystals or powder</p> <p>White</p> <p>Faint pleasant odor</p> <p>Sinks in water.</p>
<p>Avoid contact with solid and dust. Keep people away. Wear goggles and self-contained breathing apparatus. Stay upwind and use water spray to "knock down" dust. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
<p>Fire</p>	<p>Combustible. Vapor may explode if ignited in an enclosed area. Dust may form explosive mixture with air. Extinguish with water, dry chemical, chemical foam, or carbon dioxide.</p>	
<p>Exposure</p>	<p>CALL FOR MEDICAL AID. DUST Irritating to nose and throat if inhaled. Move to fresh air. SOLID Irritating to skin and eyes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water.</p>	
<p>Water Pollution</p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Disperse and flush</p>		<p>2. LABEL 2.1 Category: None 2.2 Class: Not pertinent</p>
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Not applicable 3.2 Formula: C₆H₅COOH 3.3 IMO/UN Designation: Not listed 3.4 DOT ID No.: 9094 3.5 CAS Registry No.: 65-85-0</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: White 4.3 Odor: Faint, pleasant; slight aromatic</p>
<p>5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Bureau of Mines dust respirator; when melted material present, use eye protection and organic respirator for fumes. 5.2 Symptoms Following Exposure: Dust may be irritating to nose and eyes. At elevated temperatures, fumes may cause irritation of eyes, respiratory system, and skin. 5.3 Treatment of Exposure: Remove patient to fresh air. EYE CONTACT: flush eyes with water. 5.4 Threshold Limit Value: Not pertinent 5.5 Short Term Inhalation Limits: Not pertinent 5.6 Toxicity by Ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Not pertinent 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smearing and reddening of the skin. Dust may irritate nose and eyes. 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: Data not available</p>		

<p>6. FIRE HAZARDS 6.1 Flash Point: 250°F C.C. 6.2 Flammable Limits in Air: Not pertinent 6.3 Fire Extinguishing Agents: Dry powder, chemical foam, water fog, carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: None 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor from molten benzoic acid may form explosive mixture with air. Concentrated dust may form explosive mixture. 6.7 Ignition Temperature: 1063°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not pertinent 6.10 Adiabatic Flame Temperature: Data not available</p> <p style="text-align: right;">(Continued)</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II</p> <p>11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: ORM-E 11.2 NAS Hazard Rating for Bulk Water Transportations: Not listed 11.3 NFPA Hazard Classification: Category _____ Classification _____ Health Hazard (Blue) _____ 2 Flammability (Red) _____ 1 Reactivity (Yellow) _____</p>
<p>7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: Not pertinent 7.2 Reactivity with Common Materials: Not pertinent 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 122.12 12.3 Boiling Point at 1 atm: 480.6°F = 249.2°C = 522.4°K 12.4 Freezing Point: 252.1°F = 122.3°C = 395.5°K 12.5 Critical Temperature: 894°F = 479°C = 752°K 12.6 Critical Pressure: 860 psia = 45 atm = 4.6 MN/m² 12.7 Specific Gravity: 1.316 at 28°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 33.89 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>
<p>8. WATER POLLUTION 8.1 Aquatic Toxicity: 200 ppm/7 hr/goldfish/lethal/fresh water 500 ppm/1 hr/sunfish/lethal/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 16%, 5 days 8.4 Food Chain Concentration Potential: None</p>	
<p>9. SHIPPING INFORMATION 9.1 Grades of Purity: USP, FCC grade: 99.5%-100.5% 9.2 Storage Temperature: Data not available 9.3 Inert Atmosphere: Data not available 9.4 Venting: Data not available</p>	
<p>6. FIRE HAZARDS (Continued) 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	

DHS02670

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
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1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 50-32-8
RTECS NUMBER: DJ3675000

SUBSTANCE: BENZO(A)PYRENE

TRADE NAMES/SYNONYMS:

3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(D,E,F)-CHRYSENE; B(A)P; 3,4-BP;
3,4-BENZPYRENE; 3,4-BENZ(A)PYRENE; 3,4-BENZYLPIRENE; RCRA U022; C20H12;
DHS02670

CHEMICAL FAMILY:

Hydrocarbon, polynuclear

CREATION DATE: 03/18/85

REVISION DATE: 03/24/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : BENZO(A)PYRENE
CAS NUMBER: 50-32-8
PERCENTAGE: 100

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=1 REACTIVITY=0

EMERGENCY OVERVIEW:

Yellow crystals with a faint aromatic odor.

Suspect cancer hazard (contains material which can cause cancer in animals).
Risk of cancer depends on duration and level of contact. May be irritating
to the respiratory tract, skin and eyes. May cause blood disorders. May
damage the lungs. May cause skin disorders. May form flammable or explosive
dust-air mixtures.

Avoid breathing dust. Avoid contact with eyes, skin and clothing. Keep
container tightly closed. Avoid creation of dust. Wash thoroughly after
handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include sneezing and coughing.

LONG TERM EFFECTS: May cause mucous membrane growths. May also cause cancer.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include burns, itching and tingling sensation.

LONG TERM EFFECTS: In addition to effects from short term exposure, skin disorders may occur. May also cause cancer.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include tearing and intolerance of the eyes to light.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: No information available on significant adverse effects.

LONG TERM EFFECTS: May cause anemia and lung damage. May also cause cancer.

CARCINOGEN STATUS:

OSHA: N

NTP: Y

IARC: Y

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- If victim is conscious, remove ingested poison by gastric lavage with activated charcoal and a cuffed endotracheal tube to prevent aspiration. In the absence of depression, convulsion or impaired gag reflex, ipecac emesis can also be done without increasing the hazard of aspiration. When vomiting occurs, hold the patient with head lower than hips to help prevent pulmonary aspiration. After vomiting stops, give 30 to 60 ml of Fleet's phospho-soda diluted 1:4 in water. (Dreisbach, Handbook of Poisoning, 11th Ed.).

NOTE TO PHYSICIAN

ANTIDOTE:

No specific antidote. Treat symptomatically and supportively.

SECTION 5

FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Slight fire hazard when exposed to heat or flame.

Dust-air mixtures may ignite or explode.

EXTINGUISHING MEDIA:

Dry chemical, carbon dioxide, water spray or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, use water spray, fog or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Do not scatter spilled material with high-pressure water streams. Dike fire-control water for later disposal (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 31).

Use agents suitable for type of surrounding fire. Avoid breathing hazardous vapors, keep upwind.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may release acrid smoke and irritating fumes.

SECTION 6

ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL:

Sweep up and place in suitable clean, dry containers for reclamation or later disposal. Do not flush spilled material into sewer. Keep unnecessary people away.

Reportable Quantity (RQ): 1 pound

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

SOIL SPILL:

Dig holding area such as lagoon, pond or pit for containment.

Use protective cover such as a plastic sheet to prevent material from dissolving in fire extinguishing water or rain.

WATER SPILL:

Use activated carbon to absorb spilled substance that is dissolved.

Use suction hoses to remove trapped spill material.

Use mechanical dredges or lifts to extract immobilized masses of pollution and precipitates.

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**

EXPOSURE LIMITS:**COAL TAR PITCH VOLATILES (POLYCYCLIC AROMATIC HYDROCARBONS):**

0.2 mg/m³ OSHA TWA (as benzene solubles)

0.2 mg/m³ ACGIH TWA (as benzene solubles)

ACGIH A1-Confirmed Human Carcinogen.

0.1 mg/m³ NIOSH recommended 10 hour TWA (cyclohexane-extractable fraction)

Measurement method: Particulate filter; benzene; gravimetric; (NIOSH Vol. III # 5023).

Soots, tars, and mineral oils (untreated and mildly treated oils and used engine oils):

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (February 27, 1987)

BENZO(A)PYRENE:

ACGIH A2-Suspected Human Carcinogen.

1 pound CERCLA Section 103 Reportable Quantity

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (July 1, 1987)

VENTILATION:

Provide local exhaust or process enclosure ventilation to meet published exposure limits.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance.

Emergency wash facilities:

Where there is any possibility that an employee's eyes and/or skin may be exposed to this substance, the employer should provide an eye wash fountain and quick drench shower within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment

to prevent any possibility of skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators are recommended based on information found in the physical data, toxicity and health effects sections. They are ranked in order from minimum to maximum respiratory protection.

The specific respirator selected must be based on contamination levels found in the work place, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

Any type 'C' supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece helmet or hood operated in continuous-flow mode.

Any self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9**PHYSICAL AND CHEMICAL PROPERTIES**

DESCRIPTION: Yellow crystals with a faint aromatic odor.

MOLECULAR WEIGHT: 252.32

MOLECULAR FORMULA: C₂₀H₁₂

BOILING POINT: 590-594 F (310-312 C) @ 10 mmHg

MELTING POINT: 349-351 F (176-177 C)

VAPOR PRESSURE: <1.0 mmHg @ 25 C

SPECIFIC GRAVITY: 1.35

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Benzene, toluene, xylene; sparingly soluble in alcohol

SECTION 10**STABILITY AND REACTIVITY**

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

May burn but does not ignite readily. Avoid contact with strong oxidizers, excessive heat, sparks, or open flame.

INCOMPATIBILITIES:**BENZO(A)PYRENE:**

OXIDIZERS (STRONG): Fire and explosion hazard.

HAZARDOUS DECOMPOSITION:

Thermal decomposition may release acrid smoke and irritating fumes.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11**TOXICOLOGY INFORMATION**
-----**BENZO(A)PYRENE:**

IRRITATION DATA: 14 ug skin-mouse mild.

TOXICITY DATA: 50 mg/kg subcutaneous-rat LD50; 500 mg/kg intraperitoneal-mouse LDLo; mutagenic data (RTECS); reproductive effects data (RTECS); tumorigenic data (RTECS).

CARCINOGEN STATUS: Anticipated Human Carcinogen (NTP); Animal Sufficient Evidence (IARC Group-2A). Benzo(a)pyrene, administered by a number of routes, exhibited a local and systemic carcinogenic effect in all nine species in which it was tested. No epidemiological studies on the significance of benzo(a)pyrene exposure to man are available, however, coal-tar and other materials which are known to be carcinogenic to man may contain benzo(a)pyrene.

ACUTE TOXICITY LEVEL: Insufficient data.

TARGET EFFECTS: Poisoning may affect the lungs and skin.*

AT INCREASED RISK FROM EXPOSURE: Persons with pre-existing skin disorders.*

ADDITIONAL INFORMATION: May cross the placenta. May cause immunosuppression.

* May be based on general coal tar product information.

HEALTH EFFECTS**INHALATION:****BENZO(A)PYRENE:****CARCINOGEN.**

ACUTE EXPOSURE- Coal tar product fumes may cause irritation of the respiratory tract with coughing, sneezing, and swollen nasal mucosa and sinuses. May also cause gastrointestinal effects.

CHRONIC EXPOSURE- Repeated exposure to 9.5 mg/m³ and 46.5 mg/m³ resulted in tumors of the nasal cavity, pharynx, larynx, and trachea in hamsters. Papillomas, papillary polyps, and squamous cell carcinomas in the esophagus and forestomach were also observed following chronic exposure to 46.5 mg/m³. Repeated and prolonged exposure to coal tar products may cause chronic bronchitis, gum disease, and increased mortality due to lung cancer.**SKIN CONTACT:****BENZO(A)PYRENE:****CARCINOGEN.**

ACUTE EXPOSURE- May cause irritation. An application of 120 ug caused an allergic contact hypersensitivity in previously exposed mice. A single application of 752 ug of benzo(a)pyrene in toluene to 13 mice resulted in papillomas in 2 animals and a carcinoma in one. Benzo(a)pyrene may also act as an initiator. Exposure to coal tar products may cause phototoxic reactions, especially in areas exposed to Sun or ultraviolet light. Symptoms may include erythema, local desquamation, burning and tingling sensations, itching, edema, papular dermatitis, and thermal burns.

CHRONIC EXPOSURE- Repeated dermal applications of 1% benzo(a)pyrene to human skin resulted in regressive verrucae. Nucleolar enlargement was observed in human volunteers painted daily for 4 consecutive days with benzo(a)pyrene. Repeated application of benzo(a)pyrene in a variety of solvents to a number of animal species resulted in skin papillomas and carcinomas. The incidence of benign and malignant tumors increased and the latency period decreased with higher concentrations. Repeated exposure to some coal tar products may cause photosensitivity with hypermelanosis, cornification of surface layers, and telangiectasis. Severe chronic photodermatitis may result in leukoderma.

EYE CONTACT:

BENZO(A)PYRENE:

ACUTE EXPOSURE- May cause irritation. Exposure to coal tar product fumes may cause lacrimation, photophobia, edema of the eyelids, burning, a purulent discharge, and conjunctival hyperemia.

CHRONIC EXPOSURE- Repeated and prolonged exposure to coal tar product fume may cause conjunctivitis and ptergia.

INGESTION:

BENZO(A)PYRENE:

CARCINOGEN.

ACUTE EXPOSURE- Acute intragastric administration of 50 or 150 mg/kg resulted in enzyme alterations in the mucosa of the gastrointestinal tract. A single dose of 0.2 mg in polyethylene glycol to mice resulted in 14 tumors in 5 out of 11 animals tested. A single oral dose of 100 mg to female rats produced mammary tumors in 8 of 9 animals.

CHRONIC EXPOSURE- Repeated ingestion of 120 mg/kg per day for 180 days resulted in decreased survival time in some strains of mice. Death was caused by bone marrow depression with aplastic anemia and pancytopenia, leading to hemorrhage or infection. Mice fed a diet containing 250 ppm benzo(a)pyrene for 140 days developed leukemias and lung adenomas in addition to stomach tumors. Rats fed daily doses of 2.5 mg developed papillomas in the esophagus and forestomach in 3 of 40 animals. Bi-weekly administration of 2-5 mg in oil to hamsters resulted in papillomas and carcinomas of the stomach, with the incidence dependent upon the length of administration. Hamsters fed a diet containing 500 ppm 4 days per week for up to 14 months developed tumors of the forestomach, esophagus and intestine. Effects on fertility and effects on the embryo or fetus have been reported following chronic ingestion by rodents. Chronic feeding of coal tar products to animals caused liver and lung damage and death.

 ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

 Observe all federal, state and local regulations when disposing of this substance.

Disposal must be in accordance with standards applicable to generators of hazardous waste, 40CFR 262. EPA Hazardous Waste Number U022.

US EPA RCRA Hazardous Waste Number: RCRA U022

SECTION 14

TRANSPORTATION INFORMATION

 No classification currently assigned

SECTION 15

REGULATORY INFORMATION

 TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	Y	1 pound RQ
SARA SECTION 302 (40CFR355.30):	N	
SARA SECTION 304 (40CFR355.40):	N	
SARA SECTION 313 (40CFR372.65):	N	
OSHA PROCESS SAFETY (29CFR1910.119):	N	
CALIFORNIA PROPOSITION 65:	Y	

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	Y
FIRE HAZARD:	N
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16

OTHER

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OHS02680

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

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1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 205-99-2
RTECS NUMBER: CU1400000

SUBSTANCE: BENZO(B)FLUORANTHENE

TRADE NAMES/SYNONYMS:

BENZ(E)ACEPHENANTHRYLENE; 3,4-BEN(E)ACEPHENANTHRYLENE; 2,3-BENZFLUORANTHENE;
3,4-BENZFLUORANTHENE; BENZO(E)FLUORANTHENE; B(B)F; 2,3-BENZOFLUORANTHENE;
3,4-BENZOFLUORANTHENE; C20H12; OHS02680

CHEMICAL FAMILY:

Hydrocarbon, polynuclear

CREATION DATE: 03/18/85

REVISION DATE: 03/24/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : BENZO(B)FLUORANTHENE
CAS NUMBER: 205-99-2
PERCENTAGE: 100

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=1 REACTIVITY=0

EMERGENCY OVERVIEW:

Colorless needles.

Suspect cancer hazard (contains material which can cause cancer in animals)
Risk of cancer depends on duration and level of contact. Causes respiratory tract, skin and eye irritation. May cause convulsions. May affect the central nervous system. May cause allergic skin reaction. May affect respiration. May cause eye damage. May affect the liver. May cause skin disorders.

Avoid breathing dust. Avoid contact with eyes, skin and clothing. Avoid repeated or prolonged contact. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include coughing, difficulty breathing and lung congestion.

LONG TERM EFFECTS: No information available on significant adverse effects

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation. May cause allergic reactions. Additional effects may include skin disorders and burns.

LONG TERM EFFECTS: May cause cancer.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include swelling of the eyes, redness of the skin, sores, tearing, intolerance of the eyes to light and eye damage.

LONG TERM EFFECTS: No information available on significant adverse effects

INGESTION:

SHORT TERM EFFECTS: May cause nausea, vomiting, tightness in the chest, headache, weakness, dizziness, disorientation, twitching, visual disturbances, liver damage, convulsions, unconsciousness and coma.

LONG TERM EFFECTS: No information available on significant adverse effects

CARCINOGEN STATUS:

OSHA: N

NTP: Y

IARC: Y

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- If victim is conscious, remove ingested poison by gastric lavage with activated charcoal and a cuffed endotracheal tube to prevent aspiration. In the absence of depression, convulsion or impaired gag reflex, ipecac emesis can also be done without increasing the hazard of aspiration. When vomiting occurs, hold the patient with head lower than hips to help prevent pulmonary aspiration. After vomiting stops, give 30 to 60 ml of Fleet's phospho-soda diluted 1:4 in water. (Dreisbach, Handbook of Poisoning, 11th Ed.).

NOTE TO PHYSICIAN

ANTIDOTE:

No specific antidote. Treat symptomatically and supportively.

SECTION 5

FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Slight fire hazard when exposed to heat or flame.

EXTINGUISHING MEDIA:

Dry chemical, carbon dioxide, water spray or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, use water spray, fog or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Do not scatter spilled material with high-pressure water streams. Dike fire-control water for later disposal (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 31).

Use agents suitable for type of surrounding fire. Avoid breathing hazardous vapors, keep upwind.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may release acrid smoke and irritating fumes.

SECTION 6

ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL:

Sweep up and place in suitable clean, dry containers for reclamation or later disposal. Do not flush spilled material into sewer. Keep unnecessary people away.

Reportable Quantity (RQ): 1 pound

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

SOIL SPILL:

Dig holding area such as lagoon, pond or pit for containment.

Use protective cover such as a plastic sheet to prevent material from dissolving in fire extinguishing water or rain.

WATER SPILL:

Use activated carbon to absorb spilled substance that is dissolved.

Use suction hoses to remove trapped spill material.

Use mechanical dredges or lifts to extract immobilized masses of pollution and precipitates.

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**

EXPOSURE LIMITS:

COAL TAR PITCH VOLATILES (POLYCYCLIC AROMATIC HYDROCARBONS):

0.2 mg/m³ OSHA TWA (as benzene solubles)

0.2 mg/m³ ACGIH TWA (as benzene solubles)

ACGIH A1-Confirmed Human Carcinogen.

0.1 mg/m³ NIOSH recommended 10 hour TWA (cyclohexane-extractable fraction)

Measurement method: Particulate filter; benzene; gravimetric; (NIOSH Vol. III # 5023).

Soots, tars, and mineral oils (untreated and mildly treated oils and used engine oils):

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (February 27, 1987)

BENZO(B)FLUORANTHENE:

ACGIH A2 suspect Human Carcinogen

1 pound CERCLA Section 103 Reportable Quantity

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (July 1, 1987)

VENTILATION:

Process enclosure ventilation recommended to meet published exposure limits. Ventilation equipment must be explosion-proof.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance.

Emergency wash facilities:

Where there is any possibility that an employee's eyes and/or skin may be exposed to this substance, the employer should provide an eye wash fountain and quick drench shower within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent any possibility of skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators are recommended based on information found in the physical data, toxicity and health effects sections. They are ranked in order from minimum to maximum respiratory protection.

The specific respirator selected must be based on contamination levels found in the work place, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

Any type 'C' supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet or hood operated in continuous-flow mode.

Any self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9**PHYSICAL AND CHEMICAL PROPERTIES**

DESCRIPTION: Colorless needles.

MOLECULAR WEIGHT: 252.32

MOLECULAR FORMULA: C₂₀-H₁₂

MELTING POINT: 334 F (168 C)

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Organic solvents

SECTION 10**STABILITY AND REACTIVITY**

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

May burn but does not ignite readily. Avoid contact with strong oxidizers.

excessive heat, sparks, or open flame.

INCOMPATIBILITIES:

BENZO(B)FLUORANTHENE:

OXIDIZERS (STRONG): Fire and explosion hazard.

HAZARDOUS DECOMPOSITION:

Thermal decomposition may release acrid smoke and irritating fumes.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

BENZO(B)FLUORANTHENE:

TOXICITY DATA: Mutagenic data (RTECS); tumorigenic data (RTECS).

CARCINOGEN STATUS: Anticipated Human Carcinogen (NTP); Animal Sufficient Evidence (IARC Group-2B). It has produced skin tumors in mice following repeated skin paintings. It is also an initiator of skin carcinogenesis in mice and produced local sarcomas after subcutaneous injection.

LOCAL EFFECTS: Irritant- inhalation, skin, eye.

ACUTE TOXICITY LEVEL: No data available.

TARGET EFFECTS: Sensitizer- skin. Poisoning may affect the lungs.

HEALTH EFFECTS

INHALATION:

BENZO(B)FLUORANTHENE:

IRRITANT.

ACUTE EXPOSURE- May cause respiratory irritation, cough, dyspnea, and pulmonary edema.

CHRONIC EXPOSURE- Repeated or prolonged exposure may cause bronchitis. Exposure is associated with cancers of the lungs, bladder, kidneys, and and gastrointestinal tract.

SKIN CONTACT:

BENZO(B)FLUORANTHENE:

IRRITANT/SENSITIZER/CARCINOGEN.

ACUTE EXPOSURE- Delayed effects are erythema and swelling, which appears a few hours after exposure of skin surfaces to ultraviolet light. Hypermelanosis is common. Intense contact has caused acne and/or folliculitis. Desquamation, pigmentation, dermatitis, and thermal burns have also occurred. Allergic dermatitis is rare.

CHRONIC EXPOSURE- Has produced skin tumors in mice following repeated skin paintings. May also produce leukoderma.

EYE CONTACT:

BENZO(B)FLUORANTHENE:

IRRITANT.

ACUTE EXPOSURE- Delayed irritation may occur, with conjunctival erythema, lacrimation, palpebral edema, photophobia, and corneal ulceration.

CHRONIC EXPOSURE- Prolonged exposure may produce the same effects as acute exposure.

INGESTION:

BENZO(B)FLUORANTHENE:

ACUTE EXPOSURE- Ingestion may cause dizziness, nausea and vomiting, weakness, headache, tightness in the chest, and staggering. If larger amounts have been ingested, these symptoms may progress to visual disturbances, tremors, shallow and rapid respiration, convulsions and coma. Violent excitement or delirium may precede unconsciousness. Kidney or liver damage may occur.

CHRONIC EXPOSURE- Has not been reported in humans.

 SECTION 12 ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

 SECTION 13 DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

 SECTION 14 TRANSPORTATION INFORMATION

No classification currently assigned

 SECTION 15 REGULATORY INFORMATION

TSCA STATUS: N

CERCLA SECTION 103 (40CFR302.4):	Y	1 pound RQ
SARA SECTION 302 (40CFR355.30):	N	
SARA SECTION 304 (40CFR355.40):	N	
SARA SECTION 313 (40CFR372.65):	N	
OSHA PROCESS SAFETY (29CFR1910.119):	N	
CALIFORNIA PROPOSITION 65:	Y	

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	Y
FIRE HAZARD:	N
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16.

OTHER

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OHS11330

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 193-39-5
RTECS NUMBER: NK9300000

SUBSTANCE: INDENO(1,2,3-CD)PYRENE

TRADE NAMES/SYNONYMS:

IP: ORTHO-PHENYLENEPYRENE; 1,10-(ORTHO-PHENYLENE)PYRENE;
1,10-(1,2-PHENYLENE)PYRENE; 2,3-ORTHO-PHENYLENEPYRENE; 2,3-PHENYLENEPYRENE;
RCRA U137: C22H12; OHS11330

CHEMICAL FAMILY:

Aromatic

CREATION DATE: 05/20/87

REVISION DATE: 03/24/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : INDENO(1,2,3-CD)PYRENE
CAS NUMBER: 193-39-5
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE.

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=1 REACTIVITY=0

EMERGENCY OVERVIEW:

Yellow plates or needles with a greenish-yellow fluorescence.

Suspect cancer hazard (contains material which can cause cancer in animals).

Risk of cancer depends on duration and level of contact. May be irritating to skin and eyes. May form flammable or explosive dust-air mixtures.

Avoid breathing dust. Avoid contact with eyes, skin and clothing. Keep container tightly closed. Avoid creation of dust. Wash thoroughly after handling. Use only with adequate ventilation.

POTENTIAL HEALTH EFFECTS:**INHALATION:**

SHORT TERM EFFECTS: No information available on significant adverse effects.

LONG TERM EFFECTS: No information is available.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: May cause cancer.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: No information is available.

INGESTION:

SHORT TERM EFFECTS: No information available on significant adverse effects.

LONG TERM EFFECTS: No information is available.

CARCINOGEN STATUS:

OSHA: N

NTP: Y

IARC: Y

SECTION 4FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN

ANTIDOTE:

No specific antidote. Treat symptomatically and supportively.

SECTION 5FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Slight fire hazard when exposed to heat or flame.

Dust-air mixtures may ignite or explode.

EXTINGUISHING MEDIA:

Dry chemical, carbon dioxide, water spray or regular foam

(1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, use water spray, fog or regular foam
(1990 Emergency Response Guidebook, DOT P 5800.5).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Do not scatter spilled material with high-pressure water streams. Dike fire-control water for later disposal (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 31).

Use agents suitable for type of surrounding fire. Avoid breathing hazardous vapors, keep upwind.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may release acrid smoke and irritating fumes.

SECTION 6

ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL:

Sweep up and place in suitable clean, dry containers for reclamation or later disposal. Do not flush spilled material into sewer. Keep unnecessary people away.

Reportable Quantity (RQ): 100 pounds

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

WATER SPILL:

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7

HANDLING AND STORAGE

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8

EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

COAL TAR PITCH VOLATILES (POLYCYCLIC AROMATIC HYDROCARBONS):

0.2 mg/m³ OSHA TWA (as benzene solubles)

0.2 mg/m³ ACGIH TWA (as benzene solubles)

ACGIH A1-Confirmed Human Carcinogen.

0.1 mg/m³ NIOSH recommended 10 hour TWA (cyclohexane-extractable fraction)

Measurement method: Particulate filter; benzene: gravimetric; (NIOSH Vol. III # 5023).

Boots, tars, and mineral oils (untreated and mildly treated oils and used engine oils):

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (February 27, 1987)

INDENO(1,2,3-CD)PYRENE:

100 pounds CERCLA Section 103 Reportable Quantity

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (January 1, 1988)

VENTILATION:

Process enclosure ventilation recommended to meet published exposure limits. Ventilation equipment must be explosion-proof.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

COAL TAR PITCH VOLATILES (BENZENE SOLUBLE FRACTION):

At any detectable concentration:

Any self-contained breathing apparatus that has a full facepiece and is operated in pressure-demand or other positive-pressure mode.
Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in

pressure-demand or other positive-pressure mode.

Escape- Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter.

Any appropriate escape-type, self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Yellow plates or needles with a greenish-yellow fluorescence.

MOLECULAR WEIGHT: 276.34

MOLECULAR FORMULA: C₂₂H₁₂

MELTING POINT: 324.5-327 F (163.6 C)

SPECIFIC GRAVITY: not available

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Soluble in organic solvents.

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

May burn but does not ignite readily. Avoid contact with strong oxidizers, excessive heat, sparks, or open flame.

INCOMPATIBILITIES:

INDENO(1,2,3-CD)PYRENE:

OXIDIZERS (STRONG): Fire and explosion hazard.

HAZARDOUS DECOMPOSITION:

Thermal decomposition may release acrid smoke and irritating fumes.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

INDENO(1,2,3-CD)PYRENE:

TOXICITY DATA: Mutagenic data (RTECS); tumorigenic data (RTECS).

CARCINOGEN STATUS: Anticipated Human Carcinogen (NTP); Animal Sufficient Evidence (IARC Group-2B): Indeno(1,2,3-cd)pyrene is a complete carcinogen and an initiator for skin carcinogenesis in mice. It produced local sarcoma after subcutaneous injection as well as skin application.

ACUTE TOXICITY LEVEL: No data available.

TARGET AFFECTS: Poisoning may affect the kidneys, liver, thymus and spleen.*

* May be based on general information on polycyclic aromatic hydrocarbons.

HEALTH EFFECTS

INHALATION:

INDENO(1,2,3-CD)PYRENE:

ACUTE EXPOSURE- Inhalation of dust may irritate the respiratory tract.
CHRONIC EXPOSURE- No data available.

SKIN CONTACT:

INDENO(1,2,3-CD)PYRENE:

CARCINOGEN.

ACUTE EXPOSURE- Polycyclic aromatic hydrocarbons may cause irritation.
CHRONIC EXPOSURE- Indeno(1,2,3-cd)pyrene dissolved in acetone and painted on the skin of mice at concentrations greater than 0.05% produced skin tumors, which appeared after several months.

EYE CONTACT:

INDENO(1,2,3-CD)PYRENE:

ACUTE EXPOSURE- Contact with dust may cause irritation.
CHRONIC EXPOSURE- No data available.

INGESTION:

INDENO(1,2,3-CD)PYRENE:

ACUTE EXPOSURE- The acute toxicity of polycyclic aromatic hydrocarbons appears to be low in rats and mice. At high acute doses, polycyclic aromatic hydrocarbons are toxic to many tissues, and degenerative changes may be observed in the kidney and liver; the thymus and spleen are particularly sensitive to the acute effects of polycyclic aromatic hydrocarbons.
CHRONIC EXPOSURE- No data available.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

Disposal must be in accordance with standards applicable to generators of hazardous waste. 40CFR 262. EPA Hazardous Waste Number U137.

US EPA RCRA Hazardous Waste Number: RCRA U137

SECTION 14

TRANSPORTATION INFORMATION

No classification currently assigned

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	Y	100 pounds RQ
SARA SECTION 302 (40CFR355.30):	N	
SARA SECTION 304 (40CFR355.40):	N	
SARA SECTION 313 (40CFR372.65):	N	
OSHA PROCESS SAFETY (29CFR1910.119):	N	
CALIFORNIA PROPOSITION 65:	Y	

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	N
CHRONIC HAZARD:	Y
FIRE HAZARD:	N
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16

OTHER

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PHENOL

PHN

Common Synonyms Hydroxybenzene Carboic acid Phenic acid Phenyl hydroxide	Solid crystals; or waxy liquid May float or sink, and mixes slowly with water.	White solid, or light pink liquid	Sweet tarry odor
<p>AVOID CONTACT WITH LIQUID AND SOLID. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Evacuate area in case of large discharge. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>			
Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with water, carbon dioxide, dry chemical, or foam. Cool exposed containers with water.		
Exposure	CALL FOR MEDICAL AID. LIQUID OR SOLID POISONOUS IF SWALLOWED. Will burn skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.		
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-poison Restrict access Should be removed Chemical and physical treatment	2. LABEL 2.1 Category: Poison 2.2 Class: 6		
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Phenol, cresol 3.2 Formula: C ₆ H ₅ OH 3.3 BHC/UN Designation: 9.0/1671 3.4 DOT ID No.: 1671 3.5 CAS Registry No.: 108-95-2	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid or molten liquid 4.2 Color: Colorless to light pink 4.3 Odor: Characteristically sweet; sweet, tarry; pungent, distinctive; distinct, aromatic, somewhat sickening sweet and acid		
5. HEALTH HAZARDS			
5.1 Personal Protective Equipment: Fresh-air mask for confined areas; rubber gloves; protective clothing; full face shield. 5.2 Symptoms Following Exposure: Will burn eyes and skin. The analgesic action may cause loss of pain sensation. Readily absorbed through skin, causing increase in heart rate, convulsions, and death. 5.3 Treatment of Exposure: INHALATION: If victim shows any ill effects, move him to fresh air, keep him quiet and warm, and call a doctor immediately; if breathing stops, give artificial respiration. INGESTION: do NOT induce vomiting; give milk, egg whites, or large amounts of water and call doctor immediately; no known antidote; treat the symptoms. EYES: immediately flush with plenty of water for at least 15 min.; continue for another 15 min. if doctor has not taken over. SKIN: immediately remove all clothing while in a shower and wash affected area with abundant flowing water or soap and water for at least 15 min.; clean clothing thoroughly or discard. 5.4 Threshold Limit Value: 5 ppm (includes skin exposure). 5.5 Short Term Inhalation Limits: Data not available 5.6 Toxicity by Ingestion: Grade 2; LD ₅₀ = 0.5 to 5 g/kg (rat) 5.7 Late Toxicity: Carcinogenic in laboratory animals 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Fairly severe skin irritant; may cause pain and second-degree burns after a few minutes' contact. 5.10 Odor Threshold: 0.05 ppm 5.11 IDLH Value: 100 ppm			

6. FIRE HAZARDS 6.1 Flash Point: 185°F O.C.; 175°F C.C. 6.2 Flammable Limits in Air: 1.7%-8.6% 6.3 Fire Extinguishing Agents: Water fog, foam, carbon dioxide, or dry chemical 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Toxic and irritating vapors are generated when heated. 6.6 Behavior in Fire: Yields flammable vapors when heated which will form explosive mixtures with air. 6.7 Ignition Temperature: 1319°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 3.5 mm/min. 6.10 Adiabatic Flame Temperature: Data not available <p style="text-align: right;"><i>(Continued)</i></p>	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-P-Q																																				
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 21	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Poison, B 11.2 NAS Hazard Rating for Bulk Water Transportation: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: right;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Poisons</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Aquatic Toxicity</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Aesthetic Effect</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Water</td> <td style="text-align: right;">0</td> </tr> <tr> <td>Self Reaction</td> <td style="text-align: right;">0</td> </tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: right;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Flammability (Red)</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td style="text-align: right;">0</td> </tr> </tbody> </table>	Category	Rating	Fire	1	Health		Vapor Irritant	2	Liquid or Solid Irritant	3	Poisons	3	Water Pollution		Human Toxicity	2	Aquatic Toxicity	3	Aesthetic Effect	3	Reactivity		Other Chemicals	2	Water	0	Self Reaction	0	Category	Classification	Health Hazard (Blue)	3	Flammability (Red)	2	Reactivity (Yellow)	0
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Flammability (Red)	2																																				
Reactivity (Yellow)	0																																				
8. WATER POLLUTION 8.1 Aquatic Toxicity: 11.5-28.5 mg/l/96 hr/bluegill/TL ₅₀ /fresh water 1.5 ppm/48 hr/rainbow trout/TL ₅₀ /fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 200%, 5 days 8.4 Food Chain Concentration Potential: None	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid or liquid 12.2 Molecular Weight: 94.11 12.3 Boiling Point at 1 atm: 358.2°F = 181.8°C = 458.0°K 12.4 Freezing Point: 105.8°F = 40.9°C = 314.1°K 12.5 Critical Temperature: 790.0°F = 421.1°C = 694.3°K 12.6 Critical Pressure: 869 psia = 60.5 atm = 6.13 MN/m ² 12.7 Specific Gravity: 1.058 at 41°C (liquid) 12.8 Liquid Surface Tension: 36.5 dynes/cm = 0.0065 N/m at 55°C 12.9 Liquid Water Interfacial Tension: (est.) 20 dynes/cm = 0.02 N/m at 42°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.089 12.12 Latent Heat of Vaporization: 130 Btu/lb = 72 cal/g = 3.0 X 10 ⁴ J/kg 12.13 Heat of Combustion: -13,400 Btu/lb = -7,445 cal/g = -311.7 X 10 ³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 0.3 psia																																				
9. SHIPPING INFORMATION 9.1 Grades of Purity: 90-99% (solid), 80-85% (liquid). Technical: 82-92% (contains cresols) 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum	6. FIRE HAZARDS (Continued) 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available																																				

DHS01005

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7429-90-5
RTECS NUMBER: BD0330000

SUBSTANCE: ALUMINUM OTHER THAN POWDER

TRADE NAMES/SYNONYMS:

NORAL ALUMINUM; NORAL EXTRA FINE LINING GRADE; NORAL NON-LEAFING GRADE;
ALUMINA FIBRE; ALUMINUM BRONZE; METANA; ALUMINUM; NORAL INK GRADE ALUMINUM;
A-552; A-557; A-547; I-213; I-213-10; ALUMINUM METAL; DHS01005

CHEMICAL FAMILY:

Metal

CREATION DATE: 02/06/85

REVISION DATE: 09/01/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : ALUMINUM OTHER THAN POWDER
CAS NUMBER: 7429-90-5
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE.

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=U FIRE=0 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0

EMERGENCY OVERVIEW:

Silvery-white, ductile metal with a somewhat bluish tint
No significant target effects reported. May form flammable or explosive
dust-air mixtures.
Avoid creation of dust. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: No information available on significant adverse effects
LONG TERM EFFECTS: No information is available.

SKIN CONTACT:

SHORT TERM EFFECTS: No information available on significant adverse effects
LONG TERM EFFECTS: No information is available.

EYE CONTACT:

SHORT TERM EFFECTS: No information available on significant adverse effects.
LONG TERM EFFECTS: No information is available.

INGESTION:

SHORT TERM EFFECTS: May cause gastrointestinal irritation. Additional effects may include digestive disorders.
LONG TERM EFFECTS: No information available on significant adverse effects.

CARCINOGEN STATUS:

OSHA: N
NTP: N
IARC: N

SECTION 4**FIRST AID MEASURES**
-----**INHALATION:**

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN**ANTIDOTE:**

No specific antidote. Treat symptomatically and supportively.

SECTION 5**FIRE FIGHTING MEASURES**
-----**FIRE AND EXPLOSION HAZARD:**

Neqliqible fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

The moist, finely divided metal may ignite in air.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFPA

Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may release acrid smoke and irritating fumes.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

No special precautions indicated.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**

EXPOSURE LIMITS:**ALUMINUM:**

10 mg/m³ ACGIH TWA

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

VENTILATION:

Provide local exhaust ventilation and/or general dilution ventilation to meet published exposure limits.

EYE PROTECTION:

Eye protection not required, but advisable.

CLOTHING:

Protective clothing not required. Avoid repeated or prolonged contact with this substance.

GLOVES:

Protective gloves are not required but recommended.

RESPIRATOR:

The following respirators are recommended based on information found in the

physical data, toxicity and health effects sections. They are ranked in order from minimum to maximum respiratory protection. The specific respirator selected must be based on contamination levels found in the work place, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

Any dust, mist, and fume respirator.

Any chemical cartridge respirator with a dust, mist, and fume filter.

Any powered air-purifying respirator with a dust, mist, and fume filter.

Any type 'C' supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece helmet or hood operated in continuous-flow mode.

Any self-contained breathing apparatus with a full face piece operated in pressure-demand or other positive pressure mode.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Silvery-white, ductile metal with a somewhat bluish tint

MOLECULAR WEIGHT: 26.98

MOLECULAR FORMULA: AL

BOILING POINT: 4442 F (2450 C)

MELTING POINT: 1220 F (660 C)

VAPOR PRESSURE: 1 mmHg @ 1284 C

SPECIFIC GRAVITY: 2.7

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Soluble in hydrochloric acid, hot, concentrated sulfuric acid, perchloric acid, strong alkalis; insoluble in concentrated nitric acid, hot acetic acid

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

No reports found.

INCOMPATIBILITIES:

ALUMINUM OTHER THAN POWDER:

- ARSENIC TRIOXIDE, SODIUM ARSENATE AND SODIUM HYDROXIDE: The alkaline attack on the metal produced flammable hydrogen which in turn generated toxic toxic arsine gas.
- BARIUM SULFATE: Violent explosion.
- BROMATES (BARIUM, CALCIUM, MAGNESIUM, POTASSIUM, SODIUM OR ZINC): When both are finely divided the mixture can be exploded by heat, percussion, and, sometimes, light friction.
- BROMINE: The foil reacts with the liquid at 15 C and incandescence occurs warming in the vapor.
- BUTANOL: Severely attacked the metal in an autoclave at around 100 C liberating flammable hydrogen and causing a sharp rise in pressure. Other alcohols would behave similarly.
- CALCIUM SULFATE: Violent explosion.
- CHLORATES (BARIUM, CALCIUM, MAGNESIUM, POTASSIUM, SODIUM OR ZINC): When both are finely divided, the mixture can be exploded by heat, percussion, and sometimes, light friction.
- CHLORINE FLUORIDE: Possible ignition.
- CHLORINE TRIFLUORIDE AND CARBON: Violent reaction.
- CHLOROFLUOROHYDROCARBONS: Contact with fresh metal surfaces may result in intense exothermic reactions.
- CHLOROMETHANE, LIQUIFIED: Possible ignition due to formation of an alkylaluminum compound.
- COPPER AND SULFATE: Possible explosion in a silica vacuum tube @ 900-1000 C
- COPPER OXIDE: Strong explosion on heating.
- DIBORANE: Interaction gives complex hydrides which may ignite in air.
- 1,2-DIFLUOROTETRAFLUOROETHANE: Contact with fresh metal surfaces may result in intense exothermic reactions.
- ETHYLENE DICHLORIDE, PROPYLENE DICHLORIDE AND ORTHODICHLOROBENZENE: Explosive reaction.
- FLUOROCHLORO LUBRICANTS: Explosive reaction with fresh aluminum surfaces under pressure.
- HYDROCHLORIC ACID: The metal is attacked violently by the aqueous acid.
- HYDROGEN CHLORIDE: Vigorous exothermic reaction.
- IODATES (BARIUM, CALCIUM, MAGNESIUM, POTASSIUM, SODIUM, OR ZINC): When both are finely divided, the mixture can be exploded by heat, percussion, and sometimes, light friction.
- IODINE: Violent reaction in the presence of water as liquid, vapor or that present in hydrated salts.
- IODINE MONOCHLORIDE: The metal foil ignites spontaneously and burns with a bluish-white flame after continued contact.
- IODINE HEPTAFLUORIDE: Interaction on heating with evolution of heat and light.
- IODINE PENTAFLUORIDE: Ignition on prolonged contact.
- IRON OXIDE: Impact between an aluminum object and a rusty surface may cause sparks, possibly initiating an exothermic reaction.
- LEAD OXIDE: Violent reaction.
- MERCURY(II) SALTS: In contact with the foil, in the presence of moisture, vigorous amalgamation reaction ensues.
- METHANOL AND CARBON TETRACHLORIDE (9:1): Rapid autocatalytic dissolution of the metal.

METHYL BROMIDE: Possible ignition and explosion.

MONOBROMOTRIFLUOROMETHANE: Contact with fresh metal surfaces may result in intense exothermic reactions.

PALLADIUM: If an aluminum sheath surrounding a palladium core about .0025 inch diameter is heated to the melting point of aluminum, 600 C. an alloying reaction takes place with production of a brilliant flash and a temperature of 2,800 C.

PLATINUM: Thin layers on aluminum foil or wire are used as igniters due to the intense heat of alloy formation which is sufficient to melt the intermetallic compounds.

POLYTRIFLUOROETHYLENE GREASES OR OILS: Explosive reaction with fresh aluminum surfaces under pressure.

POTASSIUM HYDROXIDE: Vigorous reaction with evolution of flammable hydrogen.

POTASSIUM SULFATE: Violent explosion on melting.

PROPYLENE DICHLORIDE: Rapid decomposition may occur.

SILICON AND LEAD OXIDE: Explosion on heating.

SILVER CHLORIDE: Incompatible.

SODIUM CARBONATE: Explosion when applied to the red-hot metal.

SODIUM HYDROXIDE: Vigorous reaction with evolution of flammable hydrogen.

SODIUM PEROXIDE: Ignition under high friction at 240 C when the metal is finely divided.

SODIUM SULFATE: Violent explosion on melting.

SULFURIC ACID, HOT, CONCENTRATED: Attacks the metal with evolution of flammable hydrogen.

TETRACHLOROETHYLENE: Violent reaction.

TETRAFLUOROMETHANE: Contact with fresh metal surfaces may result in intense exothermic reactions.

1,1,1-TRICHLOROETHANE: Violent decomposition with evolution of hydrogen

HAZARDOUS DECOMPOSITION:

Thermal decomposition may release acrid smoke and irritating fumes.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

ALUMINUM:

CARCINOGEN STATUS: None.

ACUTE TOXICITY LEVEL: No data available.

TARGET EFFECTS: No data available.

HEALTH EFFECTS

INHALATION:

ALUMINUM:

ACUTE EXPOSURE- The only reported inhalation effects are for the dust, powder or fume forms.

CHRONIC EXPOSURE- No data available.

SKIN CONTACT:

ALUMINUM:

ACUTE EXPOSURE- A sliver of aluminum penetrating the skin may form aluminum

salts which induce local irritation and possibly secondary infections. Contact with rough or sharp edges may cause cuts or abrasions.
CHRONIC EXPOSURE- No data available.

EYE CONTACT:

ALUMINUM:

ACUTE EXPOSURE- Small metal particles have been observed in the eyes of humans on or near the retina and are usually nonirritating and well tolerated. The particles gradually change into a white powder and disappear in 2 or 3 years leaving only a characteristic local necrotic "imprint". Larger particles and splinters may scratch or cut the cornea and lids.

CHRONIC EXPOSURE- No data available.

INGESTION:

ALUMINUM:

ACUTE EXPOSURE- The actual effects may be determined by the form of the aluminum that is ingested. Generally it has a very low acute systemic toxicity due to its poor absorption from the gastrointestinal tract. Massive doses may cause gastrointestinal irritation and may be toxic.

CHRONIC EXPOSURE- Large amounts may interfere with intestinal absorption of phosphates leading to ricketts. Certain disease states influence the concentration of aluminum in organs, for example, Alzheimer's disease in which excessive levels have been found in the brain.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

SECTION 14

TRANSPORTATION INFORMATION

No classification currently assigned

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): Y
OSHA PROCESS SAFETY (29CFR1910.119): N
CALIFORNIA PROPOSITION 65: N

SARA HAZARD CATEGORIES. SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD: N
CHRONIC HAZARD: N
FIRE HAZARD: N
REACTIVITY HAZARD: N
SUDDEN RELEASE HAZARD: N

SECTION 16

OTHER

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ARSENIC

ARX

<p>Common Synonyms</p> <p>Arsenic, solid Arsenic, metallic Gray arsenic</p>	<p>Solid crystals Gray</p> <p>Sinks in water.</p>
<p>AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY. Wear self-contained positive pressure breathing apparatus and full protective clothing. Stay upwind and use water spray to "knock down" dust. Stop discharge if possible. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
<p style="text-align: center;">Fire</p>	<p>Can be heated to burn in air. POISONOUS GASES ARE PRODUCED IN FIRE. Wear self-contained positive pressure breathing apparatus and full protective clothing. Extinguish small fires: dry chemical, carbon dioxide, water spray or foam; large fires: water spray, fog or foam.</p>
<p style="text-align: center;">Exposure</p>	<p>CALL FOR MEDICAL AID.</p> <p>DUST POISONOUS IF INHALED. Move victim to fresh air. IF IN EYES OR ON SKIN, immediately flush with running water for at least 15 minutes; hold eyelids open if necessary. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>SOLID POISONOUS IF SWALLOWED. IF IN EYES OR ON SKIN, flush with running water for at least 15 minutes; hold eyelids open if necessary. IF SWALLOWED and victim is CONSCIOUS and has not vomited, induce vomiting with syrup of ipecac. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>
<p style="text-align: center;">Water Pollution</p>	<p>Effects of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook)</p> <p>Issue warning - poison. Restrict access. Should be removed. Chemical and physical treatment.</p>	<p>2. LABEL</p> <p>2.1 Category: Poison 2.2 Class: 6</p>
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 CG Competibility Class: Not listed 3.2 Formula: As 3.3 IMO/UN Designation: 6.1/1558 3.4 DOT ID No.: 1558 3.5 CAS Registry No.: 7440-38-2</p>	<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Solid 4.2 Color: Silver-gray 4.3 Odor: Data not available</p>
<p>5. HEALTH HAZARDS</p>	
<p>5.1 Personal Protective Equipment: Wear self-contained positive pressure breathing apparatus and full protective clothing.</p> <p>5.2 Symptoms Following Exposure: Poisonous by inhalation of dust or by ingestion. Regardless of exposure route, symptoms in most cases are characteristic of severe gastritis or gastroenteritis. All chemical forms of arsenic eventually produce similar toxic effects. Symptoms may be delayed.</p> <p>5.3 Treatment of Exposure: Get medical attention after any exposure to this metal. INHALATION: Move victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. EYES OR SKIN: Immediately flush with running water for at least 15 minutes; hold eyelids open if appropriate. Use soap and water to clean skin. Remove and isolate contaminated clothing and shoes. INGESTION: If the victim is alert and has not vomited, induce vomiting with syrup of ipecac.</p> <p>5.4 Threshold Limit Value: 0.2 mg/m³</p> <p>5.5 Short Term Inhalation Limits: Data not available</p> <p>5.6 Toxicity by Ingestion: Data not available</p> <p>5.7 Late Toxicity: Human carcinogen. Causes mutagenic, reproductive and tumorigenic effects along with damage to the gastrointestinal tract and degeneration of the liver and kidneys.</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Data not available</p> <p>5.9 Liquid or Solid Irritant Characteristics: Data not available</p> <p>5.10 Odor Threshold: Data not available</p> <p>5.11 IDLH Value: Data not available</p>	

<p style="text-align: center;">6. FIRE HAZARDS</p> <p>6.1 Flash Point: Not pertinent 6.2 Flammable Limits in Air: Not pertinent 6.3 Fire Extinguishing Agents: Small fires: dry chemical, carbon dioxide, water spray or foam; large fires: water spray, fog or foam. 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Contain highly toxic arsenic trioxide and other forms of arsenic. Arsenic gas, the most dangerous form of arsenic, is produced upon contact with an acid or acid fumes. 6.6 Behavior in Fire: Burns to produce dense white fumes of highly toxic arsenic trioxide. 6.7 Ignition Temperature: Not pertinent 6.8 Electrical Hazard: Data not available <i>(Continued)</i></p>	<p style="text-align: center;">10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook)</p> <p style="text-align: center;">II</p> <p style="text-align: center;">11. HAZARD CLASSIFICATIONS</p> <p>11.1 Code of Federal Regulations: Poison: B 11.2 NAB Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>3</td> </tr> <tr> <td>Flammability (Red)</td> <td>2</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Classification	Health Hazard (Blue)	3	Flammability (Red)	2	Reactivity (Yellow)	0
Category	Classification								
Health Hazard (Blue)	3								
Flammability (Red)	2								
Reactivity (Yellow)	0								
<p style="text-align: center;">7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Incompatible with zinc. 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available</p>	<p style="text-align: center;">12. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 74.9216 12.3 Boiling Point at 1 atm: 1,135°F = 613°C = 886°K (sublimes) 12.4 Freezing Point: Not pertinent 12.5 Critical Temperature: 1477.4°F = 803°C = 1078.2°K 12.6 Critical Pressure: 5027.4 psia = 342.0 atm = 34.6 MN/m² 12.7 Specific Gravity: 5.727 at 25°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>								
<p style="text-align: center;">8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: Data not available 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: Bioaccumulated by fresh water and marine aquatic organisms.</p>	<p style="text-align: center;">9. SHIPPING INFORMATION</p> <p>9.1 Grades of Purity: Crude, 90-95%; Refined, 99%; Semiconductor, 99.999% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: Not listed 9.4 Venting: Not pertinent</p>								
<p>8. FIRE HAZARDS (Continued)</p>									
<p>8.9 Burning Rate: Not pertinent 8.10 Adiabatic Flame Temperature: Data not available 8.11 Stoichiometric Air to Fuel Ratio: Data not available 8.12 Flame Temperature: Data not available</p>									

DHS02270

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
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NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7440-39-3
RTECS NUMBER: CB8370000

SUBSTANCE: BARIUM METAL

TRADE NAMES/SYNONYMS:

BARIUM; BARIUM, METALLIC; METALLIC BARIUM; BARIUM ELEMENT; UN 1400; BA;
DHS02270

CHEMICAL FAMILY:

Metal

CREATION DATE: 03/19/85

REVISION DATE: 01/15/94

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : BARIUM METAL
CAS NUMBER: 7440-39-3
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE.

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=2 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=3 REACTIVITY=2

EMERGENCY OVERVIEW:

Silver-white or yellowish-white, lustrous metal.

Causes respiratory tract, skin and eye irritation. May cause blood disorders. May cause convulsions. May affect the central nervous system. May affect respiration. May affect the kidneys. Extremely flammable. May catch fire if exposed to air. May react dangerously with water. May form flammable or explosive dust-air mixtures.

Keep away from all ignition sources. Do not allow water to get in container. Avoid breathing dust. Avoid contact with eyes, skin and clothing. Keep container tightly closed. Avoid creation of dust. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include coughing, vomiting, diarrhea, difficulty breathing, weakness, anxiety, excitation, paralysis and convulsions.

LONG TERM EFFECTS: No information is available.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May cause drooling, vomiting, digestive disorders, blood in the stool, difficulty breathing, weakness, dizziness, confusion, anxiety, excitation or drowsiness, back pain, twitching, blood disorders, kidney damage, paralysis, convulsions and coma.

LONG TERM EFFECTS: No information available on significant adverse effects

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Induce vomiting immediately when soluble barium compounds are ingested. Treat supportively and symptomatically (Parmeggiani, Encyclopedia of Occupational Health and Safety, 3rd Edition). Get medical attention immediately.

NOTE TO PHYSICIAN

ANTIDOTE:

The following antidote has been recommended. However, the decision as to whether the severity of poisoning requires administration of any antidote and actual dose required should be made by qualified medical personnel.

POISONING FROM BARIUM COMPOUNDS:

Give 30 grams of sodium sulfate in 250 mL of water orally and repeat in one hour. Give by gastric tube if symptoms have appeared. The administration of sulfate salts intravenously is hazardous, since they induce the precipitation of barium sulfate in the kidney, with subsequent renal failure. Administration of potassium is critical. (Dreisbach, Handbook of Poisoning, 12th Ed.). Antidote should be administered by qualified medical personnel.

SECTION 5**FIRE FIGHTING MEASURES**

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

Finely divided material may ignite on exposure to air.

EXTINGUISHING MEDIA:

Dry chemical, soda ash, lime or sand
(1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, withdraw from area and let fire burn
(1990 Emergency Response Guidebook, DOT P 5800.5).

FIREFIGHTING:

Do not use water or foam. Move container from fire area if you can do it without risk (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 40)

Extinguish using agents indicated. Do not get water inside containers. Avoid breathing vapors from burning material.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may release corrosive fumes of oxides of barium.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

Shut off ignition sources. Do not touch spilled material. Stop leak if you can do it without risk. Do not get water on spilled material or inside the container. For small dry spills, with clean shovel place material into clean dry container and cover; move containers from spill area. For small liquid spills, take up with sand or other absorbent material and place into containers for later disposal. For larger spills, dike spill for later disposal. Cover powder spills with plastic sheet or tarp to minimize spreading. Keep unnecessary people away. Isolate hazard area and deny entry.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8

EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

BARIUM, SOLUBLE COMPOUNDS (AS BA):

0.5 mg/m³ OSHA TWA

0.5 mg/m³ ACGIH TWA

0.5 mg/m³ NIOSH recommended TWA

0.5 mg/m³ DFG MAK TWA (total dust):

1.0 mg/m³ DFG MAK 30 minute peak, average value, 4 times/shift

Measurement method: Particulate filter; water; atomic absorption spectrometry; (NIOSH Vol. III # 7056).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

VENTILATION:

Provide local exhaust ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentrations of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place; must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

BARIUM, SOLUBLE COMPOUNDS (AS BA):

5 mg/m³- Any dust and mist respirator except single-use and quarter-mask respirators.

Any supplied air respirator.

Any self-contained breathing apparatus.

- 12.5 mg/m³- Any powered air-purifying respirator with a dust and mist filter.
Any supplied-air respirator operated in a continuous flow mode.
- 25 mg/m³- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.
Any powered air-purifying respirator with a tight-fitting facepiece and a high efficiency particulate filter.
Any supplied-air respirator with a tight-fitting facepiece operated in a continuous flow mode.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
- 250 mg/m³- Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
- Escape- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.
Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Silver-white or yellowish-white, lustrous metal.
MOLECULAR WEIGHT: 137.33
MOLECULAR FORMULA: BA
BOILING POINT: 2984 F (1640 C)
MELTING POINT: 1337 F (725 C)
VAPOR PRESSURE: 10 mmHg @ 1049 C
SPECIFIC GRAVITY: 3.51
WATER SOLUBILITY: reacts
SOLVENT SOLUBILITY: Soluble in alcohol; insoluble in benzene.

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

BARIIUM METAL:

Reacts exothermically on contact with water releasing flammable hydrogen gas which may be ignited by the heat of the reaction.

CONDITIONS TO AVOID:

May ignite itself if exposed to air or in presence of moisture. May re-ignite after fire is extinguished. Violent reaction with water produces flammable gas. Runoff to sewer may create fire or explosion hazard.

INCOMPATIBILITIES:

BARIUM:

- ACIDS: Violent reaction.
- AMMONIA: Incompatible.
- BROMINE PENTAFLUORIDE: Violent reaction and possible ignition.
- CARBON TETRACHLORIDE: Violent reaction or possible explosion.
- FLUOROTRICHLOROMETHANE: Forms an explosive mixture.
- IODINE HEPTAFLUORIDE: Exothermic reaction.
- OXIDIZERS (STRONG): Fire and explosion hazard.
- TETRACHLOROETHYLENE: Forms an explosive mixture.
- TRICHLOROETHYLENE: Forms an explosive mixture.
- TRICHLOROTRIFLUOROETHANE: Forms an explosive mixture.

HAZARDOUS DECOMPOSITION:

Thermal decomposition may release corrosive fumes of oxides of barium.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

BARIUM METAL:

CARCINOGEN STATUS: None.

LOCAL EFFECTS: Irritant- inhalation, skin, eye.

ACUTE TOXICITY LEVEL: No data available.

TARGET EFFECTS: Poisoning may affect the heart and kidneys.

HEALTH EFFECTS

INHALATION:

BARIUM:

IRRITANT. 250 mg/m3 is Immediately Dangerous to Life or Health.

ACUTE EXPOSURE- May cause sore throat, coughing, shortness of breath, vomiting, diarrhea, trembling, faintness, and paralysis of the arms and legs. Barium and its soluble compounds may also cause dyspnea, weakness, anxiety, cardiac irregularity and other muscle stimulation effects, and convulsions.

CHRONIC EXPOSURE- No data available.

SKIN CONTACT:

BARIUM:

IRRITANT.

ACUTE EXPOSURE- May cause irritation.

CHRONIC EXPOSURE- Repeated or prolonged contact may cause dermatitis.

EYE CONTACT:

BARIUM:

IRRITANT.

ACUTE EXPOSURE- Direct contact may cause irritation, redness, and pain.

CHRONIC EXPOSURE- Repeated or prolonged exposure may cause conjunctivitis.

INGESTION:

BARIUM:

ACUTE EXPOSURE- Barium and soluble barium compounds may cause salivation, vomiting, severe diarrhea with watery and bloody stools, colic, gastroenteritis, weakness, giddiness, anxiety, tinnitus, vertigo, confusion, and increasing somnolence without coma, dyspnea, slow pulse, hypokalemia, delayed kidney damage, and at high levels, hemolysis and hemorrhages in the stomach, intestines and kidneys may occur. Stimulation of all muscle types may result in hyperperistalsis, bladder contraction, lumbar pain, muscle twitching progressing to convulsions and/or paralysis, vasoconstriction, and irregular contraction of the heart followed by arrest in systole. Death may occur from cardiac or respiratory failure.

CHRONIC EXPOSURE- No effects have been reported in humans. Animal studies have shown effects on the hemopoietic and central nervous systems.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

Disposal must be in accordance with standards applicable to generators of hazardous waste, 40 CFR 262, EPA hazardous waste numbers, D001 and D003, 100 pound CERCLA Section 103 Reportable Quantity.

Barium - Regulatory level: 100.0 mg/l (TCLP-40 CFR 261 Appendix II) materials which contain the above substance at or above the TCLP regulator level meet the EPA toxicity characteristic, and must be disposed of in accordance with 40 CFR part 262, EPA Hazardous Waste Number D005.

SECTION 14

TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Barium-UN 1400

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
4.3 - Dangerous when wet material

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101
AND SUBPART E:
Dangerous when wet

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: None
NON-BULK PACKAGING: 49 CFR 173.212
BULK PACKAGING: 49 CFR 173.241

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 15 kg
CARGO AIRCRAFT ONLY: 50 kg

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	N
SARA SECTION 302 (40CFR355.30):	N
SARA SECTION 304 (40CFR355.40):	N
SARA SECTION 313 (40CFR372.65):	Y
OSHA PROCESS SAFETY (29CFR1910.119):	N
CALIFORNIA PROPOSITION 65:	N

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	N
FIRE HAZARD:	Y
REACTIVITY HAZARD:	Y
SUDDEN RELEASE HAZARD:	N

SECTION 16

OTHER

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BERYLLIUM

BEM

Common Synonyms	Solid Silver color Odorless Sinks in water.
<p>AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY. Wear dust respirator and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
Fire	<p>Combustible. POISONOUS GASES MAY BE PRODUCED IN FIRE. Dust cloud may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry graphite, soda ash, or other inert powder. DO NOT USE WATER ON FIRE.</p>
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>DUST POISONOUS IF INHALED OR IF SKIN IS EXPOSED. If inhaled will cause coughing or difficult breathing. If in eyes, hold eyelids open and flush with plenty of water. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>SOLID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>
Water Pollution	<p>Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-poison, water contaminant Restrict access Should be removed Chemical and physical treatment	2. LABEL 2.1 Category: None 2.2 Class: Not pertinent
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Not listed 3.2 Formula: Be 3.3 IMO/UN Designation: 6.1/1567 3.4 DOT ID No.: 1567 3.5 CAS Registry No.: 7440-41-7	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: White 4.3 Odor: None
5. HEALTH HAZARDS	
<p>5.1 Personal Protective Equipment: Bu. Mines approved respirator; clean work clothes daily; gloves; eye protection</p> <p>5.2 Symptoms Following Exposure: Any dramatic, unexplained weight loss should be considered as possible first indication of beryllium disease. Dust is extremely toxic when inhaled; symptoms include coughing, shortness of breath, and acute or chronic lung disease. There is no record of illness from ingestion of beryllium. Contact with dust causes conjunctival inflammation of eyes and dermatitis.</p> <p>5.3 Treatment of Exposure: INHALATION: acute disease may require hospitalization with administration of oxygen; chest x-ray should be taken immediately. EYES: flush with water for at least 15 min. SKIN: flush with water; wash with soap and water; all cuts, scratches or other injuries should receive prompt medical attention.</p> <p>5.4 Threshold Limit Value: 0.002 mg/m³</p> <p>5.5 Short Term Inhalation Limits: 0.025 mg/m³, less than 30 min.</p> <p>5.6 Toxicity by Ingestion: Grade 3; oral LD₅₀ = 100 mg/kg (mouse)</p> <p>5.7 Late Toxicity: Berylliosis of lungs may occur from 3 months to 15 years after exposure. Chronic systemic diseases of the liver, spleen, lymph nodes, bone, kidney, and other organs may also occur.</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Data not available</p> <p>5.9 Liquid or Solid Irritant Characteristics: Data not available</p> <p>5.10 Odor Threshold: Odorless</p> <p>5.11 IDLH Value: Data not available</p>	

6. FIRE HAZARDS 6.1 Flash Point: Not pertinent 6.2 Flammable Limits in Air: Not pertinent 6.3 Fire Extinguishing Agents: Graphite, sand, or any other inert dry powder 6.4 Fire Extinguishing Agents Not to be Used: Water 6.5 Special Hazards of Combustion Products: Combustion yields beryllium oxide fume, which is toxic if inhaled. 6.6 Behavior in Fire: Powder may form explosive mixture with air. 6.7 Ignition Temperature: Not pertinent 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not pertinent 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Data not available 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Not listed 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Category Classification* Health Hazard (Blue)..... 4 Flammability (Red)..... 1 Reactivity (Yellow)..... 0 *Applies to dust or powder.
8. WATER POLLUTION 8.1 Aquatic Toxicity: Data not available 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 9.01 12.3 Boiling Point at 1 atm: Not pertinent 12.4 Freezing Point: Not pertinent 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.85 at 20°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: -28,000 Btu/lb = -15,560 cal/g = -652 X 10 ³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 250.0 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available
9. SHIPPING INFORMATION 9.1 Grades of Purity: Grade AA, 99.96+ %; Grade A, 99.87+ %; Nuclear grade 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open	NOTES

OHS03720

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7440-43-9
RTECS NUMBER: EU9800000

SUBSTANCE: CADMIUM

TRADE NAMES/SYNONYMS:
CADMIUM ELEMENT; C.I. 77180; CD: OHS03720

CHEMICAL FAMILY:
Metal

CREATION DATE: 12/03/84

REVISION DATE: 01/15/94

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : CADMIUM
CAS NUMBER: 7440-43-9
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=3
NFFPA RATINGS (SCALE 0-4): HEALTH=4 FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:

Soft, ductile, malleable silver-white, lustrous metal or powder.
May be fatal if inhaled. Cancer hazard (contains material which can cause cancer in humans). Risk of cancer depends on duration and level of exposure.
Harmful if swallowed. Causes respiratory tract irritation. May be irritating to skin and eyes. May cause blood disorders. May damage kidneys. May cause adverse reproductive effects. May affect the liver. May damage the lungs.
Poison. Do not breathe dust. Do not get in eyes, on skin, or on clothing.
Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include runny nose, coughing, sweating, metallic taste, chills, fever, nausea, vomiting, bloody spit, chest pain, difficulty breathing, headache, anemia, weakness, dizziness, muscle pain, bluish skin color, suffocation, lung

damage, kidney damage, liver damage and bone effects. May also cause reproductive effects and death.

LONG TERM EFFECTS: In addition to effects from short term exposure, sores, lack of sense of smell, tooth discoloration, weight loss, shortness of breath, high blood pressure and back pain may occur.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May cause drooling, nausea, vomiting, constipation or diarrhea, stomach pain, headache, dizziness, blurred vision, kidney damage and shock.

LONG TERM EFFECTS: In addition to effects from short term exposure, high blood pressure may occur. May also cause reproductive effects.

ADDITIONAL DATA: May cause cancer.

CARCINOGEN STATUS:

OSHA: N

NTP: Y

IARC: Y

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Maintain airway and blood pressure and administer oxygen if available. Keep affected person warm and at rest. Treat symptomatically and supportively. Administration of oxygen should be performed by qualified personnel. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Give milk or beaten eggs every 4 hours to relieve gastrointestinal irritation. Remove unabsorbed cadmium by catharsis with Fleet's phospho-soda, 30-60 ml diluted 1:4 in water (Dreisbach, Handbook of Poisoning, 12th Ed.). Treatment must be administered medical personnel.

NOTE TO PHYSICIAN

ANTIDOTE:

The following antidote has been recommended. However, the decision as to whether the severity of poisoning requires administration of any antidote and actual dose required should be made by qualified medical personnel.

CADMIUM POISONING:

Do not give dimercaprol (BAL). If symptoms persist, the administration of calcium disodium edetate is recommended. Give 15-25 mg/kg (0.08-0.125 mL of 20% solution per kilogram of body weight) in 250-500 mL of 5% dextrose intravenously over a 1 to 2 hour period, twice daily. The maximum dose should not exceed 50 mg/kg/day. The drug should be given in 5-day courses with a rest period of at least 2 days between courses. After the first course, subsequent courses should not exceed 50 mg/kg/day. Daily urinalyses should be done during the treatment period. The dosage should be reduced if any unusual urinary findings appear.

For intramuscular administration, give 20% solution (200 mg/mL), 12.5 mg/kg body weight every 4-6 hours. Dilute each dose with an equal volume of 1% procaine. Dose limitation is the same as that given above (Dreisbach, Handbook Of Poisoning, 12th Ed.). Antidote should be administered by qualified medical personnel.

SECTION 5**FIRE FIGHTING MEASURES**

FIRE AND EXPLOSION HAZARD:

Slight fire hazard in metallic form. The finely divided metal may be pyrophoric in air. Dust-air mixtures may be explosive.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFFA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products may include toxic oxides of cadmium.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

For large spills, sweep up with a minimum of dusting and place into suitable clean, dry containers for reclamation or later disposal.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

Reportable Quantity (RQ): 10 pounds

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

WATER SPILL:

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7

HANDLING AND STORAGE

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8

EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

CADMIUM (AS CD):

0.005 mg/m³ OSHA TWA; 0.0025 mg/m³ OSHA action level

0.01 mg/m³ ACGIH TWA (total dust); 0.002 mg/m³ ACGIH TWA (respirable dust)
ACGIH A2-Suspected Human Carcinogen.

0.05 mg/m³ ACGIH ceiling limit (cadmium oxide fume)

(Notice of Intended Changes 1990-91)

Lowest feasible limit NIOSH recommended exposure criteria

Measurement method: Particulate filter; acid; atomic absorption spectrometry: (NIOSH Vol. III # 7048).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (October 1, 1987)

CADMIUM:

10 pounds CERCLA Section 103 Reportable Quantity

VENTILATION:

Process enclosure ventilation recommended to meet published exposure limits. Ventilation equipment must be explosion-proof.

Cadmium:

Ventilation should meet the requirements of 29 CFR 1910.1027(f).

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CADMIUM:

Protective eye equipment should meet the requirements for protective work clothing and equipment in 29 CFR 1910.1027(i).

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

CADMIUM:

Protective clothing should meet the requirements for protective work clothing and equipment in 29 CFR 1910.1027(i).

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

CADMIUM:

Protective gloves should meet the requirements for protective work clothing and equipment in 29 CFR 1910.1027(i).

RESPIRATOR:

The following respirators are the minimum legal requirements as set forth by the Occupational Safety and Health Administration found in 29 CFR 1910, Subpart Z.

CADMIUM:

- | | |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Less than or equal to 10x PEL- | A half mask, air-purifying respirator equipped with a high-efficiency particulate filter. |
| Less than or equal to 25x PEL- | A powered air-purifying respirator with a loose-fitting hood or helmet equipped with a high-efficiency particulate filter.
A supplied-air respirator with a loose-fitting hood or helmet facepiece operated in the continuous flow mode. |
| Less than or equal to 50x PEL- | A full facepiece air-purifying respirator equipped with a high-efficiency particulate filter.
A powered air-purifying respirator with a tight-fitting half mask equipped with a high-efficiency particulate filter.
A supplied-air respirator with a tight-fitting half mask operated in the continuous flow mode. |
| Less than or equal | |

- to 250x PEL- A powered air-purifying respirator with a tight-fitting full facepiece equipped with a high-efficiency particulate filter.
A supplied-air respirator with a tight-fitting full facepiece operated in the continuous flow mode.
- Less than or equal to 1000x PEL- A supplied-air respirator with half mask or full facepiece operated in the pressure demand or other positive pressure mode.
- Greater than 1000x PEL or unknown concentrations- A self-contained breathing apparatus with a full facepiece operated in the pressure demand or other positive pressure mode.
A supplied-air respirator with a full facepiece operated in the pressure demand or other positive pressure mode and equipped with an auxiliary escape type self-contained breathing apparatus operated in the pressure demand mode.

* - A full facepiece respirator is required when eye irritation is experienced.

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH pocket guide to chemical hazards or NIOSH criteria documents.

The specific respirator selected must be based on contamination levels found in the work place and be jointly approved by the National Institute of Occupational Safety and Health and the Mine Safety and Health Administration.

CADMIUM DUST AND FUME (AS CD):

At any detectable concentration:

- Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
- Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Escape- Any air-purifying, full-facepiece respirator with high-efficiency particulate filter.

Any appropriate escape-type, self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Soft, ductile, malleable silver-white, lustrous metal or powder.

MOLECULAR WEIGHT: 112.41

MOLECULAR FORMULA: CD

BOILING POINT: 1409 F (765 C)

MELTING POINT: 610 F (321 C)

VAPOR PRESSURE: 1 mmHg @ 394 C

SPECIFIC GRAVITY: 8.642

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Soluble in acids, ammonium nitrate solutions, hot sulfuric and hydrochloric acids.

AUTOIGNITION TEMP: 482 F (250 C) (layer), 1058 F (570 C) (cloud)

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

Avoid dispersion of dust in air. Finely divided particles, dust, or fumes may be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:

CADMIUM:

AMMONIUM NITRATE (FUSED): Violent or explosive reaction.

HYDRAZOIC ACID: May explode violently.

NITRYL FLUORIDE: Incandescent reaction when heated slightly.

OXIDIZERS (STRONG): Fire and explosion hazard.

SELENIUM: Exothermic reaction.

SULFUR: Fire and explosion hazard.

TELLURIUM: Incandescent reaction in hydrogen atmosphere.

ZINC: Intense exothermic reaction.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products may include toxic oxides of cadmium.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

CADMIUM:

TOXICITY DATA: 88 ug/m³/8.6 years inhalation-man TCl₀: 39 mg/m³/20 minutes inhalation-human LCl₀: 25 mg/m³/30 minutes inhalation-rat LC₅₀: 170 mg/m³ inhalation-mouse LCl₀: 225 mg/kg oral-rat LD₅₀: 70 mg/kg oral-rabbit LD₀: 890 mg/kg oral-mouse LD₅₀: 9 mg/kg subcutaneous-rat LD₅₀: 6 mg/kg subcutaneous-rabbit LD₀: 1800 ug/kg intravenous-rat LD₅₀: 5 mg/kg

intravenous-rabbit LDLo: 4 mg/kg intraperitoneal-rat LD50: 5700 ug/kg intraperitoneal-mouse LD50: 15 mg/kg unreported-man LDLo: 1140 mg/kg unreported-rat LD50: 890 mg/kg unreported-mouse LD50: mutagenic data (RTECS); reproductive effects data (RTECS); tumorigenic data (RTECS).

CARCINOGEN STATUS: Anticipated Human Carcinogen (NTP); Human Limited Evidence, Animal Sufficient Evidence (IARC Group-2A). Cadmium has produced local sarcomas in rats following intramuscular administration. Exposure to cadmium, primarily as the oxide, has been associated with increased risks of prostatic and respiratory cancers.

LOCAL EFFECTS: Irritant- inhalation.

ACUTE TOXICITY LEVEL: Highly toxic by inhalation; toxic by ingestion.

TARGET EFFECTS: Nephrotoxin. Poisoning may affect the liver, bone, blood, lungs, and the nervous system.

AT INCREASED RISK FROM EXPOSURE: Persons with kidney or respiratory disorders.

ADDITIONAL DATA: Deficiencies in iron, calcium, zinc, protein and vitamins C and d may enhance the toxic effects. Alterations of drug metabolizing activity have been induced in animals. Smoking may result in higher blood cadmium levels.

HEALTH EFFECTS

INHALATION:

CADMIUM:

IRRITANT/NEPHROTOXIN/HIGHLY TOXIC.

ACUTE EXPOSURE- The average concentration of fume responsible for fatalities is 40-50 mg/m³ for 1 hour or 9 mg/m³ for 5 hours. Early symptoms may include mild irritation of the upper respiratory tract, rhinitis, vertigo, a sensation of constriction of the throat, a metallic taste in the mouth and cough. A latent period from 1-10 hours may precede the onset of rapidly progressing dyspnea, cyanosis, substernal or precordial chest pain, and a flu-like syndrome with weakness, malaise, nausea, vomiting, headache, fever, chills, shivering, profuse sweating, and muscular pains in the back and limbs. Cough with foamy or bloody sputum and pulmonary rales mark the onset of acute pulmonary edema which usually develops within 24 hours and reaches a maximum by 3 days. If death from asphyxia does not occur, and exposure was mild, symptoms may resolve within a week. In more severe exposures, all symptoms including proliferative interstitial pneumonitis may persist from 3-10 days. Permanent pulmonary fibrosis and hypertrophy of bronchial vessels may occur. The fatality rate has been estimated to be between 15-20%. Acute renal necrosis and/or liver damage may develop following massive acute exposure. Sequelae from non-fatal exposure may include microcytic, hypochromic anemia, testicular atrophy, cardiovascular effects, emphysema, anemia and osteomalacia.

CHRONIC EXPOSURE- Cadmium is highly cumulative. Repeated or prolonged exposure may cause irreversible lung injury of the emphysematous type with cough and shortness of breath, abnormal lung function, airways obstruction and possibly pulmonary fibrosis. Ulceration of the nasal septum and yellow discoloration of the teeth may occur. Cadmium induced kidney damage is irreversible and may progress after exposure ceases. Proteinuria may be the first sign of damage and may be associated with glucosuria, aminoaciduria, impaired excretion, decreased concentrating capacity, increased excretion of calcium and phosphorus, and increased plasma creatinine. Calciuria may favor the development of kidney stones. Some cases of kidney failure have been reported. Osteomalacia, osteoporosis, and spontaneous fractures may occur and may be manifested

as back pain, pain in the extremities, difficulty in walking, and pain on bone pressure. Other symptoms may include damage to the olfactory nerve and anosmia, hemolytic and iron-deficiency anemia, weight loss, and irritability. Some studies suggest a relationship between cadmium levels in air and human cardiovascular disease and hypertension, but causal association has not been proven. Long-term sequelae may include renal tubular necrosis, cardiovascular effects, and liver damage. Occupational exposure to cadmium is implicated in a significant increase in the incidence of prostatic and respiratory cancers. One study also reports a significant increase in renal cancers in those with inferred occupational exposure to cadmium. There is also limited information suggesting that cadmium may interfere with sperm production in humans.

SKIN CONTACT:**CADMIUM:**

ACUTE EXPOSURE- Direct contact may result in irritation.

CHRONIC EXPOSURE- Repeated or prolonged exposure may result in dermatitis.

EYE CONTACT:**CADMIUM:**

ACUTE EXPOSURE- Direct contact may cause irritation, redness, pain and smarting, but no injury has been reported.

CHRONIC EXPOSURE- Repeated or prolonged exposure may cause conjunctivitis.

INGESTION:**CADMIUM:****NEPHROTOXIN/TOXIC.**

ACUTE EXPOSURE- Cadmium is a powerful emetic which induces vomiting so that less is retained and absorbed. If sufficient amounts are absorbed systemic toxicity may occur. Symptoms, which may begin within 1-60 minutes after ingestion, are salivation, choking, severe nausea, persistent vomiting, diarrhea, tenesmus, abdominal pain, blurred vision, dizziness, vertigo, headache, muscular cramps and rarely, convulsions, exhaustion, collapse, shock and unconsciousness. If death occurs, it is usually within 24 hours from shock due to fluid loss, or, it may be delayed 7-14 days and result from acute renal failure or cardiopulmonary depression. If victim survives, delayed liver and/or kidney damage may occur. A dose exceeding 300 mg may be fatal.

CHRONIC EXPOSURE- Cadmium is highly cumulative. Prolonged low level exposure may cause irreversible renal tubular dysfunction as described in chronic inhalation. Animal experiments indicate antagonistic activity between cadmium and zinc such that abnormal zinc metabolism was found to contribute significantly to the toxic syndrome following prolonged ingestion of cadmium. Functional changes in the liver, pancreas and adrenal glands which alter glucose metabolism may occur. Although inconclusive, some studies suggest a relationship between prolonged exposure to cadmium and human cardiovascular disease and hypertension. A study which supports this theory was reported where female rats exhibited hypertension after chronically ingesting cadmium through their drinking water. Reproductive effects such as congenital abnormalities, increased mortality, and reduced rates of growth have been found in animals after prolonged ingestion of cadmium.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

Cadmium - Regulatory level: 1.0 mg/l (TCLP-40 CFR 261 Appendix II) materials which contain the above substance at or above the TCLP regulatory level meet the EPA toxicity characteristic, and must be disposed of in accordance with 40 CFR part 262, EPA Hazardous Waste Number D006.

SECTION 14

TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Cadmium compounds-UN 2570

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
6.1 - Poisonous materials

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG I

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101
AND SUBPART E:
Poison

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: None
NON-BULK PACKAGING: 49 CFR 173.211
BULK PACKAGING: 49 CFR 173.244

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 5 kg
CARGO AIRCRAFT ONLY: 50 kg

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4): Y 10 pounds RQ

SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): Y
OSHA PROCESS SAFETY (29CFR1910.119): N
CALIFORNIA PROPOSITION 65: Y

SARA HAZARD CATEGORIES. SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD: Y
CHRONIC HAZARD: Y
FIRE HAZARD: Y
REACTIVITY HAZARD: N
SUDDEN RELEASE HAZARD: N

SECTION 16

OTHER

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CALCIUM

CAM

<p>Common Synonyms</p>	<p>Solid Silvery to grayish white Odorless</p> <p>Sinks in water. Reacts slowly with water.</p>
<p>Avoid contact with solid and dust. Keep people away. Wear rubber overclothing (including gloves). Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
<p>Fire</p>	<p>FLAMMABLE Extinguish with dry graphite, soda ash, or other inert powder. DO NOT USE WATER, FOAM, CARBON DIOXIDE OR VAPORIZING LIQUIDS ON FIRE.</p>
<p>Exposure</p>	<p>CALL FOR MEDICAL AID. SOLID Will burn skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water.</p>
<p>Water Pollution</p>	<p>Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Disperse and flush</p>	<p>2. LABEL 2.1 Category: Flammable solid 2.2 Class: 4</p>
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Competibility Class: Not applicable 3.2 Formula: Ca 3.3 IMO/UN Designation: 4.3/1401 3.4 DOT ID No.: 1401 3.5 CAS Registry No.: Data not available</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: Silvery; turns to grayish-white on exposure to air. 4.3 Odor: None</p>
<p>5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Goggles and rubber gloves. 5.2 Symptoms Following Exposure: Contact with eyes or skin produces caustic burns. 5.3 Treatment of Exposure: Flush with water 5.4 Threshold Limit Value: Not pertinent 5.5 Short Term Inhalation Limits: Not pertinent 5.6 Toxicity by Ingestion: Data not available 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Not pertinent 5.9 Liquid or Solid Irritant Characteristics: Data not available 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: Not pertinent</p>	

<p>6. FIRE HAZARDS 6.1 Flash Point: Not pertinent (flammable solid) 6.2 Flammable Limits in Air: Not pertinent 6.3 Fire Extinguishing Agents: Dry graphite, soda ash, powdered sodium chloride, or appropriate metal fire extinguishing dry powder. 6.4 Fire Extinguishing Agents Not to be Used: Water, halogenated hydrocarbons, dry chemical, carbon dioxide, foam 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Burns violently, especially if finely divided. 6.7 Ignition Temperature: 1454 ± 18°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not pertinent 6.10 Adiabatic Flame Temperature: Data not available</p> <p style="text-align: right;"><i>(Continued)</i></p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II-RR</p>								
<p>7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: Reacts to form flammable hydrogen gas, which may ignite. The reaction is not violent. 7.2 Reactivity with Common Materials: Reacts with moist air to form skin of hydroxide. The reaction is not hazardous. 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Flush with water 7.5 Polymerization: Stable 7.6 Inhibitor of Polymerization: Stable 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available</p>	<p>11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable solid 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Category</td> <td style="text-align: right;">Classification</td> </tr> <tr> <td style="text-align: right;">Health Hazard (Blue)</td> <td style="text-align: right;">1</td> </tr> <tr> <td style="text-align: right;">Flammability (Red)</td> <td style="text-align: right;">1</td> </tr> <tr> <td style="text-align: right;">Reactivity (Yellow)</td> <td style="text-align: right;">2</td> </tr> </table> </p>	Category	Classification	Health Hazard (Blue)	1	Flammability (Red)	1	Reactivity (Yellow)	2
Category	Classification								
Health Hazard (Blue)	1								
Flammability (Red)	1								
Reactivity (Yellow)	2								
<p>8. WATER POLLUTION 8.1 Aquatic Toxicity: See Calcium hydroxide (CAH) 8.2 Waterfowl Toxicity: See Calcium hydroxide (CAH) 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: None</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 40.1 12.3 Boiling Point at 1 atm: 2,714°F = 1,490°C = 1,763°K 12.4 Freezing Point: 1,562°F = 850°C = 1,123°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.55 at 20°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: -6790 Btu/lb = -3,770 cal/g = -158 X 10³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 55.7 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>								
<p>9. SHIPPING INFORMATION 9.1 Grades of Purity: Commercial, 99.5%; redistilled 99.9% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Sealed containers must be in a ventilated area.</p>									
<p>6. FIRE HAZARDS (Continued) 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>									

DHS05000

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7440-47-3
RTECS NUMBER: GB4200000

SUBSTANCE: CHROMIUM

TRADE NAMES/SYNONYMS:

CHROME: CHROMIUM ELEMENT: CHROMIUM METAL: METALLIC CHROMIUM: CR: DHS05000

CHEMICAL FAMILY:

Metal

CREATION DATE: 10/25/84

REVISION DATE: 12/23/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : CHROMIUM
CAS NUMBER: 7440-47-3
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:

Odorless, steel-gray, lustrous metal or powder.

May be irritating to the respiratory tract, skin and eyes. May cause blood disorders. May affect the kidneys. May damage the lungs. Extremely flammable. May catch fire if exposed to air. May form flammable or explosive dust-air mixtures.

Keep away from all ignition sources. Avoid breathing dust. Avoid contact with eyes, skin and clothing. Keep container tightly closed. Avoid creation of dust. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: May cause sores and perforation of the nose, digestive

disorders, lung damage and blood disorders.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: In addition to effects from short term exposure, kidney damage may occur.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: In addition to effects from short term exposure, tearing may occur.

INGESTION:

SHORT TERM EFFECTS: May cause thirst, vomiting, stomach pain, inability to urinate, dizziness and shock.

LONG TERM EFFECTS: No information is available.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN

ANTIDOTE:

The following antidote has been recommended. However, the decision as to whether the severity of poisoning requires administration of any antidote and actual dose required should be made by qualified medical personnel.

CHROMIUM POISONING:

Use of dimercaprol has been suggested on the basis of findings in animals. Give 3 mg/kg (or 0.3 mL/10 kg) every 4 hours, intramuscularly for the first 2 days and then 2 mg/kg every 12 hours for a total of 10 days (Dreisbach).

Handbook of Poisoning, 12th Ed.). Antidote should be administered by qualified medical personnel.

SECTION 5**FIRE FIGHTING MEASURES**

FIRE AND EXPLOSION HAZARD:

Neoglignible fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

Finely divided material may ignite on exposure to air.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFPA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5600.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

LOWER FLAMMABLE LIMIT: 0.230 oz/ft³

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products may include toxic chromic oxide.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

For large spills, sweep up with a minimum of dusting and place into suitable clean, dry containers for reclamation or later disposal.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

Reportable Quantity (RQ): 5000 pounds

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.
Keep in a tightly closed container. Store in a cool, dry, ventilated area.
Store away from incompatible substances.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

CHROMIUM:

1 mg/m³ OSHA TWA
0.5 mg/m³ ACGIH TWA
(Notice of Intended Changes 1993-94)
0.5 mg/m³ NIOSH recommended TWA

Measurement method: Particulate filter; acid; atomic absorption spectrometry; (NIOSH Vol. III # 7024).

5000 pounds CERCLA Section 103 Reportable Quantity
Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

VENTILATION:

Provide local exhaust ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentrations of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

CHROMIUM, METAL AND INSOLUBLE SALTS (AS CR):

2.5 mg(Cr)/m³- Any dust and mist respirator.

5 mg(Cr)/m³- Any dust and mist respirator except single-use and quarter-mask respirators.
Any supplied-air respirator.
Any self-contained breathing apparatus.

12.5 mg(Cr)/m³- Any powered, air-purifying respirator with a dust and mist filter.
Any supplied-air respirator operated in a continuous-flow mode.

25 mg(Cr)/m³- Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter.
Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.

500 mg(Cr)/m³- Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Escape- Any air-purifying, full-facepiece respirator with a high-efficiency particulate filter.
Any appropriate escape-type, self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Odorless, steel-gray, lustrous metal or powder.

MOLECULAR WEIGHT: 51.996

MOLECULAR FORMULA: CR

BOILING POINT: 4842 F (2672 C)

MELTING POINT: 3339-3411 F (1837-1877 C)

VAPOR PRESSURE: 1 mmHg @ 1616

SPECIFIC GRAVITY: 7.20 @ 28 C

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Soluble in dilute sulfuric acid, hydrochloric acid;
insoluble in nitric acid, aqua regia.

AUTOIGNITION TEMPERATURE: 1076 F (580 C) (cloud): 752 F (400 C) (laver)

SECTION 10**STABILITY AND REACTIVITY**

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

Avoid dispersion of dust in air. Finely divided particles, dust, or fumes may be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:**CHROMIUM:**

ALKALI CARBONATES: Attacked.

ALKALIES (CAUSTIC): Attacked.

AMMONIUM NITRATE (FUSED): Violent or explosive reaction.

BROMINE PENTAFLUORIDE: Violent reaction and possible ignition.

HYDROGEN PEROXIDE: Violent decomposition reaction.

LITHIUM (MOLTEN): Vigorous reaction at elevated temperatures.

NITROGEN OXIDE: Incandescent reaction.

OXIDIZERS (STRONG): Fire and explosion hazard.

POTASSIUM CHLORATE (FUSED): Vigorous incandescent reaction.

SULPHUR DIOXIDE: Incandescent reaction.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products may include toxic chromic oxide.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11**TOXICOLOGY INFORMATION**

CHROMIUM:

TOXICITY DATA: 27500 ug/kg unreported route-rat LD50: tumorigenic data (RTECS).

CARCINOGEN STATUS: Human Inadequate Evidence, Animal Inadequate Evidence (IARC Group-3 for chromium metal).

ACUTE TOXICITY LEVEL: Insufficient data.

TARGET EFFECTS: Poisoning may affect the liver and kidneys.*

ADDITIONAL DATA: Chromium may cross the placenta and be excreted in breast milk.

* May be based on general information on chromium compounds.

HEALTH EFFECTS**INHALATION:****CHROMIUM:**

ACUTE EXPOSURE- High concentrations of dusts or fumes may cause irritation.

CHRONIC EXPOSURE- Repeated or prolonged exposure to various chromium compounds has been reported to result in ulceration and perforation of

the nasal septum, irritation of the throat and lower respiratory tract, less commonly in gastrointestinal disturbances, blood changes, pulmonary sensitization, pulmonary pneumoconiosis or fibrosis, and rarely liver effects. These effects have not been reported from exposure to the metal per se.

SKIN CONTACT:**CHROMIUM:**

ACUTE EXPOSURE- Contact with dusts or powder may cause irritation.

CHRONIC EXPOSURE- Repeated or prolonged exposure to various chromium compounds has been reported to cause various types of dermatitis, including eczema, "chrome holes", sensitization, and, in contact with damaged skin, kidney damage. These effects have not been reported from exposure to the metal per se.

EYE CONTACT:**CHROMIUM:**

ACUTE EXPOSURE- Contact with dusts or powders may cause irritation.

CHRONIC EXPOSURE- Repeated or prolonged exposure to some chromium compounds may cause conjunctivitis and lacrimation. These effects have not been reported from exposure to the metal per se.

INGESTION:**CHROMIUM:**

ACUTE EXPOSURE- Chromium metal is poorly absorbed by the intestinal tract. Absorption of sufficient amounts of some chromium compounds may result in dizziness, intense thirst, abdominal pain, vomiting, shock, oliguria or anuria, and uremia, which may be fatal.

CHRONIC EXPOSURE- No data available.

SECTION 12**ECOLOGICAL INFORMATION**

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13**DISPOSAL INFORMATION**

Observe all federal, state and local regulations when disposing of this substance.

Chromium - Regulatory level: 5.0 mg/l (TCLP-40 CFR 261 Appendix II) materials which contain the above substance at or above the TCLP regulator level meet the EPA toxicity characteristic, and must be disposed of in accordance with 40 CFR part 262, EPA Hazardous Waste Number D007.

DHS05250

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7440-48-4
RTECS NUMBER: GF8750000

SUBSTANCE: COBALT

TRADE NAMES/SYNONYMS:
C.I.77320; COBALT-59; C-363; COBALT ELEMENT; CO; DHS05250

CHEMICAL FAMILY:
Metal

CREATION DATE: 11/30/84

REVISION DATE: 12/23/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : COBALT
CAS NUMBER: 7440-48-4
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:

Odorless, silver-gray or bluish-white metal.
Suspect cancer hazard (contains material which can cause cancer in animals).
Risk of cancer depends on duration and level of contact. Causes respiratory tract, skin and eye irritation. May cause blood disorders. May cause adverse reproductive effects. May cause allergic reaction. May cause hearing loss. May affect the heart. May affect the liver. May damage the lungs.
Do not breathe dust. Avoid contact with eyes, skin and clothing. Avoid repeated or prolonged contact. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. May cause allergic reactions.

Additional effects may include redness and swelling of the eyes, runny nose, weakness and liver damage. May also cause tumors.
LONG TERM EFFECTS: In addition to effects from short term exposure, sneezing, coughing, weight loss, digestive disorders, chest pain, difficult breathing, high blood pressure, headache, sleeplessness, lung damage, hearing disorders, nerve effects and paralysis may occur. May also cause reproductive effects.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation. May cause allergic reactions. Additional effects may include rash.
LONG TERM EFFECTS: Same effects as short term exposure.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.
LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May cause vomiting and diarrhea.
LONG TERM EFFECTS: In addition to effects from short term exposure, rash, coughing, ringing in the ears, digestive disorders, shortness of breath, hearing loss, bluish skin color, blood disorders and heart failure may occur.

ADDITIONAL DATA: Drinking alcohol may worsen the effects. May cause cancer.

CARCINOGEN STATUS:

OSHA: N
NTP: N
IARC: Y

SECTION 4**FIRST AID MEASURES**

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN
ANTIDOTE:

The following antidote has been recommended. However, the decision as to whether the severity of poisoning requires administration of any antidote and actual dose required should be made by qualified medical personnel.

POISONING FROM COBALT COMPOUNDS:

Give calcium disodium edetate, available as 5 mL ampules of a 20% solution. Give 15-25 mg/kg (0.08-0.125 mL of 20% solution per kilogram of body weight) in 250-500 ml of 5% dextrose intravenously over a 1 to 2 hour period, twice daily. The maximum dose should not exceed 50 mg/kg/day. The drug should be give in 5-day courses with a rest period of at least 2 days between courses. After the first course, subsequent courses should not exceed 50 mg/kg/day. Daily urinalyses should be done during the treatment period. The dosage should be reduced if any unusual urinary findings appear. For intramuscular administration, give 20% solution (200 mg/mL), 12.5 mg/kg body weight every 4-6 hours. Dilute each dose with an equal volume of 1% procaine. Dose limitation is the same as that given above. For severe intoxications, some experts urge simultaneous administration of dimercaprol during the first 48 hours of treatment (Dreisbach Handbook of Poisoning, 12th Ed.). Antidote should be administered by qualified medical personnel. Get medical attention immediately.

SECTION 5**FIRE FIGHTING MEASURES**

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard in metallic form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames. Finely divided cobalt may be pyrophoric in air.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFPA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products may include toxic oxides of cobalt.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

For large spills, sweep up with a minimum of dusting and place into suitable clean, dry containers for reclamation or later disposal.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

WATER SPILL:

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance. Store away from incompatible substances.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**
-----**EXPOSURE LIMITS:**

COBALT METAL, DUST, AND FUME (AS CO):

0.05 mg/m³ OSHA TWA

0.05 mg/m³ ACGIH TWA

(Notice of Intended Changes 1992-93)

0.05 mg/m³ NIOSH recommended TWA

Measurement method: Particulate filter; acid; atomic absorption spectrometry; (NIOSH Vol. III # 7027).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting
Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements-. (July 1, 1992)

OSHA revoked the final rule limits of January 19, 1989 in response to the 11th Circuit Court of Appeals decision (AFL-CIO v. OSHA) effective June 30, 1993. See 29 CFR 1910.1000 (58 FR 35338)

VENTILATION:

Provide local exhaust ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentrations of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance.

Emergency wash facilities:

Where there is any possibility that an employee's eyes and/or skin may be exposed to this substance, the employer should provide an eye wash fountain and quick drench shower within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

COBALT METAL, DUST, AND FUME (AS CO):**For dust or mist:**

0.5 mg(Co)/m³- Any dust and mist respirator except single-use respirators.

1 mg(Co)/m³- Any dust and mist respirator except single-use and quarter-mask respirators.

2.5 mg(Co)/m³- Any powered air-purifying respirator with a dust and mist filter.

For dust, mist or fume:

1 mg(Co)/m³- Any dust, mist, and fume respirator.
Any supplied-air respirator.
Any self-contained breathing apparatus.

2.5 mg(Co)/m³- Any supplied-air respirator operated in a continuous flow mode.
Any powered air-purifying respirator with a dust, mist, and fume filter.

5 mg(Co)/m³- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.
Any self-contained breathing apparatus.
Any supplied-air respirator with a full facepiece.

20 mg(Co)/m³- Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.

Escape- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.
Any appropriate escape-type self-contained breathing apparatus

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in

pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Odorless, silver-gray or bluish-white metal.

MOLECULAR WEIGHT: 58.93

MOLECULAR FORMULA: CO

BOILING POINT: 5198 F (2870 C)

MELTING POINT: 2723 F (1495 C)

SPECIFIC GRAVITY: 8.92

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Soluble in dilute nitric acid, hydrochloric acid, sulfuric acid.

AUTOIGNITION TEMPERATURE: 698 F (370 C) (layer), 1400 F (760 C) (cloud)

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

Stable under normal temperatures and pressures.

Finely divided cobalt may react pyrophorically in air.

CONDITIONS TO AVOID:

Avoid dispersion of dust in air. Finely divided particles, dust, or fumes may be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:

COBALT:

ACETYLENE: Incandescent reaction.

AMMONIUM NITRATE: Violent or explosive reaction.

BROMINE PENTAFLUORIDE: Violent reaction with possible ignition.

BROMINE TETRAFLUORIDE: Violent reaction with possible ignition.

HYDRAZINIUM NITRATE: Possible explosion above 70 C.

NITRYL FLUORIDE: Incandescent reaction.

OXIDIZERS (STRONG): Fire and explosion hazard.

1,3,4,7-TETRAMETHYLISOINDOLE: Possible explosion on heating.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products may include toxic oxides of cobalt.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

COBALT:

TOXICITY DATA: 100 ug/m³/6 hours/13 weeks intermittent inhalation-quinea pig

TCLo: 6170 mg/kg oral-rat LD50: 750 mg/kg oral-rabbit LDLo: 25 mg/kg intratracheal-rat LDLo: 100 mg/kg intravenous-rabbit LDLo: 100 mg/kg intravenous-rat LDLo: 100 mg/kg intraperitoneal-mouse LDLo: 250 mg/kg intraperitoneal-rat LDLo: tumorigenic data (RTECS).

CARCINOGEN STATUS: Human Inadequate Evidence, Animal Sufficient Evidence (for cobalt metal powder) (IARC Group-2B for cobalt and cobalt compounds). A significant increase in the risk for lung cancer was reported among workers in cobalt production who were also exposed to nickel and arsenic and hard-metal workers with documented exposure to cobalt-containing dusts. A significant increase in lung cancer risk was seen in people exposed for more than 10 years whose exposure had begun more than 20 years previously. A number of single cases of malignant tumors, mostly sarcomas, have been reported at the site of orthopaedic implants containing cobalt. Intramuscular and intrathoracic injections of cobalt metal powder in rats produced sarcomas at the injection site.

LOCAL EFFECTS: Irritant- inhalation, skin, eye.

ACUTE TOXICITY LEVEL: Slightly toxic by ingestion.

TARGET EFFECTS: Sensitizer- respiratory, dermal. Poisoning may also affect the respiratory, gastrointestinal, cardiovascular, endocrine and nervous systems.

AT INCREASED RISK FROM EXPOSURE: Persons with pre-existing respiratory or skin disease.

ADDITIONAL DATA: Alcohol may enhance the toxic effects.

HEALTH EFFECTS

INHALATION:

COBALT:

IRRITANT/SENSITIZER.

20 mg(Co)/m³ Immediately Dangerous to Life or Health.

ACUTE EXPOSURE- May cause upper respiratory tract irritation, rhinitis, conjunctivitis and tracheitis. Sensitization reactions may occur in previously exposed individuals. An obliterative bronchiolitis adenomatous has been produced in guinea pigs intratracheally injected with the dust at doses of 50, 25, and 10 mg. Intratracheal administration of 12.5 mg/kg caused lethargy and death in rats in 15 minutes to 6 hours.

CHRONIC EXPOSURE- Prolonged or repeated exposure may cause respiratory irritation, discharge from respiratory or digestive mucous membranes, nasal obstruction, sneezing, clear secretions sometimes containing blood, an intense burning sensation when swallowing, exertional dyspnea, gastrointestinal distress, appetite and weight loss, peripheral neuritis, headache, weakness, irritability, partial or complete loss of the sense of smell, auditory nerve problems, and an increased incidence of spontaneous abortions in women workers and in the wives of men workers. Several cases of cardiomyopathy have been reported in workers. The onset of the disease may begin gradually with steadily increasing chest discomfort and sharp pains near the heart. Other symptoms may include dry cough, mucoid sputum, general malaise, drop in blood pressure, right sided hemiparesis, sleeplessness, and weight loss. Fragmented myocardial fibers, vacuolar change, diffused thickening of the endocardium and absence of an inflammatory reaction were signs of cardiomyopathy. Studies from workers chronically exposed to cobalt in tungsten carbide manufacturing of hard metal revealed three types of respiratory disease: Airways obstruction may occur from simple irritation and appears to be related to an allergic response. It has been reported to occur at a level of 0.06 mg/m³ and i

characterized by wheezing, cough, and shortness of breath while at work with symptoms improving when exposure ceases. This syndrome may not develop until 6 to 18 months of exposure has occurred and is not thought to be progressive. However once sensitized a worker could probably not tolerate inhalation of even small amounts; interstitial pneumonitis, a syndrome similar to extrinsic allergic alveolitis has been reported in workers. The signs and symptoms are compatible with transient pneumonitis. Basal crackles and radiographic abnormalities occur but symptoms improve and respiratory impairment is decreased or resolved once the subject is removed from exposure for a period of time; interstitial fibrosis has been observed to occur in workers exposed to 0.1 to 0.2 mg/m³ for usually 10 years. Symptoms included cough, scanty mucoid sputum, and shortness of breath which progressively worsens. Tachypnea is frequent, and clubbing of the digits, and basal crackles are late features of this condition. Pulmonary function is decreased and death is usually due to pulmonary hypertension and cor pulmonale.

SKIN CONTACT:**COBALT:****IRRITANT/SENSITIZER.**

ACUTE EXPOSURE- May cause irritation. Sensitization dermatitis may occur in persons who have been previously exposed. Both urticarial eruptions and erythematous papular types have been described and usually occur in skin areas subjected to friction, such as the elbow flexures, ankles, and neck.

CHRONIC EXPOSURE- Repeated or prolonged contact may lead to sensitization dermatitis.

EYE CONTACT:**COBALT:****IRRITANT.**

ACUTE EXPOSURE- May cause irritation. Workers in the cobalt-cemented tungsten industry have not experienced eye irritation at concentrations below 1 mg/m³.

CHRONIC EXPOSURE- Repeated or prolonged exposure may cause conjunctivitis.

INGESTION:**COBALT:**

ACUTE EXPOSURE- Vomiting, diarrhea, and a sensation of hotness may occur after the ingestion of large amounts.

CHRONIC EXPOSURE- Cardiomyopathy has been caused by excessive intake of cobalt. Signs and symptoms of this illness included gastrointestinal disturbances with nausea, vomiting and diarrhea, shortness of breath, dry and persistent cough, thoracic and right upper quadrant abdominal pain, ankle edema, cyanosis, lowered blood pressure, heart enlargement, pericardial effusion, rapid heart rate, electrocardiographic abnormalities and death. Sequela following this illness included recurrent chronic heart failure, and neurologic and mental deterioration. Therapeutic administration has caused nausea, vomiting, skin rash, tinnitus, nerve deafness, thyroid hyperplasia, myxedema, polycythemia, congestive heart failure, and death. Administration to humans at 1 mg daily for three days resulted in prolonged time for blood clot formation. Degenerative changes have occurred in the liver, kidneys, and pancreas of animals. Administration in drinking water produced erythropoietic effects, immunosuppression, and inhibited reflex learning in rats.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

SECTION 14

TRANSPORTATION INFORMATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 172.101:

*Flammable solid

Department of Transportation labeling requirements 49-CFR 172.101 and SUBPART E:

*Flammable solid

*Hazard classification and label apply to dust and powder form only.

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49-CFR 173.154

EXCEPTIONS: 49-CFR 173.153

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	N
SARA SECTION 302 (40CFR355.30):	N
SARA SECTION 304 (40CFR355.40):	N
SARA SECTION 313 (40CFR372.65):	Y
OSHA PROCESS SAFETY (29CFR1910.119):	N
CALIFORNIA PROPOSITION 65:	Y

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	Y
FIRE HAZARD:	Y
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16

OTHER

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DHS05430

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

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11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7440-50-8
RTECS NUMBER: GL5325000

SUBSTANCE: COPPER

TRADE NAMES/SYNONYMS:

ALLBRI NATURAL COPPER; C.I. PIGMENT METAL 2; COPPER DUST; COPPER FUME;
COPPER-AIRBORNE; COPPER-BRONZE; COPPER-MILLED; COPPER SLAG-AIRBORNE;
COPPER SLAG-MILLED; GOLD BRONZE;
ELECTROLYTIC TOUGH PITCH (EASTERN ROLLING MILLS, INC.); C.I. 77400;
METAL WROUGHT PRODUCTS (WELDALOY PRODUCTS COMPANY); CU; DHS05430

CHEMICAL FAMILY:

Metal

CREATION DATE: 12/03/84

REVISION DATE: 12/23/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : COPPER
CAS NUMBER: 7440-50-8
PERCENTAGE: 100

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:

Reddish, ductile, malleable, lustrous metal or cubic crystals.

Causes respiratory tract and eye irritation. May be irritating to skin. May cause adverse reproductive effects. May form flammable or explosive dust-air mixtures.

Avoid breathing dust. Avoid contact with eyes, skin and clothing. Keep container tightly closed. Avoid creation of dust. Wash thoroughly after handling. Use only with adequate ventilation.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include sores and perforation of the nose, coughing, head cold, foul taste, chills, fever, nausea and weakness.

LONG TERM EFFECTS: May cause runny nose, discoloration of the skin and metallic taste.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: May cause discoloration of the skin.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include tearing and blurred vision.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May cause weight loss, nausea, vomiting, diarrhea, headache and weakness.

LONG TERM EFFECTS: May cause reproductive effects.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID: IF PERSON IS CONSCIOUS, GIVE LARGE AMOUNTS OF WATER IMMEDIATELY. Remove by emesis or gastric lavage. Do not make an unconscious person vomit or drink anything. Give activated charcoal. Give oxygen if respiration is depressed. Maintain airway and blood pressure. Get medical attention. (Dreisbach, Handbook of Poisoning, 11th Ed.) Lavage or oxygen must be administered by qualified medical personnel.

NOTE TO PHYSICIAN

ANTIDOTE:

The following antidote has been recommended. However, the decision as to whether the severity of poisoning requires administration of any antidote and

actual dose required should be made by qualified medical personnel.

COPPER POISONING:

Give calcium disodium edetate 15-25 mg/kg (0.08-0.125 mL of 20% solution per kilogram body weight) in 250-500 mL of 5% dextrose intravenously over a 1 1/2 hour period twice daily. The maximum dose should not exceed 50 mg/kg/day. The drug should be given in 5-day courses with a rest period of at least 2 days between courses. After the first course, subsequent courses should not exceed 50 mg/kg/day. Daily urinalyses should not be done during the treatment period. The dosage should be reduced if any unusual urinary findings appear. Intravenous administration is contraindicated in the presence of elevated cerebrospinal fluid pressure. Penicillamine is also effective in copper poisoning. Give up to 100 mg/kg/day (maximum 1 g/day) divided into 4 doses for no longer than 1 week. If a longer administration period is warranted, dosage should not exceed 40 mg/kg/day. Give the drug orally, half an hour before meals (Dreisbach, Handbook of Poisoning, 12th Ed.). Antidote should be administered by qualified medical personnel.

SECTION 5

FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFPA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT F 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

FLASH POINT: flammable (dust)

AUTOIGNITION: 1292 F (700 C)

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may release toxic and/or hazardous gases.

SECTION 6

ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL:

Shut off ignition sources. Do not touch spilled material. For small spills with clean shovel, place material into clean, dry container and cover; move containers from spill area. For larger spills, wet down with water and dike

for later disposal. No smoking, flames or flares in hazard area. Keep unnecessary people away. Isolate hazard area and deny entry.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

Reportable Quantity (RQ): 5000 pounds

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

SOIL SPILL:

Dig holding area such as lagoon, pond or pit for containment.

Use cement powder or fly ash to absorb liquid mass.

Use protective cover such as a plastic sheet to prevent material from dissolving in fire extinguishing water or rain.

WATER SPILL:

Use activated carbon to absorb spilled substance that is dissolved.

Use suction hoses to remove trapped spill material.

Use mechanical dredges or lifts to extract immobilized masses of pollution and precipitates.

SECTION 7

HANDLING AND STORAGE

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8

EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

COPPER AND COMPOUNDS (AS CU):

0.1 mg/m³ OSHA TWA (fume); 1 mg/m³ OSHA TWA (dust and mist)

0.2 mg/m³ ACGIH TWA (fume); 1 mg/m³ ACGIH TWA (dust and mist)

0.1 mg/m³ NIOSH recommended TWA (fume);

1 mg/m³ NIOSH recommended TWA (dust and mist)

0.1 mg/m³ DFG MAK TWA (fume) (fine dust);

0.2 mg/m³ DFG MAK 30 minute peak, average value, 4 times/shift (fume)

1 mg/m³ DFG MAK TWA (dust and mist) (total dust);

2 mg/m³ DFG MAK 30 minute peak, average value, 4 times/shift (dust and mist)

Measurement method: Particulate filter; acid; atomic absorption spectrometry; (NIOSH Vol. III # 7029).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

COPPER:

5000 pounds CERCLA Section 103 Reportable Quantity

VENTILATION:

Provide local exhaust ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentrations of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

COPPER (AS CU):

For fume:

1 mg/m³- Any dust, mist, and fume respirator.
Any supplied-air respirator.
Any self-contained breathing apparatus.

2.5 mg/m³- Any powered air-purifying respirator with a dust, mist, and fume filter.
Any supplied-air respirator operated in a continuous flow mode.

5 mg/m³- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.
Any powered air-purifying respirator with a tight-fitting facepiece and a high efficiency particulate filter.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.

Any supplied-air respirator with a tight-fitting facepiece operated in a continuous flow mode.

200 mg/m³- Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.

Escape- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.

Any appropriate escape-type, self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Reddish, ductile, malleable, lustrous metal or cubic crystals.
 MOLECULAR WEIGHT: 63.5
 MOLECULAR FORMULA: CU
 BOILING POINT: 4653 F (2567 C)
 MELTING POINT: 1946 F (1083 C)
 VAPOR PRESSURE: 1 mmHg @ 1628 C
 SPECIFIC GRAVITY: 8.92
 WATER SOLUBILITY: insoluble
 SOLVENT SOLUBILITY: Soluble in nitric acid, sulfuric acid (hot), hydrogen bromide (hot); slightly soluble in hydrochloric acid, ammonium hydroxide

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

Avoid dispersion of dust in air. Finely divided particles, dust, or fumes may be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:

COPPER:

ACETYLENE: Forms explosive copper acetylide.

ACETYLENIC COMPOUNDS: Formation of explosive acetylides.

ALUMINUM + SULFUR: Possible explosion.

AMMONIUM NITRATE: Violent or explosive reaction.

BARIUM BROMATE: Explosive reaction by heat, impact or friction.

BARIUM CHLORATE: Explosive reaction by heat, impact or friction.

BARIUM IODATE: Explosive reaction by heat, impact or friction.

1-BROMO-2-PROPENE: Formation of explosive compound.
CALCIUM BROMATE: Explosive reaction by heat, impact or friction.
CALCIUM CHLORATE: Explosive reaction by heat, impact or friction.
CALCIUM IODATE: Explosive reaction by heat, impact or friction.
CHLORATES: Explosive reaction.
CHLORINE: Ignition reaction.
CHLORINE + OXYGEN DIFLUORIDE: Explosive reaction at -10 C.
CHLORINE TRIFLUORIDE: Intense reaction with possible ignition.
DIMETHYL SULFOXIDE + TRICHLOROACETIC ACID: Possible explosion.
ETHYLENE OXIDE: Possible explosion.
FLUORINE: Ignition reaction.
HYDRAZINIUM NITRATE: Ignition reaction.
HYDRAZOIC ACID: Possible explosion.
HYDROGEN PEROXIDE: Violent decomposition.
HYDROGEN SULFIDE: Intense exothermic reaction with possible ignition.
LEAD AZIDE: Forms explosive copper azide.
MAGNESIUM BROMATE: Explosive reaction by heat, impact or friction.
MAGNESIUM CHLORATE: Explosive reaction by heat, impact or friction.
MAGNESIUM IODATE: Explosive reaction by heat, impact or friction.
PHOSPHORUS: Incandescent reaction.
POTASSIUM BROMATE: Explosive reaction by heat, impact or friction.
POTASSIUM CHLORATE: Explosive reaction by heat, impact or friction.
POTASSIUM DIOXIDE: Incandescent reaction.
POTASSIUM IODATE: Explosive reaction by heat, impact or friction.
SODIUM AZIDE: Forms explosive compound.
SODIUM BROMATE: Explosive reaction by heat, impact or friction.
SODIUM CHLORATE: Explosive reaction by heat, impact or friction.
SODIUM IODATE: Explosive reaction by heat, impact or friction.
SODIUM PEROXIDE: Incandescent reaction.
SULFUR + CHLORATES: Spontaneous explosion.
SULFURIC ACID: Intense reaction.
ZINC BROMATE: Explosive reaction by heat, impact or friction.
ZINC CHLORATE: Explosive reaction by heat, impact or friction.
ZINC IODATE: Explosive reaction by heat, impact or friction.

HAZARDOUS DECOMPOSITION:

Thermal decomposition may release toxic and/or hazardous gases.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11**TOXICOLOGY INFORMATION**

COPPER:

TOXICITY DATA: 120 ug/kg oral-human TDLo; 3500 ug/kg intraperitoneal-mouse LD50; reproductive effects data (RTECS); tumorigenic data (RTECS).

CARCINOGEN STATUS: None.

LOCAL EFFECTS: Irritant- inhalation, eye.

ACUTE TOXICITY LEVEL: Insufficient data.

TARGET EFFECTS: Poisoning may affect the liver and kidneys.

AT INCREASED RISK FROM EXPOSURE: Persons with pre-existing respiratory, liver, kidney, skin, and blood disorders or Wilson's disease.

HEALTH EFFECTS

INHALATION:

COPPER:

IRRITANT.

ACUTE EXPOSURE- Powdered dust may cause irritation of the upper respiratory tract and ulceration and perforation of the nasal septum. A feeling of illness similar to the common cold has been reported with symptoms of chills and stuffiness of the head. Workers exposed to copper dust in concentrations of 0.075 to 0.120 mg/m³ complained of mild nasal discomfort. Exposure to copper fume may cause irritation to the mucous membranes. Freshly formed copper fumes may cause metal fume fever. Symptoms may include a sweet, metallic, or foul taste in the mouth, dry throat, coughing, fever, chills, muscle aches, weakness, lassitude, nausea, rarely vomiting, mild to severe headaches, and sometimes exaggerated mental activity. Workers exposed to concentrations of 1 to 3 mg/m³ experienced an altered taste response but no nausea.

CHRONIC EXPOSURE- Prolonged industrial exposure may cause a green discoloration of the skin, hair and teeth. Welders exposed to copper fume experienced atrophic rhinitis, metallic taste, runny nose, and mucosal irritation of the mouth and eyes. Exposure in animals has caused destruction of red blood cells and lung cell injury. It is inconclusive as to whether prolonged exposure has any effect on the nervous system. A small number of studies suggest an affinity of copper for the sympathetic system, however, there is no proof that chronic poisoning will affect either the central or peripheral nervous system.

SKIN CONTACT:

COPPER:

ACUTE EXPOSURE- May be irritating and cause keratinization. Allergic dermatitis although rare, has been reported. Dermal absorption is negligible through intact skin.

CHRONIC EXPOSURE- Repeated or prolonged contact may cause irritation and discoloration of the skin.

EYE CONTACT:

COPPER:

IRRITANT.

ACUTE EXPOSURE- The dust may cause irritation with redness and pain, tearing, and blurred vision. Copper particles in the eye may result in a foreign body response with characteristic discoloration of ocular tissue degeneration and/or detachment of the retina, and atrophy of the globe.

CHRONIC EXPOSURE- Repeated or prolonged exposure to irritants may cause conjunctivitis.

INGESTION:

COPPER:

ACUTE EXPOSURE- May cause headache, weakness, diarrhea, or weight loss. 120 ug/kg ingested by a human caused gastrointestinal disorder with nausea and vomiting.

CHRONIC EXPOSURE- Copper is an essential element and is found in most human diets in minute amounts. Prolonged ingestion through the diet is not known to cause toxic effects except in people with a recessive gene disorder termed Wilson's disease which causes an abnormally high absorption.

retention, and storage of copper by the body. This disease may cause a dysfunction of and structural damage to the liver, central nervous system, kidney, bones and eyes. The disease is usually progressive and may be fatal if left untreated. Reproductive effects have been reported in animals.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

SECTION 14

TRANSPORTATION INFORMATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 172.101:

*Flammable solid

Department of Transportation labeling requirements 49-CFR 172.101 and SUBPART E:

*Flammable solid

*Hazard classification and label apply to dust and powder form only.

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49-CFR 173.154

EXCEPTIONS: 49-CFR 173.153

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	Y	5000 pounds R0
SARA SECTION 302 (40CFR355.30):	N	
SARA SECTION 304 (40CFR355.40):	N	
SARA SECTION 313 (40CFR372.65):	Y	
OSHA PROCESS SAFETY (29CFR1910.119):	N	
CALIFORNIA PROPOSITION 65:	N	

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD: Y

CHRONIC HAZARD:	N
FIRE HAZARD:	Y
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16

OTHER

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OHS11490

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

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1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7439-89-6
RTECS NUMBER: NO4565500

SUBSTANCE: IRON

TRADE NAMES/SYNONYMS:

FERRIUM; IRON DUST; ARMCO IRON; LOHA; CARBONYL IRON;
I-60, I-61, I-62, I-185, I-57; FE: IRON MICROPOWDER GRADE 9 SERIES; OHS11490

CHEMICAL FAMILY:

Metal

CREATION DATE: 12/11/84

REVISION DATE: 01/15/94

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : IRON
CAS NUMBER: 7439-89-6
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:

Silver-white or gray, soft, malleable metal.

May be irritating to skin and eyes. May damage the lungs. Flammable solid.
May form flammable or explosive dust-air mixtures.

Keep away from all ignition sources. Avoid breathing dust. Avoid contact
with eyes, skin and clothing. Keep container tightly closed. Avoid creation
of dust. Wash thoroughly after handling. Use only with adequate ventilation.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause coughing, sweating, metallic taste, thirst,
chills, fever, nausea, vomiting, diarrhea, frequent urination, headache,
weakness and muscle pain.

LONG TERM EFFECTS: May cause difficulty breathing and lung damage.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: No information is available.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include glaucoma.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May cause vomiting, diarrhea and shock.

LONG TERM EFFECTS: No information available on significant adverse effects.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4**FIRST AID MEASURES**

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN**ANTIDOTE:**

No specific antidote. Treat symptomatically and supportively.

SECTION 5**FIRE FIGHTING MEASURES**

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate

metal-extinguishing powder. Do not apply water to burning material (NFPA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products may include toxic oxides of iron and iron fumes.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

For large spills, sweep up with a minimum of dusting and place into suitable clean, dry containers for reclamation or later disposal.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**

EXPOSURE LIMITS:

IRON OXIDE DUST AND FUME (AS FE):

10 mg/m³ OSHA TWA (total particulate)

5 mg/m³ ACGIH TWA

5 mg/m³ NIOSH recommended TWA (total particulate)

6 mg/m³ DFG MAK TWA (fine dust)

Measurement method: Particulate filter; X-ray fluorescence spectrometry; (NIOSH Vol. III # 7200, Welding and Brazing Fume).

VENTILATION:

Provide local exhaust ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentrations of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators are recommended based on information found in the physical data, toxicity and health effects sections. They are ranked in order from minimum to maximum respiratory protection.

The specific respirator selected must be based on contamination levels found in the work place, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

Any dust, mist, and fume respirator.

Any chemical cartridge respirator with a dust, mist, and fume filter.

Any powered air-purifying respirator with a dust, mist, and fume filter.

Any type 'C' supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece helmet or hood operated in continuous-flow mode.

Any self-contained breathing apparatus with a full face piece operated in pressure-demand or other positive pressure mode.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Silver-white or gray, soft, malleable metal.
MOLECULAR WEIGHT: 55.85

MOLECULAR FORMULA: FE
 BOILING POINT: 4982 F (2750 C)
 MELTING POINT: 2795 F (1535 C)
 VAPOR PRESSURE: 1 mmHg @ 1787 C
 SPECIFIC GRAVITY: 7.86
 WATER SOLUBILITY: insoluble
 SOLVENT SOLUBILITY: Soluble in acids; insoluble in alkalies, alcohol, ether.

BRINELL HARDNESS: 60
 AUTOIGNITION TEMPERATURE: 428-968 F (220-520 C) (laver)
 878-1436 F (470-780 C) (cloud)

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY:
 Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:
 Avoid dispersion of dust in air. Finely divided particles, dust, or fumes may be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:

IRON:

- ACETALDEHYDE: Polymerizes readily.
- AMMONIUM NITRATE: Violent or explosive reaction.
- AMMONIUM PEROXODISULFATE: Violent reaction.
- BROMINE PENTAFLUORIDE: Violent reaction and possible ignition.
- CHLORIC ACID: Forms explosive compound.
- CHLORINE (GAS): Ignites.
- CHLORINE TRIFLUORIDE: Violent reaction and possible ignition.
- CHLOROFORMAMIDIUM NITRATE: Explosive ignition.
- DINITROGEN TETRAOXIDE: Ignites.
- FLUORINE: Ignites.
- HYDROGEN PEROXIDE: Violent decomposition.
- NITROGEN DIOXIDE: Incandescent reaction.
- NITRYL FLUORIDE: Incandesces when heated.
- PHOSPHORUS: Incandesces when heated.
- POLYSTYRENE BEADS: Possible static ignition.
- POTASSIUM DICHROMATE: Ignites on contact.
- POTASSIUM PERCHLORATE + MANGANESE DIOXIDE: Ignites.
- SODIUM ACETYLIDE: Possible violent reaction.
- SODIUM PEROXIDE: Ignites under friction @ 240 C.
- SULFURIC ACID: Possible explosion hazard.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products may include toxic oxides of iron and iron fumes.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

IRON:

TOXICITY DATA: 77 mg/kg oral-child TDLo; 30 gm/kg oral-rat LD50; 20 gm/kg oral-guinea pig LD50; 20 mg/kg intraperitoneal-rabbit LDLo; tumorigenic data (RTECS).

CARCINOGEN STATUS: None. Iron and steel founding: Human Sufficient Evidence (IARC Group-1). The consistency of the excess in studies from around the world shows that certain exposures in iron and steel founding can cause lung cancer in humans. Other cancer excesses reported have included leukemia, all urogenital and digestive system cancers.

ACUTE TOXICITY LEVEL: Relatively non-toxic by ingestion.

TARGET EFFECTS: Poisoning may affect the gastrointestinal, respiratory, nervous and hematopoietic systems and the liver.

HEALTH EFFECTS

INHALATION:

IRON:

ACUTE EXPOSURE- Dust may cause mucous membrane and respiratory irritation due to mechanical action. Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed iron oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes. Lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

CHRONIC EXPOSURE- Prolonged or repeated exposure may cause a mottling of the lungs, a condition called siderosis which is considered to be a benign pneumoconiosis that does not cause significant physiologic impairment. Symptoms may include chronic bronchitis, emphysema, and dyspnea on exertion.

SKIN CONTACT:

IRON:

ACUTE EXPOSURE- Dust may cause irritation. Penetration of iron particles into the skin may cause an exogenous siderosis which may be characterized by a red-brown pigmentation of the affected area.

CHRONIC EXPOSURE- No data available.

EYE CONTACT:

IRON:

ACUTE EXPOSURE- May cause irritation due to mechanical action. Iron particles imbedded in the eye may cause ocular siderosis. Effects may include discoloration of the cornea and iris, and pupillary effects including poor reaction to light, accommodation, and atropine. If a particle enters the lens there may be cataract formation. Glaucoma occurs rarely in some cases of ocular siderosis.

CHRONIC EXPOSURE- Repeated and prolonged contact may cause conjunctivitis.

INGESTION:

IRON:

ACUTE EXPOSURE- There are no reports available on poisoning from metallic iron. The principal manifestations of poisoning with iron compounds are vomiting, diarrhea, and circulatory collapse.

CHRONIC EXPOSURE- Repeated or prolonged exposure may cause hemosiderosis or hemochromatosis.

SECTION 12ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

SECTION 14

TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Metal powders, flammable, n.o.s. (iron)-UN 3089

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
4.1 - Flammable solid

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101
AND SUBPART E:
Flammable solid

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.151
NON-BULK PACKAGING: 49 CFR 173.212
BULK PACKAGING: 49 CFR 173.240

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 15 kg
CARGO AIRCRAFT ONLY: 50 kg

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

DERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): N
OSHA PROCESS SAFETY (29CFR1910.119): N
CALIFORNIA PROPOSITION 65: N

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD: N
CHRONIC HAZARD: N
FIRE HAZARD: Y
REACTIVITY HAZARD: N
SUDDEN RELEASE HAZARD: N

SECTION 16

OTHER

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OHS12510

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

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1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7439-92-1
RTECS NUMBER: OF7525000

SUBSTANCE: LEAD

TRADE NAMES/SYNONYMS:

C.I. PIGMENT METAL 4; C.I. 77575; LEAD FLAKE; K5-4; LEAD S 2; SI; SO;
PLUMBUM; SO; PB-S 100; LEAD ELEMENT; L-18; L-24; L-29; L-27; T-134;
40BP, 80BP, 100BP, 200BP, FP, SFP (SCM METAL PRODUCTS INC); LEAD GRANULES;
PB: OHS12510

CHEMICAL FAMILY:

Metal

CREATION DATE: 12/10/84

REVISION DATE: 09/10/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : LEAD
CAS NUMBER: 7439-92-1
PERCENTAGE: 99.8

OTHER CONTAMINANTS: BISMUTH, COPPER, ARSENIC, ANTIMONY, TIN, IRON,
SILVER, ZINC

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0

EMERGENCY OVERVIEW:

Bluish-white, silvery gray, heavy, malleable metal

Suspect cancer hazard (contains material which can cause cancer in animals).
Risk of cancer depends on duration and level of contact. May cause birth
defects in humans. May be irritating to skin and eyes. May cause blood
disorders. May cause convulsions. May damage kidneys. May damage nerves. May
affect the central nervous system. May cause visual disturbances. May form
flammable or explosive dust-air mixtures.

Avoid breathing dust, Avoid contact with eyes, skin and clothing. Keep
container tightly closed. Avoid creation of dust. Wash thoroughly after
handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause coughing, sweating, metallic taste, thirst, chills, fever, yellowing of the skin and eyes, drooling, vomiting, digestive disorders, blood in the urine, blood in the stool, frequent urination, headache, weakness, disorientation, restlessness, sleeplessness, tingling sensation, muscle pain, loss of memory, kidney damage, nerve damage, paralysis, effects on the brain, convulsions and shock. May also cause reproductive effects.

LONG TERM EFFECTS: In addition to effects from short term exposure, black lines on the gums, lack of appetite, weight loss, high blood pressure, anemia, incoordination, nervousness, twitching, visual disturbances, impotence, sterility, unconsciousness and coma may occur. May also cause reproductive effects.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: May cause effects as reported in short term inhalation. Additional effects may include kidney damage and nerve damage. May also cause reproductive effects.

LONG TERM EFFECTS: No information available on significant adverse effects.

ADDITIONAL DATA: May cause cancer.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: Y

SECTION 4FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Do not induce vomiting. Qualified medical personnel should remove chemical by gastric lavage or catharsis. Activated charcoal is useful. Get medical attention immediately.

NOTE TO PHYSICIAN

ANTIDOTE:

The following antidote has been recommended. However, the decision as to whether the severity of poisoning requires administration of any antidote and actual dose required should be made by qualified medical personnel.

FOR LEAD POISONING:

Initiate urine flow first. Give 10% dextrose in water intravenously, 10-20 mL/kg body weight, over a period of 1-2 hours. If urine flow does not start, give mannitol, 20% solution, 5-10 mL/kg body weight intravenously over 20 minutes. Fluid must be limited to requirements and catheterization may be necessary in coma. Daily urine output should be 350-500 mL/m²/24 hours. Excessive fluids further increase cerebral edema.

For adults with acute encephalopathy, give dimercaprol, 4 mg/kg, intramuscularly every 4 hours for 30 doses. Beginning 4 hours later, give calcium disodium edetate at a separate injection site, 12.5 mg/kg intramuscularly every 4 hours as a 20% solution, with 0.5% procaine added, for a total of 30 doses. If significant improvement has not occurred by the fourth day, increase the number of injections by 10 for each drug.

For symptomatic adults, the course of dimercaprol and calcium disodium edetate can be shortened or calcium disodium edetate only can be given in a dosage of 50 mg/kg intravenously as 0.5% solution in 5% dextrose in water or normal saline by infusion over not less than 8 hours for not more than 5 days. Follow with penicillamine, 500-750 mg/day, orally for 1-2 months or until urine lead levels drops below 0.3 mg/24 hours (Dreisbach, Handbook of Poisoning, 12th Ed.). Antidote should be administered by qualified medical personnel.

SECTION 5

FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Not a fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

EXTINGUISHING MEDIA:

Dry chemical, carbon dioxide, water spray or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

For larger fires, use water spray, fog or regular foam (1990 Emergency Response Guidebook, DOT P 5800.5).

FIRE FIGHTING:

Move container from fire area if you can do it without risk (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 53).

Extinguish using agent suitable for type of surrounding fire. Avoid breathing vapors and dusts. Keep upwind.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products are toxic oxides of lead.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

Do not touch spilled material. Stop leak if you can do it without risk. For small spills, take up with sand or other absorbent material and place into containers for later disposal. For small dry spills, with a clean shovel place material into clean, dry container and cover. Move containers from spill area. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard area and deny entry.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

Reportable Quantity (RQ): 1 pound

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

WATER SPILL:

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**

EXPOSURE LIMITS:**LEAD, INORGANIC FUMES AND DUST (AS PB):**

50 $\mu\text{g}/\text{m}^3$ OSHA 8 hour TWA

30 $\mu\text{g}/\text{m}^3$ OSHA 8 hour TWA action level

If an employee is exposed to lead for more than 8 hours per day the following formula is used:

Maximum permissible limit (in $\mu\text{g}/\text{m}^3$) = 400 divided by hours worked in the day

0.15 mg/m^3 ACGIH TWA

(Notice of Intended Changes 1993-94)

<0.10 mg/m^3 NIOSH recommended 10 hour TWA

0.1 mg/m^3 DFG MAK TWA:

1.0 mg/m^3 DFG MAK 30 minute peak, average value, 1 time/shift

MEASUREMENT METHOD: Particulate filter; nitric acid/hydrogen peroxide:

atomic absorption spectrometry: (NIOSH Vol. III # 7082).

1 pound CERCLA Section 103 Reportable Quantity
 Subject to SARA Section 313 Annual Toxic Chemical Release Reporting
 Subject to California Proposition 65 cancer and/or reproductive toxicity
 warning and release requirements- (February 27, 1987)

VENTILATION:

Provide local exhaust ventilation system to meet published exposure limits.

Lead (elemental, inorganic, and soaps):

Ventilation should meet the requirements in 29 CFR 1910.1025(e).

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

LEAD (ELEMENTAL, INORGANIC, AND SOAPS):

Protective eye equipment should meet the requirements for protective work clothing and equipment in 29 CFR 1910.1025(g).

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

LEAD (ELEMENTAL, INORGANIC, AND SOAPS):

Protective clothing should meet the requirements for protective work clothing and equipment in 29 CFR 1910.1025(g).

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

LEAD (ELEMENTAL, INORGANIC & SOAPS):

Protective gloves should meet the requirements for protective work clothing and equipment in 29 CFR 1910.1025(g).

RESPIRATOR:

The following respirators are the minimum legal requirements as set forth by the Occupational Safety and Health Administration found in 29 CFR 1910. Subpart Z.

RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne concentration of lead or condition of use

Required respirator

Not in excess of 0.5 mg/m³ (10x PEL)

Half-mask, air purifying respirator equipped with high-efficiency filters.

Not in excess of 2.5 mc/m³ (50x PEL)

Full facepiece, air-purifying respirator with high efficiency filters.

Not in excess of 50 mg/m³ (1000x PEL)

Any powered air-purifying respirator with high efficiency filters:

or

Half-mask supplied-air respirator operated in positive-pressure mode.

Not in excess of 100 mc/m³

Supplied-air respirators with full facepiece, hood or helmet or suit, operated in positive pressure mode.

Greater than 100 mc/m³, unknown concentrations or firefighting.

Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.

(Respirators specified for higher concentrations can be used at lower concentrations of lead).

(Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.)

(A high efficiency particulate filter means 99.97% efficient against 0.3 micron particles.)

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH pocket guide to chemical hazards or NIOSH criteria documents.

The specific respirator selected must be based on contamination levels found in the work place and be jointly approved by the National Institute of Occupational Safety and Health and the Mine Safety and Health Administration.

LEAD, INORGANIC FUMES AND DUSTS (AS PB):

0.50 mg(Pb)/m³- Any supplied-air respirator.

Any air-purifying respirator with a high-efficiency particulate filter.

Any self-contained breathing apparatus.

1.25 mg(Pb)/m³- Any powered air-purifying respirator with a high-efficiency particulate filter.

Any supplied-air respirator operated in a continuous flow mode.

2.50 mc(Pb)/m³- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.

Any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.

Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

Any supplied-air respirator with a tight-fitting facepiece operated in a continuous flow mode.

50.0 mg(Pb)/m³- Any supplied-air respirator operated in a pressure-demand or other positive pressure mode.

100.0 mg(Pb)/m³- Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.

Escape- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.

Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Bluish-white, silvery gray, heavy, malleable metal
MOLECULAR WEIGHT: 207.19
MOLECULAR FORMULA: Pb
BOILING POINT: 3164 F (1740 C)
MELTING POINT: 622 F (328 C)
VAPOR PRESSURE: 1.3 mmHg @ 970 C
SPECIFIC GRAVITY: 11.3
WATER SOLUBILITY: insoluble
SOLVENT SOLUBILITY: Soluble in nitric acid, hot concentrated sulfuric acid
HARDNESS (MOHS): 1.5

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

May burn but does not ignite readily. Prevent dispersion of dust in air. Do not allow spilled material to contaminate water sources.

INCOMPATIBILITIES:

LEAD:

AMMONIUM NITRATE: Violent or explosive reaction.

CHLORINE TRIFLUORIDE: Violent reaction.

DISODIUM ACETYLIDE: Trituration in mortar may be violent and liberate carbon.
HYDROGEN PEROXIDE (52% OR GREATER): Violent decomposition.
HYDROGEN PEROXIDE (60% SOLUTION) AND TRIOXANE: Spontaneously detonable.
METALS (ACTIVE): Incompatible.
NITRIC ACID: Lead-containing rubber may ionite.
OXIDIZERS (STRONG): Incompatible.
SODIUM AZIDE: Forms lead azide and copper azide in copper pipe.
SODIUM CARBIDE: Vigorous reaction.
SULFURIC ACID (HOT): Reacts.
ZIRCONIUM-LEAD ALLOYS: Ignition on impact.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products are toxic oxides of lead.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11**TOXICOLOGY INFORMATION**

LEAD:

TOXICITY DATA: 10 ug/m³ inhalation-human TCl₀₁: 450 mg/kg/6 years oral-woman TDLo: 1000 mg/kg intraperitoneal-rat LDLo: mutagenic data (RTECS); reproductive effects data (RTECS).

CARCINOGEN STATUS: Human Inadequate Evidence. Animal Sufficient Evidence (IARC Group-2B for inorganic lead compounds). Renal tumors were produced in animals by lead acetate, subacetate and phosphate given orally, subcutaneously or intraperitoneally. No evaluation could be made of the carcinogenicity of powdered lead.

ACUTE TOXICITY LEVEL: Insufficient data.

TARGET EFFECTS: Neurotoxin; nephrotoxin; teratogen. Poisoning may also affect the blood, heart, and the endocrine and immune systems.

AT INCREASED RISK FROM EXPOSURE: Persons with nervous system or gastrointestinal disorders, anemia, or chronic bronchitis.

ADDITIONAL DATA: May cross the placenta. Smoking may result in high blood lead levels.

HEALTH EFFECTS**INHALATION:****LEAD:**

See information on lead compounds and metal fume fever.

LEAD COMPOUNDS:**NEUROTOXIN/NEPHROTOXIN/TERATOGEN:**

ACUTE EXPOSURE- Absorption of large amounts of lead may cause a metallic taste, thirst, a burning sensation in the mouth and throat, salivation, abdominal pain with severe colic, vomiting, diarrhea of black or bloody stools, constipation, fatigue, sleep disturbances, dullness, restlessness, irritability, memory loss, loss of concentration, delirium, oliguria often with hematuria and albuminuria, encephalopathy with visual failure, paresthesias, muscle pain and weakness, convulsions, and paralysis. Death may result from cardiorespiratory arrest or shock. Survivors of acute

exposure may experience the onset of chronic intoxication. Liver effects may include enlargement and tenderness, and jaundice. The fatal dose of absorbed lead is approximately 0.5 grams. Pathological findings include gastrointestinal inflammation and renal tubular degeneration.

CHRONIC EXPOSURE- Prolonged or repeated exposure to low levels of lead may result in an accumulation in body tissues and exert adverse effects on the blood, nervous systems, heart, endocrine and immune systems, kidneys, and reproduction. Early stages of lead poisoning, "plumbism", may be evidenced by anorexia, weight loss, constipation, apathy or irritability, occasional vomiting, fatigue, headache, weakness, metallic taste in the mouth, gingival lead line in persons with poor dental hygiene, and anemia. Loss of recently developed motor skills is generally observed only in children. More advanced stages of poisoning may be characterized by intermittent vomiting, irritability and nervousness, myalgia of the arms, legs, joints and abdomen, paralysis of the extensor muscles of the arms and legs with wrist and/or foot drop. Severe "plumbism" may result in persistent vomiting, ataxia, periods of stupor or lethargy, encephalopathy with visual disturbances which may progress to optic neuritis and atrophy, hypertension, papilledema, cranial nerve paralysis, delirium, convulsions, and coma. Neurologic sequelae may include mental retardation, seizures, cerebral palsy, and dystonia musculorum deformans. Irreversible kidney damage has been associated with industrial exposure. Reproductive effects have been exhibited in both males and females. Paternal effects may include decreased sex drive, impotence, sterility and adverse effects on the sperm which may increase the risk of birth defects. Maternal effects may include miscarriage and stillbirths in exposed women or women whose husbands were exposed, abortion, sterility or decreased fertility, and abnormal menstrual cycles. Lead crosses the placenta and may affect the fetus causing birth defects, mental retardation, behavioral disorders, and death during the first year of childhood. Animal studies indicate that reproductive effects may be additive if both parents are exposed to lead.

METAL FUME FEVER:

ACUTE EXPOSURE- Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

CHRONIC EXPOSURE- There is no form of chronic metal fume fever, however, repeated bouts with symptoms as described above are quite common. Resistance to the condition develops after a few days of exposure, but is quickly lost in 1 or 2 days.

SKIN CONTACT:

LEAD:

See information on lead compounds.

LEAD COMPOUNDS:

ACUTE EXPOSURE- Contact with lead powders or dust may be irritating. Lead is not absorbed through the skin, but may be transferred to the mouth inadvertently by cigarettes, chewing tobacco, food, or make-up.

CHRONIC EXPOSURE- Prolonged or repeated exposure to the powder or dust may result in dermatitis. Systemic toxicity may develop if lead is transferred to the mouth by cigarettes, chewing tobacco, food, or make-up.

EYE CONTACT:

LEAD:

See information on lead compounds.

LEAD COMPOUNDS:

ACUTE EXPOSURE- Lead dust or powders may be irritating. Metallic lead particles may cause an inflammatory foreign body reaction and injury is generally thought to be mechanical and not toxic.

CHRONIC EXPOSURE- Prolonged exposure may cause conjunctivitis.

INGESTION:

LEAD:

See information on lead compounds.

LEAD COMPOUNDS:

NEUROTOXIN/NEPHROTOXIN/TERATOGEN.

ACUTE EXPOSURE- Absorption of large amounts of lead from the intestinal tract may cause all the same effects as detailed in acute inhalation. The fatal dose of absorbed lead is approximately 0.5 grams.

CHRONIC EXPOSURE- Prolonged or repeated exposure to low levels of lead may result in an accumulation in body tissues and adverse effects on the kidneys, heart and blood and on the nervous, reproductive, endocrine and immune systems as detailed in chronic inhalation.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

Lead - Regulatory level: 5.0 mg/l (TCLP-40 CFR 261 Appendix II)
materials which contain the above substance at or above the TCLP regulatory level meet the EPA toxicity characteristic, and must be disposed of in

accordance with 40 CFR part 262. EPA Hazardous Waste Number D008.

SECTION 14 TRANSPORTATION INFORMATION

No classification currently assigned

SECTION 15 REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	Y	1 pound RQ
SARA SECTION 302 (40CFR355.30):	N	
SARA SECTION 304 (40CFR355.40):	N	
SARA SECTION 313 (40CFR372.65):	Y	
OSHA PROCESS SAFETY (29CFR1910.119):	N	
CALIFORNIA PROPOSITION 65:	Y	

SARA HAZARD CATEGORIES. SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	Y
FIRE HAZARD:	N
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16 OTHER

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MAGNESIUM

MGX

Common Synonyms	Solid	Silvery	Odorless
Sinks in water.			
Call fire department. Stop discharge if possible. Keep people away. Isolate and remove discharged material. Notify local health and pollution control agencies.			
Fire	<p>FLAMMABLE. Extinguish with dry graphite, soda ash, or other inert powder. DO NOT USE WATER, FOAM, CARBON DIOXIDE, DRY CHEMICALS, OR VAPORIZING LIQUID ON FIRE.</p>		
Exposure	<p>CALL FOR MEDICAL AID. SOLID Irritating to eyes. Harmful if swallowed. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>		
Water Pollution	<p>Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Should be removed Chemical and physical treatment</p>		<p>2. LABEL 2.1 Category: Flammable solid; dangerous when wet 2.2 Class: 4</p>	
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Not listed 3.2 Formula: Mg 3.3 IMO/UN Designation: Pellets, turnings, or ribbon; 4.1/1869; powder, non-pyronic; 4.3/1418 3.4 DOT ID No.: 1418 (powder), 1869 (pellets) 3.5 CAS Registry No.: 7430-95-4</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: Silvery; looks like aluminum 4.3 Odor: None</p>	
<p>5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Eye protection 5.2 Symptoms Following Exposure: Dust irritates eyes in same way as any foreign material. Penetration of skin by fragments of metal is likely to produce local irritation, blisters, and ulcers which may become infected. 5.3 Treatment of Exposure: EYES: flush with water to remove dust. SKIN: treat as any puncture. 5.4 Threshold Limit Value: Data not available 5.5 Short Term Inhalation Limits: Not pertinent 5.6 Toxicity by Ingestion: Oral LD₅₀ (lowest lethal dose) = 230 mg/kg (dog) 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Not pertinent 5.9 Liquid or Solid Irritant Characteristics: Data not available 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: Data not available</p>			

<p>6. FIRE HAZARDS 6.1 Flash Point: Not pertinent (solid). Flammable when in the form of turnings or powder. 6.2 Flammable Limits in Air: Not pertinent 6.3 Fire Extinguishing Agents: Inert dry powders (e.g., graphite, limestone, salt) 6.4 Fire Extinguishing Agents Not to be Used: Water, foam, halogenated agents, carbon dioxide. 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Forms dense white smoke. Flame is very bright. 6.7 Ignition Temperature: 883°F 6.8 Electrical Hazard: Class I, Group E 6.9 Burning Rate: Not pertinent 6.10 Adiabatic Flame Temperature: Data not available</p> <p style="text-align: right;">(Continued)</p>	<p>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) II</p> <p>11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable solid 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>0</td> </tr> <tr> <td>Flammability (Red)</td> <td>1</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>2</td> </tr> </tbody> </table>	Category	Classification	Health Hazard (Blue)	0	Flammability (Red)	1	Reactivity (Yellow)	2
Category	Classification								
Health Hazard (Blue)	0								
Flammability (Red)	1								
Reactivity (Yellow)	2								
<p>7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: In finely divided form, reacts with water and acids to release flammable hydrogen gas. 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available</p>	<p>12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 24.3 12.3 Boiling Point at 1 atm: 2,012°F = 1,100°C = 1,373°K 12.4 Freezing Point: 1,202°F = 650°C = 923°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.74 at 20°C (solid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: -11,950 Btu/lb = -6,650 cal/g = -278 X 10³ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 88.9 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>								
<p>8. WATER POLLUTION 8.1 Aquatic Toxicity: None 8.2 Waterfowl Toxicity: None 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: None</p>									
<p>9. SHIPPING INFORMATION 9.1 Grades of Purity: Pigs, ingots, turnings, sticks; all high purity. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester)</p>									
<p>6. FIRE HAZARDS (Continued) 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>									

OHS13590

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7439-96-5
RTECS NUMBER: 009275000

SUBSTANCE: MANGANESE

TRADE NAMES/SYNONYMS:

COLLOIDAL MANGANESE; MANGANESE ELEMENT; CUTAVAL; MANGANESE METAL; MN;
OHS13590

CHEMICAL FAMILY:

Metal

CREATION DATE: 06/27/85

REVISION DATE: 12/23/93

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : MANGANESE
CAS NUMBER: 7439-96-5
PERCENTAGE: 100.0

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=1 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=3 REACTIVITY=1

EMERGENCY OVERVIEW:

Reddish-gray or silver, brittle metallic solid.

May be irritating to the respiratory tract, skin and eyes. May cause blood disorders. May damage nerves. May affect the central nervous system. May cause adverse reproductive effects. May cause hearing loss. May affect the liver. May damage the lungs. May cause visual disturbances. May form flammable or explosive dust-air mixtures. May react with water.

Do not allow water to get in container. Avoid breathing dust. Avoid contact with eyes, skin and clothing. Keep container tightly closed. Avoid creation of dust. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include coughing, sweating, metallic taste, thirst, chills, fever, nausea, vomiting, diarrhea, frequent urination, headache, weakness, muscle pain and nerve damage.

LONG TERM EFFECTS: In addition to effects from short term exposure, drooling, lack of appetite, drowsiness, feeling of well-being, confusion, difficulty walking, restlessness, sleeplessness, twitching, hallucinations, mental disorders, hearing loss, visual disturbances, sexual excitement, impotence, lung damage, blood disorders and liver damage may occur.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: No information available on significant adverse effects

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: No information is available.

INGESTION:

SHORT TERM EFFECTS: May cause gastrointestinal irritation. Additional effects may include digestive disorders.

LONG TERM EFFECTS: No information available on significant adverse effects

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN

ANTIDOTE:

The following antidote has been recommended. However, the decision as to whether the severity of poisoning requires administration of any antidote an

actual dose required should be made by qualified medical personnel.

MANGANESE POISONING:

Calcium edetate is effective in removing manganese, but has no permanent effect on symptomatic patients in the late stages of manganism. The administration of calcium disodium edetate is recommended. Edetate is available as 5 mL ampules of 20% solution. Give 15-25 mg/kg (0.08-0.125 mL of 20% solution per kilogram body weight) in 250-500 mL of 5% dextrose intravenously over a 1 to 2 hour period twice daily. The maximum dose should not exceed 50 mg/kg/day. The drug should be given in 5-day courses with a rest period of at least 2 days between courses. After the first course, subsequent courses should not exceed 50 mg/kg/day. Daily urinalyses should be done during the treatment period. The dosage should be reduced if any unusual urinary findings appear. Intravenous administration is contraindicated in the presence of elevated cerebrospinal fluid pressure. For intramuscular administration, give 20% solution (200 mg/mL), 12.5 mg/kg body weight every 4-6 hours. Dilute each dose with an equal volume of 1% procaine. Dose limitation is the same as that given above (Dreisbach, Handbook of Poisoning, 11th Ed.). Antidote should be administered by qualified medical personnel.

SECTION 5**FIRE FIGHTING MEASURES**

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFPA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition products may include toxic oxides of manganese.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

For large spills, sweep up with a minimum of dusting and place into suitable clean, dry containers for reclamation or later disposal.

Residue should be cleaned up using a high-efficiency particulate filter

vacuum.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.
Store away from incompatible substances.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**

EXPOSURE LIMITS:**MANGANESE AND COMPOUNDS (AS MN):**

5 mg/m³ OSHA ceiling; 1 mg/m³ OSHA TWA (fume); 3 mg/m³ OSHA STEL (fume)
5 mg/m³ ACGIH TWA (dust);
1 mg/m³ ACGIH TWA (fume); 3 mg/m³ ACGIH STEL (fume)
1 mg/m³ NIOSH recommended TWA; 3 mg/m³ NIOSH recommended STEL
5 mg/m³ DFG MAK TWA (total dust);
50 mg/m³ DFG MAK 30 minute peak, average value, 1 time/shift

Measurement method: Particulate filter; acid; inductively coupled plasma;
(NIOSH Vol. III # 7300, Elements).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

VENTILATION:

Provide local exhaust ventilation to meet published exposure limits.
Ventilation equipment should be explosion-proof if explosive concentrations
of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent
eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may
be exposed to this substance, the employer should provide an eye wash
fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment
to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this
substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations
by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to
Chemical Hazards; NIOSH criteria documents or by the U.S. Department of
Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found
in the work place, must not exceed the working limits of the respirator and

be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

MANGANESE AND COMPOUNDS (AS MN):

10 mg/m³- Any dust and mist respirator except single-use and quarter-mask respirators.

Any supplied-air respirator.

Any self-contained breathing apparatus.

25 mg/m³- Any powered air-purifying respirator with a dust and mist filter (if not present as a fume).

Any supplied-air respirator operated in a continuous flow mode.

50 mg/m³- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.

Any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.

Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

Any supplied-air respirator with a tight-fitting facepiece operated in a continuous flow mode.

1000 mg/m³- Any supplied-air respirator with a half-mask and operated in a pressure-demand or other positive pressure mode.

2000 mg/m³- Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.

Escape- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.

Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Reddish-gray or silver, brittle metallic solid.

MOLECULAR WEIGHT: 54.9380

MOLECULAR FORMULA: MN

BOILING POINT: 3564 F (1962 C)

MELTING POINT: 2266-2277 F (1241-1247 C)

VAPOR PRESSURE: 1 mmHg @ 1292 C

SPECIFIC GRAVITY: 7.20

WATER SOLUBILITY: decomposes

SOLVENT SOLUBILITY: Soluble in dilute mineral acids, sodium and potassium bicarbonate.

HARDNESS (MOHS): 5.0.

SECTION 10**STABILITY AND REACTIVITY**

REACTIVITY:**MANGANESE:**

Decomposes water or steam to produce flammable hydrogen gas.

CONDITIONS TO AVOID:

Avoid dispersion of dust in air. Finely divided particles, dust, or fumes may be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:**MANGANESE:**

ALUMINUM (DUST): Forms explosive mixtures with air.

AMMONIUM NITRATE (FUSED): Violent or explosive reaction.

BROMINE PENTAFLUORIDE: Violent reaction and possible ignition.

CARBON DIOXIDE: Ignites.

CHLORINE: Ignites.

FLUORINE: Incandescent reaction.

HYDROGEN PEROXIDE: Violent decomposition and/or ignition.

NITRIC ACID: Incandescent reaction and feeble explosion.

NITROGEN DIOXIDE: Ignition.

OXIDIZERS (STRONG): Fire and explosion hazard.

PHOSPHORUS: Incandescent reaction when heated.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products may include toxic oxides of manganese.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11**TOXICOLOGY INFORMATION**

MANGANESE:

IRRITATION DATA: 500 mg/24 hours skin-rabbit mild; 500 mg/24 hours eye-rabbit mild.

Toxicity data: 2300 ug/m³ inhalation-man TCLo: 9 gm/kg oral-rat LD50; tumorigenic data (RTECS).

CARCINOGEN STATUS: None.

ACUTE TOXICITY DATA: Slightly toxic by ingestion.

TARGET EFFECTS: Neurotoxin. Poisoning may also affect the respiratory system and the liver and kidneys.

AT INCREASED RISK FROM EXPOSURE: Persons with a history of alcoholism, psychiatric, neurologic, or pulmonary diseases, liver dysfunction, or anemia.

ADDITIONAL DATA: Symptoms may depend on a combination of contributing factors including genetic predisposition, age, nutrition, anemia or alcohol.

HEALTH EFFECTS

INHALATION:

MANGANESE:

NEUROTOXIN. 10.000 mg/m³ Immediately Dangerous to Life or Health.

ACUTE EXPOSURE- Dust or fumes may be irritating to the mucous membranes. Metal fume fever, an influenza-like illness, may occur due to the inhalation of freshly formed metal oxide particles sized below 1.5 microns and usually between 0.02-0.05 microns. Symptoms may be delayed 4-12 hours and begin with a sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms may include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Fever, chills, muscular pain, mild to severe headache, nausea, occasional vomiting, exaggerated mental activity, profuse sweating, excessive urination, diarrhea and prostration may also occur. Tolerance to fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours.

CHRONIC EXPOSURE- If sufficient quantities of manganese dust or fumes are inhaled and absorbed, systemic poisoning known as "manganism", a Parkinsonian-like syndrome may occur. It is characterized initially by anorexia, asthenia, headache, insomnia or somnolence, irritability, restlessness, and spasm or pain in the muscles. Manganese psychosis may follow with uncontrollable behavior, unaccountable laughing or crying, visual hallucinations, confusion and euphoria. Sexual excitement followed by impotence may occur. These symptoms may disappear with the onset of true neurological manifestations of slow, slurred and irregular speech, monotonous tone, double vision, impaired hearing, difficulty with fine motor movements, and disturbances in gait and balance with frequent propulsion or retropulsion. Mask-like face, decreased movement of the eyelids and eyes and tremors of the upper extremities and head may also occur. Other signs and symptoms may include urinary bladder disturbances, excessive salivation and sweating, hematological changes, vasomotor disorders, decreased pulmonary function, kidney and possibly liver damage. Removal from exposure shortly after onset of symptoms usually results in improvement, although there may be residual disturbances in gait and speech. Once manganism is well established it becomes irreversible and progressive, but not fatal. An increased incidence of bronchitis and pneumonitis has been reported in studies of workers exposed to manganese dust and fume, and although these effects have been confirmed by animal experiments, they may represent an aggravation of a pre-existing condition. Allergic diseases of the respiratory tract have also been reported in one study.

SKIN CONTACT:

MANGANESE:

ACUTE EXPOSURE- 500 mg applied to the skin of rabbits caused mild irritation.

CHRONIC EXPOSURE- Sensitization has been reported in guinea pigs.

EYE CONTACT:

MANGANESE:

ACUTE EXPOSURE- Dust or fumes may be irritating to the eyes. 500 mg applied to the eyes of rabbits caused mild irritation.

CHRONIC EXPOSURE- No data available.

INGESTION:

MANGANESE:

ACUTE EXPOSURE- Extremely large doses may cause gastrointestinal irritation and possibly systemic toxicity.

CHRONIC EXPOSURE- Manganese poisoning has been reported in persons drinking manganese-contaminated well water.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

SECTION 14

TRANSPORTATION INFORMATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 172.101:
*Flammable solid

Department of Transportation labeling requirements 49-CFR 172.101 and
SUBPART E:
*Flammable solid

*Hazard classification and label apply to dust and powder form only.

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49-CFR 173.154
EXCEPTIONS: 49-CFR 173.153

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	N
SARA SECTION 302 (40CFR355.30):	N
SARA SECTION 304 (40CFR355.40):	N
SARA SECTION 313 (40CFR372.65):	Y
OSHA PROCESS SAFETY (29CFR1910.119):	N
CALIFORNIA PROPOSITION 65:	N

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD: Y
CHRONIC HAZARD: Y
FIRE HAZARD: Y
REACTIVITY HAZARD: Y
SUDDEN RELEASE HAZARD: N

SECTION 16	OTHER
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MERCURY

MCR

<p>Common Synonyms Quicksilver</p>	<p>Liquid</p> <p>Sinks in water.</p>	<p>Silver</p>	<p>Odorless</p>
<p>AVOID CONTACT WITH LIQUID. Keep people away. Stop discharge if possible. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>			
<p>Fire</p>	<p>Not flammable.</p>		
<p>Exposure</p>	<p>CALL FOR MEDICAL AID. LIQUID Effects of exposure may be delayed.</p>		
<p>Water Pollution</p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed Chemical and physical treatment</p>		<p>2. LABEL 2.1 Category: None</p>	
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Not listed 3.2 Formula: Hg 3.3 IMO/IUN Designation: Not listed 3.4 DOT ID No.: 2809 3.5 CAS Registry No.: 7439-97-6</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Silvery 4.3 Odor: None</p>	
<p>5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Avoid contact of liquid with skin. For vapor use chemical cartridge (Hocallite) respirator. 5.2 Symptoms Following Exposure: No immediate symptoms. As poisoning becomes established, slight muscular tremor, loss of appetite, nausea, and diarrhea are observed. Psychic, kidney, and cardiovascular disturbances may occur. 5.3 Treatment of Exposure: Consult a doctor. 5.4 Threshold Limit Value: 0.05 ng/m³ 5.5 Short Term Inhalation Limit: Data not available 5.6 Toxicity by Ingestion: No immediate toxicity 5.7 Late Toxicity: Development of mercury poisoning 5.8 Vapor (Gas) Irritant Characteristics: None 5.9 Liquid or Solid Irritant Characteristics: None 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: 28 mg/m³</p>			

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not flammable
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Autobaric Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
0.5-1 ppm/48 hr/carp
0.29 ppm/48 hr/marine fish/TL₅₀/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: Mercury concentrates in liver and kidneys of ducks and geese to levels above FDA limit of 0.5 ppm. Muscle tissue usually well below the limit.

9. SHIPPING INFORMATION

9.1 Grades of Purity: Pure
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE
(See Hazard Assessment Handbook)
A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-B
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 200.59
12.3 Boiling Point at 1 atm: 675°F = 357°C = 630°K
12.4 Freezing Point: -38.0°F = -38.9°C = 234.3°K
12.5 Critical Temperature: 2064°F = 1462°C = 1735°K
12.6 Critical Pressure: 23,300 psia = 1587 atm = 160.8 MN/m²
12.7 Specific Gravity: 13.55 at 20°C (liquid)
12.8 Liquid Surface Tension: 470 dynes/cm = 0.470 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 375 dynes/cm = 0.375 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 2.7 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

DHS16240

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7440-02-0
RTECS NUMBER: GR5950000

SUBSTANCE: NICKEL**TRADE NAMES/SYNONYMS:**

C.I. 77775; NICKEL ELEMENT; NI;
NICKEL 270, NICKEL 200 (MATERIALS RESEARCH CORP.); PULVERIZED NICKEL;
NICKEL PARTICLES; NI 0901-5; NP2; N-40; DHS16240

CHEMICAL FAMILY:

Metal

CREATION DATE: 12/14/84

REVISION DATE: 01/15/94

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : NICKEL
CAS NUMBER: 7440-02-0
PERCENTAGE: <100

OTHER CONTAMINANTS: WATER

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:

White to silver-gray, malleable, ductile, lustrous metal, powder or cubic crystals.

Suspect cancer hazard (contains material which can cause cancer in animals). Risk of cancer depends on duration and level of contact. Causes respiratory tract and skin irritation. May be irritating to eyes. May cause adverse reproductive effects. May cause allergic reaction. May damage the lungs. Flammable solid. May form flammable or explosive dust-air mixtures. Do not breathe dust. Keep away from all ignition sources. Avoid contact with eyes, skin and clothing. Avoid repeated or prolonged contact. Keep containers tightly closed. Avoid creation of dust. Wash thoroughly after handling. Use only with adequate ventilation.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EFFECTS: May cause irritation. May cause allergic reactions. Additional effects may include coughing, fever, asthma and lung damage.

LONG TERM EFFECTS: In addition to effects from short term exposure, perforation of the nose, runny nose and lack of sense of smell may occur. May also cause cancer.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation. May cause allergic reactions. Additional effects may include redness and swelling of the eyes, redness and swelling of the mouth, redness and swelling of the gums, rash, itching, fever, asthma and lung damage.

LONG TERM EFFECTS: Same effects as short term exposure.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation.

LONG TERM EFFECTS: No information is available.

INGESTION:

SHORT TERM EFFECTS: No information available on significant adverse effects.

LONG TERM EFFECTS: May cause reproductive effects.

CARCINOGEN STATUS:

OSHA: N

NTP: Y

IARC: Y

SECTION 4FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN

ANTIDOTE:

No specific antidote. Treat symptomatically and supportively.

SECTION 5

FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard in bulk form; however, dust, powder, or fumes are flammable or explosive when exposed to heat or flames.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFPA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

FLASH POINT: flammable (dust)

HAZARDOUS COMBUSTION PRODUCTS:

NICKEL:

May form toxic and highly flammable nickel carbonyl under thermal decomposition.

SECTION 6

ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL:

Shut off ignition sources. Do not touch spilled material. For small spills with clean shovel, place material into clean, dry container and cover; move containers from spill area. For larger spills, wet down with water and dike for later disposal. No smoking, flames or flares in hazard area. Keep unnecessary people away. Isolate hazard area and deny entry.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

Reportable Quantity (RQ): 100 pounds

The Superfund Amendments and Reauthorization Act (SARA) Section 304 requires that a release equal to or greater than the reportable quantity for this substance be immediately reported to the local emergency planning committee and the state emergency response commission (40 CFR 355.40). If the release of this substance is reportable under CERCLA Section 103, the National Response Center must be notified immediately at (800) 424-8802 or (202) 426-2675 in the metropolitan Washington, D.C. area (40 CFR 302.6).

SOIL SPILL:

Dig holding area such as lagoon, pond or pit for containment.

Use protective cover such as a plastic sheet to prevent material from dissolving in fire extinguishing water or rain.

WATER SPILL:

Trap spilled material at bottom in deep water pockets, excavated holding area or within sand bag barriers.

Use suction hoses to remove trapped spill material.

Use mechanical dredges or lifts to extract immobilized masses of pollution and precipitates.

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) prohibits contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance

Store away from incompatible substances.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**
-----**EXPOSURE LIMITS:**

NICKEL, METAL AND INSOLUBLE COMPOUNDS (AS NI):

1 mg/m³ OSHA TWA

1 mg/m³ ACGIH TWA (Notice of Intended Changes 1989-1990)

0.015 mg/m³ NIOSH recommended TWA

Measurement method: Particulate filter; acid; inductively coupled plasma; (NIOSH Vol. III # 7300, Elements).

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting
Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (October 1, 1989)
(nickel and certain nickel compounds)

NICKEL:

100 pounds CERCLA Section 103 Reportable Quantity

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements- (October 1, 1987)

(nickel refinery dust from the pyrometallurgical process)

OSHA revoked the final rule limits of January 19, 1989 in response to the 11th Circuit Court of Appeals decision (AFL-CIO v. OSHA) effective June 30, 1993. See 29 CFR 1910.1000 (58 FR 35338)

VENTILATION:

Provide local exhaust or process enclosure ventilation to meet the published exposure limits. Ventilation equipment should be explosion-proof if explosive

concentrations of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

NICKEL AND COMPOUNDS:

At any detectable concentration:

- Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode.
- Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Escape- Any air-purifying full facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against nickel and compounds.

Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: White to silver-gray, malleable, ductile, lustrous metal, powder or cubic crystals.

MOLECULAR WEIGHT: 58.71

MOLECULAR FORMULA: NI

BOILING POINT: 4946 F (2730 C)

MELTING POINT: 2651 F (1455 C)

VAPOR PRESSURE: 1 mmHg @ 1810 C

SPECIFIC GRAVITY: 8.90

WATER SOLUBILITY: insoluble

SOLVENT SOLUBILITY: Soluble in dilute nitric acid; slightly soluble in hydrochloric and sulphuric acid; insoluble in ammonia.

HARDNESS (MOHS): 3.8

SECTION 10

STABILITY AND REACTIVITY

REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:

Avoid dispersion of dust in air. Finely divided particles, dust, or fumes may be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:

NICKEL:

ACIDS (STRONG): Possible violent reaction.

ALUMINUM: May react explosively on heating.

AMMONIA: Possible violent reaction.

AMMONIUM NITRATE: Violent or explosive reaction.

BROMINE PENTAFLUORIDE: Violent reaction with possible ignition.

ETHYLENE + ALUMINUM CHLORIDE: Violent, exothermic reaction.

DIOXANE: Explosive reaction above 210 C.

FLUORINE: Violent reaction.

HYDRAZINE: Vigorous decomposition.

HYDRAZOIC ACID: Vigorous decomposition.

HYDROGEN: Exothermic above 150 C.

METHANOL: Possible ignition.

NITRIC ACID: Attacks.

NITRYL FLUORIDE: Incandescence on warming.

ORGANIC SOLVENTS: Possible explosion on heating.

OXIDANTS: Violent reaction.

PERFORMIC ACID: Violent reaction.

PHOSPHORUS: Incandescence on heating.

POTASSIUM PERCHLORATE, TITANIUM, AND INFUSORIAL EARTH: Shock-sensitive mixture.

SELENIUM: Incandescent reaction with heating.

SULFUR AND COMPOUNDS: Incandescent reaction with heating.

HAZARDOUS DECOMPOSITION:

NICKEL:

May form toxic and highly flammable nickel carbonyl under thermal

decomposition.

POLYMERIZATION:

Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11

TOXICOLOGY INFORMATION

NICKEL:

TOXICITY DATA: 5 gm/kg oral-rat LDLo; 5 mg/kg oral-guinea pig LDLo; 12 mg/kg intratracheal-rat LDLo; 7500 ug/kg subcutaneous-rabbit LDLo; 12500 ug/kg subcutaneous-cat LDLo; 50 mg/kg intravenous-mouse LDLo; 7 mg/kg intraperitoneal-rabbit LDLo; mutagenic data (RTECS); reproductive effects data (RTECS); tumorigenic data (RTECS).

CARCINOGEN STATUS: Anticipated Human Carcinogen (NTP); Human Inadequate Evidence, Animal Sufficient Evidence (IARC Group-2B for nickel). Metallic nickel was tested by inhalation exposure in mice, rats and guinea-pigs, by intratracheal instillation in rats, by intramuscular injection in rats and hamsters, and by intrapleural, subcutaneous, intraperitoneal and intrarenal injection in rats. The studies by inhalation exposure were inadequate for an assessment of carcinogenicity. After intratracheal instillation, it produced significant numbers of squamous-cell carcinomas and adenocarcinomas of the lung. Intrapleural injections induced sarcomas in rats. Subcutaneous administration of metallic nickel pellets induced sarcomas in rats, intramuscular injection of nickel powder induced sarcomas in rats and hamsters, and intraperitoneal injections induced carcinomas and sarcomas in rats.

There is inadequate evidence in humans and limited evidence in experimental animals for the carcinogenicity of nickel alloys. A ferronickel alloy did not induce local tumors after intramuscular or intrarenal injection in rats. Two powdered nickel alloys induced malignant tumors following intraperitoneal injection in rats, and one nickel alloy induced sarcomas following subcutaneous implantation of pellets in rats.

LOCAL EFFECTS: Irritant- inhalation, skin.

ACUTE TOXICITY LEVEL: Insufficient data.

TARGET EFFECTS: Sensitizer- respiratory, dermal. Poisoning may also affect the heart, liver, kidneys and brain.

AT INCREASED RISK FROM EXPOSURE: Persons with pre-existing skin or pulmonary disorders, or a history of asthma and allergies.

HEALTH EFFECTS

INHALATION:

NICKEL:

IRRITANT/SENSITIZER/CARCINOGEN.

ACUTE EXPOSURE- May cause respiratory irritation, cough, pneumonitis and fever. Pulmonary edema may be a delayed symptom. Pulmonary sensitization may occur causing eosinophilic pneumonitis, asthma and host rejection of nickel containing prostheses. Two workers experienced severe but transient pneumonitis after being exposed to 0.26 mg/m³ for six hours.

CHRONIC EXPOSURE- Repeated or prolonged inhalation may cause mucous membrane irritation and pulmonary sensitization. Workers exposed to nickel dust frequently developed chronic hypertrophic rhinitis and nasal sinusitis. Anosmia, nasal polyposis and perforation of the nasal septum.

may also occur. Rabbits exposed to 1 mg/m³ dust for 6 hours per day, five days a week for up to six months showed two- to three- fold increases in the volume density of alveolar type II cells. The six-month exposure caused focal pneumonia. Rats injected intratracheally once a week with 0.9 mg for ten weeks or 0.3 mg for 20 weeks showed adenocarcinomas, squamous-cell carcinomas, one adenoma and one mixed tumor.

SKIN CONTACT:**NICKEL:****IRRITANT/SENSITIZER.**

ACUTE EXPOSURE- May cause irritation. Skin sensitization may occur in previously exposed individuals. "Nickel itch", a type of dermatitis resulting from sensitization to nickel may begin with a sensation of burning and itching at the place of contact and usually occurs seven days before the characteristic skin eruptions appear. The primary skin eruption is erythematous or follicular; it may be followed by superficial discrete ulcers which discharge and become crusted. The eruption may spread to areas related to the activity of the primary site. Pigmented or depigmented plaques may be formed. This sensitization reaction may be accompanied by fever, stomatitis, gingivitis, conjunctivitis, paroxysmal asthmatic attacks and eosinophilic pneumonitis. Recovery usually occurs within 7 days after exposure. Nickel is not absorbed through the unbroken skin in amounts sufficient to cause intoxication.

CHRONIC EXPOSURE- Repeated or prolonged skin contact may cause sensitization dermatitis.

EYE CONTACT:**NICKEL:**

ACUTE EXPOSURE- Dust may be irritating to the eyes.

CHRONIC EXPOSURE- No data available.

INGESTION:**NICKEL:**

ACUTE EXPOSURE- Insoluble nickel compounds have a low level of toxicity due to poor absorption from the gastrointestinal tract.

CHRONIC EXPOSURE- Reproductive effects have been reported in animals.

SECTION 12**ECOLOGICAL INFORMATION**

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13**DISPOSAL INFORMATION**

Observe all federal, state and local regulations when disposing of this

substance.

SECTION 14

TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER. 49 CFR 172.101:
Metal powders, flammable, n.o.s. (nickel)-UN 3089

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION. 49 CFR 172.101:
4.1 - Flammable solid

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP. 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS. 49 CFR 172.101
AND SUBPART E:
Flammable solid

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.151
NON-BULK PACKAGING: 49 CFR 173.212
BULK PACKAGING: 49 CFR 173.240

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 15 kg
CARGO AIRCRAFT ONLY: 50 kg

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4):	Y	100 pounds RB
SARA SECTION 302 (40CFR355.30):	N	
SARA SECTION 304 (40CFR355.40):	N	
SARA SECTION 313 (40CFR372.65):	Y	
OSHA PROCESS SAFETY (29CFR1910.119):	N	
CALIFORNIA PROPOSITION 65:	Y	

SARA HAZARD CATEGORIES. SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	Y
FIRE HAZARD:	Y
REACTIVITY HAZARD:	N
SUDDEN RELEASE HAZARD:	N

SECTION 16

OTHER

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SODIUM

SDU

Common Synonyms	Soft solid under kerosene Silver to grayish-white Odorless
Floats and reacts violently with water. Flammable gas is produced.	
<p>AVOID CONTACT WITH SOLID. Keep people away. Call fire department. Wear goggles, and rubber overclothing (including gloves). Notify local health and pollution control agencies.</p>	
Fire	<p>FLAMMABLE. FIRE MAY START ON CONTACT WITH AIR. Flammable gas formed on contact with water or moisture. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). DO NOT USE WATER, CARBON DIOXIDE, OR VAPORIZING LIQUIDS. Extinguish with dry graphite, soda ash, powdered sodium chloride or other approved dry powder.</p>
Exposure	<p>CALL FOR MEDICAL AID. SOLID Will burn skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water.</p>
Water Pollution	Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Restrict access Evacuate area Chemical and physical treatment</p>	<p>2. LABEL 2.1 Category: Flammable solid; dangerous when wet 2.2 Class: 4</p>
<p>3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Not listed 3.2 Formula: Na 3.3 IMO/UN Designation: 4.3/1428 3.4 DOT ID No.: 1428 3.5 CAS Registry No.: 7440-23-5</p>	<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Soft solid or liquid 4.2 Color: Silvery white, changing to gray on exposure to air 4.3 Odor: Odorless</p>
5. HEALTH HAZARDS	
<p>5.1 Personal Protective Equipment: Maximum protective clothing; goggles and face shield. 5.2 Symptoms Following Exposure: Severe burns caused by burning metal or by caustic soda formed by reaction with moisture on skin. 5.3 Treatment of Exposure: SKIN: brush off any metal, then flood with water for at least 15 min.; treat as heat or caustic burn; call a doctor. 5.4 Threshold Limit Value: Data not available 5.5 Short Term Inhalation Limit: Not pertinent 5.6 Toxicity by Ingestion: Not pertinent 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Non-volatile 5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second- and third-degree burns on short contact and is very injurious to the eyes. 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: Data not available</p>	

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent
 6.2 Flammable Limits in Air: Not pertinent
 6.3 Fire Extinguishing Agents: Dry soda ash, graphite, salt, or other approved dry powder such as dry limestone.
 6.4 Fire Extinguishing Agents Not to be Used: Water, carbon dioxide or halogenated extinguishing agents.
 6.5 Special Hazards of Combustion Products: Fumes of burning Na are highly irritating to skin, eyes, and mucous membranes.
 6.6 Behavior in Fire: Not pertinent
 6.7 Ignition Temperature: 250°F
 6.8 Electrical Hazard: Not pertinent
 6.9 Burning Rate: Not pertinent
 6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts violently, with formation of flammable hydrogen gas and caustic soda solution. A fire often occurs.
 7.2 Reactivity with Common Materials: No reaction
 7.3 Stability During Transport: Stable
 7.4 Neutralizing Agents for Acids and Caustics: After reaction with water, caustic soda formed can be diluted with water and/or neutralized with acetic acid.
 7.5 Polymerizations: Not pertinent
 7.6 Inhibitor of Polymerization: Not pertinent
 7.7 Molar Ratio (Reactant to Product): Data not available
 7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Not pertinent
 8.2 Waterway Toxicity: Not pertinent
 8.3 Biological Oxygen Demand (BOD): None
 8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial grade: 99.95%
 9.2 Storage Temperature: 230°—250°F (liquid); ambient (solid)
 9.3 Inert Atmosphere: Dry nitrogen or argon (for liquid); under kerosene (for solid)
 9.4 Venting: Pressure-vacuum

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
 6.12 Flame Temperature: Data not available

10. HAZARD ASSESSMENT CODE
 (See Hazard Assessment Handbook)
 RR-C

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable solid
 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
 11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	1
Reactivity (Yellow)	2

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 18°C and 1 atm: Solid
 12.2 Molecular Weight: 22.49
 12.3 Boiling Point at 1 atm: 1821°F = 883°C = 1156°K
 12.4 Freezing Point: 207.5°F = 97.5°C = 370.7°K
 12.5 Critical Temperature: 3632°F = 2000°C = 2273°K
 12.6 Critical Pressure: 5040 psia = 343 atm = 34.8 MN/m²
 12.7 Specific Gravity: 0.971 at 20°C (solid)
 12.8 Liquid Surface Tension: Not pertinent
 12.9 Liquid Water Interfacial Tension: Not pertinent
 12.10 Vapor (Gas) Specific Gravity: Not pertinent
 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
 12.12 Latent Heat of Vaporization: Not pertinent
 12.13 Heat of Combustion: Not pertinent
 12.14 Heat of Decomposition: Not pertinent
 12.15 Heat of Solution: Not pertinent
 12.16 Heat of Polymerization: Not pertinent
 12.25 Heat of Fusion: 27.4 cal/g
 12.26 Limiting Value: Data not available
 12.27 Reid Vapor Pressure: Data not available

DHS24740

SECTION 1 CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION:
CONTACT: 1-615-366-2000 USA

CAS NUMBER: 7440-62-2
RTECS NUMBER: YW1355000

SUBSTANCE: VANADIUM

TRADE NAMES/SYNONYMS:
VANADIUM-51; VANADIUM ELEMENT; V; DHS24740

CHEMICAL FAMILY:
Metal

CREATION DATE: 03/26/85

REVISION DATE: 01/15/94

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT : VANADIUM
CAS NUMBER: 7440-62-2
PERCENTAGE: 100

OTHER CONTAMINANTS: NONE

SECTION 3 HAZARDS IDENTIFICATION

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW:

Light gray or white lustrous powder, fused hard lumps, or crystals.

May be irritating to the respiratory tract, skin and eyes. May cause blood disorders. May affect the kidneys. May affect the liver. May damage the lungs. Flammable solid. May form flammable or explosive dust-air mixture. Keep away from all ignition sources. Avoid breathing dust. Avoid contact with eyes, skin and clothing. Keep container tightly closed. Avoid creation of dust. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:**INHALATION:**

SHORT TERM EFFECTS: May cause irritation. Additional effects may include sneezing, coughing, metallic taste, digestive disorders, bloody spit.

difficulty breathing and lung damage.

LONG TERM EFFECTS: May cause high blood pressure, lung effects, blood disorders and liver and kidney damage.

SKIN CONTACT:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include rash and itching.

LONG TERM EFFECTS: Same effects as short term exposure.

EYE CONTACT:

SHORT TERM EFFECTS: May cause irritation. Additional effects may include tearing and blurred vision.

LONG TERM EFFECTS: Same effects as short term exposure.

INGESTION:

SHORT TERM EFFECTS: No information available on significant adverse effects.

LONG TERM EFFECTS: No information is available.

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4

FIRST AID MEASURES

INHALATION:

FIRST AID- Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately.

SKIN CONTACT:

FIRST AID- Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

EYE CONTACT:

FIRST AID- Wash eyes immediately with large amounts of water or normal saline occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

INGESTION:

FIRST AID- Treat symptomatically and supportively. Get medical attention immediately. If vomiting occurs, keep head lower than hips to prevent aspiration.

NOTE TO PHYSICIAN

ANTIDOTE:

no data available

SECTION 5

FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard in bulk form; however, dust, powder, or fumes are

flammable or explosive when exposed to heat or flames.

EXTINGUISHING MEDIA:

Use dry sand, dolomite, graphite, sodium chloride, soda ash, or appropriate metal-extinguishing powder. Do not apply water to burning material (NFPA Fire Protection Handbook, 16th Edition).

FIREFIGHTING:

Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn (1990 Emergency Response Guidebook, DOT P 5800.5, Guide Page 32).

Extinguish using agent for type of fire. Avoid breathing fumes from burning material.

HAZARDOUS COMBUSTION PRODUCTS:

Thermal decomposition may include toxic oxides of vanadium.

SECTION 6**ACCIDENTAL RELEASE MEASURES**

OCCUPATIONAL SPILL:

For large spills, sweep up with a minimum of dusting and place into suitable clean, dry containers for reclamation or later disposal.

Residue should be cleaned up using a high-efficiency particulate filter vacuum.

SECTION 7**HANDLING AND STORAGE**

Observe all federal, state and local regulations when storing this substance.

Store away from incompatible substances.

SECTION 8**EXPOSURE CONTROLS/PERSONAL PROTECTION**

EXPOSURE LIMITS:**VANADIUM:**

- 0.05 mg(V2O5)/m3 OSHA TWA (respirable dust and fume)
- 0.05 mg(V2O5)/m3 ACGIH TWA (respirable dust and fume)
- 1 mg(V)/m3 NIOSH recommended 10 hour TWA

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting

VENTILATION:

Provide local exhaust ventilation to meet published exposure limits. Ventilation equipment should be explosion-proof if explosive concentration of dust, vapor or fume are present.

EYE PROTECTION:

Employee must wear splash-proof or dust-resistant safety goggles to prevent eye contact with this substance.

Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain within the immediate work area for emergency use.

CLOTHING:

Employee must wear appropriate protective (impervious) clothing and equipment to prevent repeated or prolonged skin contact with this substance.

GLOVES:

Employee must wear appropriate protective gloves to prevent contact with this substance.

RESPIRATOR:

The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards; NIOSH criteria documents or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

VANADIUM, AS VANADIUM PENTOXIDE (V2O5):**Dust or fume:**

- 0.5 mg/m³- Any air-purifying respirator with a high-efficiency particulate filter.
 - Any supplied-air respirator.
 - Any self-contained breathing apparatus.
- 1.25 mg/m³- Any supplied-air respirator operated in a continuous flow mode.
 - Any powered air-purifying respirator with a high-efficiency particulate filter.
- 2.5 mg/m³- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.
 - Any self-contained breathing apparatus with a full facepiece.
 - Any supplied-air respirator with a full facepiece.
 - Any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.
- 70 mg/m³- Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
- Escape- Any air-purifying full facepiece respirator with a high-efficiency particulate filter.
 - Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITION

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

DESCRIPTION: Light gray or white lustrous powder, fused hard lumps, or crystals.
MOLECULAR WEIGHT: 50.94
MOLECULAR FORMULA: V
BOILING POINT: 6116 F (3380 C)
MELTING POINT: 3416-3452 F (1880-1990 C)
VAPOR PRESSURE: 0 @ 20 C (approx)
SPECIFIC GRAVITY: 5.96
WATER SOLUBILITY: insoluble
SOLVENT SOLUBILITY: Soluble in aqua regia, nitric acid, concentrated sulfuric acid, hydrofluoric acid; insoluble in hydrochloric acid, alkalies.

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY:
Stable under normal temperatures and pressures.

CONDITIONS TO AVOID:
Avoid dispersion of dust in air. Finely divided particles, dust, or fumes be flammable or explosive. Keep away from sparks or ignition sources.

INCOMPATIBILITIES:
VANADIUM:
BROMINE TRIFLUORIDE: Incandescent reaction.
CHLORINE: Explodes on contact at 0 C.
LITHIUM (MOLTEN): Severe reaction at 180 C.
NITRYL FLUORIDE: Incandescent reaction.

HAZARDOUS DECOMPOSITION:
Thermal decomposition may include toxic oxides of vanadium.

POLYMERIZATION:
Hazardous polymerization has not been reported to occur under normal temperatures and pressures.

SECTION 11 TOXICOLOGY INFORMATION

VANADIUM:
TOXICITY DATA: 59 mg/kg subcutaneous-rabbit LD50; tumorigenic data (RTECS).
CARCINOGEN STATUS: None.

ACUTE TOXICITY LEVEL: Insufficient data.

TARGET EFFECTS: Poisoning may affect the respiratory system.

HEALTH EFFECTS

INHALATION:

VANADIUM:

70 mg(V2O5)/m3 Immediately Dangerous to Life or Health.

ACUTE EXPOSURE- Inhalation of vanadium dust or fumes may cause respiratory tract irritation, metallic taste, greenish-black discoloration of the tongue, sore throat and chest, sneezing, paroxysmal cough with rales and rhonchi, hemoptysis, sputum, wheezing, dyspnea, tracheitis, bronchitis, bronchospasms, and pneumonitis. Symptoms may be delayed. Vanadium toxicity may cause gastrointestinal disturbances, liver, kidney and central nervous system effects. More severe exposure may result in pulmonary edema, and pneumonia. Recovery usually occurs with cessation of exposure. Sensitization may occur in previously exposed individuals.

CHRONIC EXPOSURE- Repeated or prolonged exposure to low levels of vanadium dust or fumes may result in chronic bronchitis with or without emphysema, hypertension, and other effects as in acute exposure. There may also be blood changes, and liver and kidney damage. Sensitization reactions may occur.

SKIN CONTACT:

VANADIUM:

ACUTE EXPOSURE- Irritation from contact with the metal has not been reported. Vanadium fumes may result in irritation, a seborrhea-like eczema with intense itching, and generalized urticaria. Sensitization resulting in contact dermatitis may occur in previously exposed individuals.

CHRONIC EXPOSURE- Repeated or prolonged contact may result in allergic eczema, sensitization, and dermatitis.

EYE CONTACT:

VANADIUM:

ACUTE EXPOSURE- Irritation from contact with the metal has not been reported. Vanadium fumes may result in irritation, profuse lacrimation, blurred vision, and a burning sensation of the conjunctiva.

CHRONIC EXPOSURE- Repeated or prolonged exposure may cause conjunctivitis.

INGESTION:

VANADIUM:

ACUTE EXPOSURE- Systemic toxicity from the metal itself is unlikely to occur. However, vanadium toxicity may affect the gastrointestinal system, liver and kidneys.

CHRONIC EXPOSURE- No data available.

SECTION 12

ECOLOGICAL INFORMATION

ENVIRONMENTAL IMPACT RATING (0-4): no data available

ACUTE AQUATIC TOXICITY: no data available

DEGRADABILITY: no data available

LOG BIOCONCENTRATION FACTOR (BCF): no data available

LOG OCTANOL/WATER PARTITION COEFFICIENT: no data available

SECTION 13

DISPOSAL INFORMATION

Observe all federal, state and local regulations when disposing of this substance.

SECTION 14

TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
Flammable solid, n.o.s. (vanadium)-UN 1325

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
4.1 - Flammable solid

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101
AND SUBPART E:
Flammable solid

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.151
NON-BULK PACKAGING: 49 CFR 173.212
BULK PACKAGING: 49 CFR 173.240

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 15 kg
CARGO AIRCRAFT ONLY: 50 kg

SECTION 15

REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): Y
OSHA PROCESS SAFETY (29CFR1910.119): N
CALIFORNIA PROPOSITION 65: N

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)
ACUTE HAZARD: Y
CHRONIC HAZARD: N
FIRE HAZARD: Y
REACTIVITY HAZARD: N
SUDDEN RELEASE HAZARD: N

SECTION 16

OTHER

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OHS25229

MATERIAL SAFETY DATA SHEET

OCCUPATIONAL HEALTH SERVICES, INC.
11 WEST 42ND STREET, 12TH FLOOR
NEW YORK, NEW YORK 10036
1-800-445-MSDS (1-800-445-6737) OR
1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION
CONTACT: 1-615-366-2000

SUBSTANCE IDENTIFICATION

SUBSTANCE: ZINC

CAS NUMBER: 7440-66-6
RTECS NUMBER: ZG8600000

TRADE NAMES/SYNONYMS:

ZINC ELEMENT; ZINC METAL; ZINC DUST; ZINC POWDER; BLUE POWDER;
GRANULAR ZINC; UN 1436; ZN; OHS25229

CHEMICAL FAMILY:
METAL

MOLECULAR FORMULA: ZN

MOLECULAR WEIGHT: 65.38

CERCLA RATINGS (SCALE 0-3): HEALTH=0 FIRE=3 REACTIVITY=1 PERSISTENCE=3
NFPA RATINGS (SCALE 0-4): HEALTH=0 FIRE=1 REACTIVITY=1

COMPONENTS AND CONTAMINANTS

COMPONENT: ZINC PERCENT: 100.0
CAS# 7440-66-6

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

ZINC OXIDE:

5 MG/M3 OSHA TWA (RESPIRABLE FRACTION); 10 MG/M3 OSHA TWA (TOTAL DUST)
5 MG/M3 OSHA TWA (FUME); 10 MG/M3 OSHA STEL (FUME)
10 MG/M3 ACGIH TWA (DUST);
5 MG/M3 ACGIH TWA (FUME); 10 MG/M3 ACGIH STEL (FUME)
5 MG/M3 NIOSH RECOMMENDED TWA (DUST);
15 MG/M3 NIOSH RECOMMENDED CEILING (DUST)
5 MG/M3 NIOSH RECOMMENDED TWA (FUME); 10 MG/M3 NIOSH RECOMMENDED STEL (FUME)
5 MG/M3 DFG MAK TWA (FINE DUST) (FUME);
50 MG/M3 DFG MAK 30 MINUTE PEAK, AVERAGE VALUE, 1 TIME/SHIFT (FUME)

MEASUREMENT METHOD: PARTICULATE FILTER; X-RAY DIFFRACTION SPECTROMETRY;
(NIOSH VOL. III # 7502).

ZINC:

1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY.

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING.

PHYSICAL DATA

DESCRIPTION: ODORLESS, BLUISH-WHITE METAL OR POWDER WHICH MAY FORM A WHITE CARBONATE COATING ON EXPOSURE TO MOIST AIR. BOILING POINT: 1665 F (907 C)
MELTING POINT: 788 F (420 C) SPECIFIC GRAVITY: 7.14
VAPOR PRESSURE: 1 MMHG @ 487 C SOLUBILITY IN WATER: REACTS
AUTOIGNITION TEMPERATURE: 1256 F (680 C) (CLOUD); 860 F (460 C) (LAYER)
MOHS' HARDNESS: 2.5

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
NEGLECTIBLE FIRE HAZARD IN BULK FORM; HOWEVER, DUST, POWDER, OR FUMES ARE FLAMMABLE OR EXPLOSIVE WHEN EXPOSED TO HEAT OR FLAMES.

FINELY DIVIDED MATERIAL MAY IGNITE ON EXPOSURE TO AIR.

LOWER EXPLOSIVE LIMIT: 0.5 OZ/FT3

FIREFIGHTING MEDIA:

USE DRY CHEMICAL, SODA ASH, LIME OR SAND. DO NOT USE WATER OR FOAM. (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:

USE WATER SPRAY TO REDUCE VAPOR; DO NOT GET WATER INSIDE CONTAINER. MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES; IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 76).

EXTINGUISH USING AGENTS INDICATED. DO NOT ALLOW WATER TO CONTACT BURNING MATERIAL.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:
FLAMMABLE SOLID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND SUBPART E:
FLAMMABLE SOLID AND DANGEROUS WHEN WET

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.220
EXCEPTIONS: 49 CFR 173.153

FINAL RULE ON HAZARDOUS MATERIALS REGULATIONS (HMR, 49 CFR PARTS 171-180), DOCKET NUMBERS HM-181, HM-181A, HM-181B, HM-181C, HM-181D AND HM-204. EFFECTIVE DATE OCTOBER 1, 1991. HOWEVER, COMPLIANCE WITH THE REGULATIONS IS AUTHORIZED ON AND AFTER JANUARY 1, 1991. (55 FR 52402, 12/21/90)

EXCEPT FOR EXPLOSIVES, INHALATION HAZARDS, AND INFECTIOUS SUBSTANCES, THE EFFECTIVE DATE FOR HAZARD COMMUNICATION REQUIREMENTS IS EXTENDED TO OCTOBER 1, 1993. (56 FR 47158, 10/18/91)

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101:
ZINC POWDER-UN 1436

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101:
4.3 - DANGEROUS WHEN WET MATERIAL

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101:
PG I

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101
AND SUBPART E:
DANGEROUS WHEN WET, SPONTANEOUSLY COMBUSTIBLE

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS:
EXCEPTIONS: NONE
NON-BULK PACKAGING: 49 CFR 173.211
BULK PACKAGING: 49 CFR 173.242

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: FORBIDDEN
CARGO AIRCRAFT ONLY: 15 KG

TOXICITY

ZINC:
IRRITATION DATA: 300 UG/3 DAYS INTERMITTENT SKIN-HUMAN MILD.
TOXICITY DATA: 124 MG/M3/50 MINUTES INHALATION-HUMAN TCLO.
CARCINOGEN STATUS: NONE.
ACUTE TOXICITY LEVEL: INSUFFICIENT DATA.
TARGET EFFECTS: POISONING MAY AFFECT THE GASTROINTESTINAL TRACT, LUNGS,
CENTRAL NERVOUS SYSTEM, HEMATOPOIETIC SYSTEM, AND BONES.
AT INCREASED RISK FROM EXPOSURE: PERSONS WITH SKIN DISORDERS OR IMPAIRED
RESPIRATORY FUNCTION.
ADDITIONAL DATA: EXCESSIVE ZINC INTAKE HAS BEEN ASSOCIATED WITH A
COPPER-DEFICIENCY ANEMIA.

HEALTH EFFECTS AND FIRST AID

INHALATION:
ZINC:

ACUTE EXPOSURE- INHALATION OF DUST MAY CAUSE IRRITATION WITH DIFFICULTY IN
BREATHING AND SNEEZING. NEUROLOGICAL AND PSYCHIATRIC SYMPTOMOLOGY

INCLUDING IRRITABILITY, UPPER EXTREMITY COARSE INTENTION TREMOR, INCOORDINATION, AND ATAXIA HAVE ALSO BEEN REPORTED. METAL FUME FEVER, AN INFLUENZA-LIKE ILLNESS, MAY OCCUR DUE TO THE INHALATION OF FRESHLY FORMED METAL OXIDE PARTICLES SIZED BELOW 1.5 MICRONS AND USUALLY BETWEEN 0.02-0.05 MICRONS. SYMPTOMS MAY BE DELAYED 4-12 HOURS AND BEGIN WITH A SUDDEN ONSET OF THIRST, AND A SWEET, METALLIC, OR FOUL TASTE IN THE MOUTH. OTHER SYMPTOMS MAY INCLUDE UPPER RESPIRATORY TRACT IRRITATION ACCOMPANIED BY COUGHING AND A DRYNESS OF THE MUCOUS MEMBRANES, LASSITUDE, AND A GENERALIZED FEELING OF MALAISE. FEVER, CHILLS, MUSCULAR PAIN, MILD TO SEVERE HEADACHE, NAUSEA, OCCASIONAL VOMITING, EXAGGERATED MENTAL ACTIVITY, PROFUSE SWEATING, EXCESSIVE URINATION, DIARRHEA, AND PROSTRATION MAY ALSO OCCUR. TOLERANCE TO FUMES DEVELOPS RAPIDLY, BUT IT IS QUICKLY LOST. ALL SYMPTOMS USUALLY SUBSIDE WITHIN 24-36 HOURS.

CHRONIC EXPOSURE- SEVERE GASTROINTESTINAL DISTURBANCES AND HYPOCHROMIC ANEMIA HAVE BEEN REPORTED, BUT OTHER CHEMICALS MAY HAVE CONTRIBUTED TO THE EFFECTS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

ZINC:

ACUTE EXPOSURE- DUST MAY CAUSE MECHANICAL IRRITATION AND MILD DERMATITIS IN INTERTRIGINOUS AREAS.

CHRONIC EXPOSURE- 300 UG APPLIED TO HUMAN SKIN INTERMITTENTLY FOR 3 DAYS CAUSED MILD IRRITATION. ALLERGIC REACTIONS ARE RARE, BUT HAVE BEEN REPORTED.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

ZINC:

ACUTE EXPOSURE- DUST MAY CAUSE MECHANICAL IRRITATION OR INJURY TO THE SURFACE OF THE EYE, WITH DISCOMFORT, REDDENING, AND TEARING.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

ZINC:

ACUTE EXPOSURE- LARGE ORAL DOSES MAY CAUSE GASTROINTESTINAL DISTRESS WITH STOMACH CRAMPS, DEHYDRATION, ELECTROLYTE IMBALANCE, ABDOMINAL PAIN, NAUSEA, VOMITING, HEMATEMESIS, DIARRHEA, LETHARGY, IMMUNE SYSTEM EFFECTS, FEVER, DIZZINESS, TIGHTNESS IN THE THROAT, SHOCK, COLLAPSE, RENAL FAILURE, AND DEATH. SURVIVORS MAY HAVE RESIDUAL NEPHRITIS AND STRICTURES OF THE ESOPHAGUS AND PYLORIC END OF THE STOMACH.

CHRONIC EXPOSURE- PATIENTS TAKING ZINC IN AMOUNTS 10 TIMES THE RDA FOR

MONTHS AND YEARS HAVE NOT SHOWN ANY ADVERSE REACTIONS. EXCESSIVE ABSORPTION MAY CAUSE COPPER-DEFICIENCY ANEMIA. INGESTION OF APPROXIMATELY 85.7 MG/KG/DAY FOR 2 DAYS CAUSED LETHARGY, LIGHTHEADEDNESS, STAGGERING, AND DIFFICULTY IN WRITING CLEARLY. 2 PEOPLE WHO INGESTED 40 PPM IN DRINKING WATER FOR SEVERAL MONTHS EXPERIENCED LACK OF CONCENTRATION, DROWSINESS, MENTAL AND PHYSICAL FATIGUE, PAIN IN THE ARMS AND LEGS, HEADACHE, STIFFNESS, MUSCLE PAINS, LOSS OF APPETITE, NAUSEA, WEIGHT LOSS, AND LASSITUDE. 90 PPM IN THE DIET FOR 5 WEEKS HAS RESULTED IN A DECREASE IN THE HDL CHOLESTEROL LEVEL. PANCREATIC ABNORMALITIES HAVE ALSO BEEN OBSERVED. A DIET OF 0.25% IN RATS CAUSED NO INJURY; ABOVE 0.25% THERE WAS BREAKDOWN OF THE HOMEOSTATIC MECHANISM, GROWTH RETARDATION, HYPOCHROMIC ANEMIA, AND DEFECTIVE MINERALIZATION OF THE BONES. MICE FED 500 PPM FOR 14 MONTHS EXHIBITED HYPERTROPHY OF THE ADRENAL CORTEX AND CHANGES INDICATING HYPERACTIVITY OF THE PANCREATIC ISLETS AND PITUITARY GLAND; 30,000 PPM FOR 13 WEEKS CAUSED LIVER AND KIDNEY DAMAGE AND SOME DEATHS. COWS FED 2% FOR 2 DAYS DEVELOPED SEVERE ENTERITIS, WITH 7 OF 40 DYING. SEVERE PULMONARY EMPHYSEMA AND CHANGES IN THE MYOCARDIUM, KIDNEYS, AND LIVER WERE OBSERVED. PIGS FED >1000 PPM HAD REDUCED FOOD INTAKE AND WEIGHT GAIN; AT >2000 PPM, DEATH OCCURRED AFTER 2 WEEKS. BONE CHANGES WERE OBSERVED IN FOALS FED 5400 PPM. HIGH DIETARY LEVELS OF ZINC HAVE BEEN ASSOCIATED WITH REDUCED FETAL WEIGHTS, ALTERED CONCENTRATIONS OF FETAL IRON AND COPPER, AND ALOPECIA AND REDUCED GROWTH OF OFFSPRING IN ANIMALS.

FIRST AID- TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.

ANTIDOTE:

POISONING FROM ZINC SALTS:

GIVE CALCIUM DISODIUM EDETATE 15-25 MG/KG (0.08-0.125 ML OF 20% SOLUTION PER KILOGRAM OF BODY WEIGHT) IN 250-500 ML OF 5% DEXTROSE INTRAVENOUSLY OVER A 1 TO 2 HOUR PERIOD TWICE DAILY. THE MAXIMUM DOSE SHOULD NOT EXCEED 50 MG/KG/DAY. THE DRUG SHOULD BE GIVEN IN 5-DAY COURSES WITH A REST PERIOD OF AT LEAST 2 DAYS BETWEEN COURSES. AFTER THE FIRST COURSE, SUBSEQUENT COURSES SHOULD NOT EXCEED 50 MG/KG/DAY. DAILY URINALYSES SHOULD BE DONE DURING THE TREATMENT PERIOD. THE DOSAGE SHOULD BE REDUCED IF ANY UNUSUAL URINARY FINDINGS APPEAR.

FOR INTRAMUSCULAR ADMINISTRATION, GIVE 12.5 MG/KG BODY WEIGHT EVERY 4-6 HOURS. DILUTE EACH DOSE WITH AN EQUAL VOLUME OF 1% PROCAINE. DOSE LIMITATION IS THE SAME AS THAT GIVEN ABOVE. (DREISBACH, HANDBOOK OF POISONING, 12TH ED.) ANTIDOTE SHOULD BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL.

REACTIVITY

REACTIVITY:

ZINC POWDER OR DUST EVOLVES HIGHLY FLAMMABLE HYDROGEN GAS ON CONTACT WITH WATER; THE HEAT OF THE REACTION MAY BE SUFFICIENT TO IGNITE THE HYDROGEN. ZINC FOIL MAY IGNITE IN THE PRESENCE OF MOISTURE.

INCOMPATIBILITIES:

ZINC:

ACIDS: EVOLVES HYDROGEN GAS WHICH MAY BE IGNITED BY THE HEAT OF THE REACTION

ALKALIES: EVOLVES HYDROGEN GAS WHICH MAY BE IGNITED BY THE HEAT OF THE REACTION.
 ALUMINUM (POWDER): POSSIBLE IGNITION.
 ALUMINUM-MAGNESIUM ALLOY + RUSTED STEEL: MAY SPARK ON IMPACT.
 AMMONIUM NITRATE: VIOLENT REACTION OR FORMATION OF EXPLOSIVE MIXTURE.
 AMMONIUM SULFIDE: MAY EXPLODE IN A CLOSED CONTAINER.
 ARSENIC: INCANDESCENT REACTION WHEN HEATED.
 ARSENIC TRIOXIDE: EXPLOSIVE REACTION ON HEATING.
 BROMOMETHANE: FORMS FLAMMABLE COMPOUNDS.
 CADMIUM: INCANDESCENT REACTION.
 CALCIUM CHLORIDE: EVOLVES HYDROGEN GAS WHICH MAY BE IGNITED BY THE HEAT OF THE REACTION.
 CARBON DISULFIDE: INCANDESCENT REACTION.
 CARBON TETRACHLORIDE + METHANOL: EXTREMELY VIGOROUS REACTION.
 CHLORATES: FORMS SHOCK-SENSITIVE MIXTURES.
 CHLORINATED RUBBER: VIOLENT OR EXPLOSIVE REACTION AT ELEVATED TEMPERATURES.
 CHROMIC ANHYDRIDE: VIOLENT REACTION AND POSSIBLE IGNITION.
 COBALT HALIDE (METHANOLIC SOLUTION) + IRON PENTACARBONYL: VIOLENT REACTION.
 ETHYL ACETOACETATE + TRIBROMONEOPENTYL ALCOHOL: MAY REACT EXPLOSIVELY.
 HALOCARBONS: POSSIBLE VIOLENT REACTION WITH IGNITION.
 HALOGENS: POSSIBLE IGNITION.
 HYDRAZINE NITRATE: IGNITES ON WARMING.
 HYDROXYLAMINE: MAY IGNITE OR EXPLODE WHEN HEATED.
 INTERHALOGENS: VIOLENT REACTION AND POSSIBLE IGNITION.
 LEAD AZIDE: INCREASED SENSITIVITY TO EXPLOSIVE DECOMPOSITION.
 MANGANESE DICHLORIDE: EXPLOSIVE REACTION WHEN HEATED.
 METAL OXIDES: POSSIBLE IGNITION OR INCANDESCENT REACTION.
 NITRIC ACID: INCANDESCENT REACTION.
 2-NITROANISOLE + SODIUM HYDROXIDE: EXOTHERMIC REACTION.
 NITROBENZENE: MAY FORM PYROPHORIC RESIDUE.
 NITRYL FLUORIDE: INCANDESCES WHEN WARMED.
 OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
 PEROXYFORMIC ACID: VIOLENT EXPLOSION ON CONTACT.
 POTASSIUM NITRATE: EXPLOSIVE REACTION ON HEATING.
 POTASSIUM PEROXIDE: INCANDESCENT REACTION.
 RHODIUM HALIDES (METHANOLIC SOLUTION) + IRON PENTACARBONYL: VIOLENT REACTION.
 RUTHENIUM HALIDES (METHANOLIC SOLUTION) + IRON PENTACARBONYL: VIOLENT REACTION.
 SELENIUM: INCANDESCENT REACTION.
 SELENINYL BROMIDE: IGNITION.
 SILVER + ELECTROLYTES (BATTERIES): MAY SPONTANEOUSLY COMBUST.
 SODIUM PEROXIDE: INCANDESCENT REACTION.
 SULFUR: VIOLENT REACTION.
 TELLURIUM: INCANDESCENT REACTION.
 ZINC CHLORIDE: MAY INCREASE FLAMMABILITY.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC FUMES OF ZINC OXIDE.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

****STORAGE****

PROTECT AGAINST PHYSICAL DAMAGE. STORE IN COOL, DRY, VENTILATED PLACE. SEPARATE FROM ACIDS, HALOGENATED HYDROCARBONS AND STRONG ALKALI HYDROXIDES. PROTECT FROM MOISTURE. (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262. EPA HAZARDOUS WASTE NUMBER D001.
100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

CONDITIONS TO AVOID

PREVENT DISPERSION OF DUST IN AIR. MAY BE IGNITED BY HEAT, SPARKS, OR FLAMES. MAY BURN RAPIDLY WITH FLARE-BURNING EFFECT. MAY IGNITE IN THE PRESENCE OF MOISTURE.

SPILL AND LEAK PROCEDURES**OCCUPATIONAL SPILL:**

DO NOT TOUCH SPILLED MATERIAL. SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING OR FLAMES IN HAZARD AREA. FOR SMALL DRY SPILLS, WITH CLEAN SHOVEL PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; MOVE CONTAINERS FROM SPILL AREA. NO WATER ON SPILLED MATERIAL; DO NOT GET WATER INSIDE CONTAINER. DIKE SPILL FOR LATER DISPOSAL. CLEAN UP ONLY UNDER SUPERVISION OF AN EXPERT.

REPORTABLE QUANTITY (RQ): 1000 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT**VENTILATION:**

PROVIDE LOCAL EXHAUST OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED

EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

FOR ZINC OXIDE FUME:

50 MG/M3- ANY DUST, MIST AND FUME RESPIRATOR WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR.
ANY SELF-CONTAINED BREATHING APPARATUS.

125 MG/M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH A DUST, MIST AND FUME FILTER.
ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

250 MG/M3- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY POWERED AIR-PURIFYING RESPIRATOR WITH A TIGHT-FITTING FACEPIECE AND A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A TIGHT-FITTING FACEPIECE OPERATED IN A CONTINUOUS FLOW MODE.

2500 MG/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A HALF-MASK AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS

SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.
CREATION DATE: 03/26/86 REVISION DATE: 10/29/91

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ZINC

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5.0 SITE CONTROL

5.1 ZONATION

The general zonation protocols employed by ABB-ES at hazardous waste sites are described in Appendix G, Part II. The site-specific zonation to be used for the Becker Electronics Manufacturing site is described as follows. Each exploration location will be considered an Exclusion Zone. A support van will be used to support the field activities, serving as a storage area for health and safety equipment and as a mobile site office. An area for decontamination called the Contamination Reduction Zone (CRZ) will be established at each exploration location.

5.1.1 Exclusion Zone

Each exploration location will be considered an Exclusion Zone. The Exclusion Zone isolates the area of contaminant generation and restricts (to the extent possible) the spread of contamination from active areas of the site to support areas and off-site locations. The Exclusion Zone is demarcated by the Hot Line (i.e., a tape line or physical barrier). Personnel entering the Exclusion Zone must (1) enter through the CRZ; (2) wear the prescribed level of protection; and (3) be otherwise authorized by the HSO to enter the downrange area. Any personnel, equipment, or materials exiting the Exclusion Zone will be considered contaminated. Personnel leaving the Exclusion Zone will be subject to decontamination; equipment and materials leaving the Exclusion Zone will either be subject to decontamination or containerized for disposal. Specific access for emergency services to areas of specific site operations will be established.

5.1.2 Contamination Reduction Zone

The CRZ will be established at the perimeter of the Exclusion Zone where personal decontamination will take place. The CRZ is a transition zone between contaminated and uncontaminated areas of the site. When personnel, equipment, or materials considered to be contaminated exit the Exclusion Zone, they pass through the CRZ, in which they are decontaminated. Decontamination fluids, disposable towels, and other materials necessary for personnel and portable

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equipment decontamination are staged in the CRZ. Following decontamination, equipment and personnel are considered clean, and are allowed to exit the CRZ.

5.1.3 Support Zone

The Support Zone is considered the support van used to support field activities, separated from the CRZ and considered a clean area. Movement of personnel and materials from this zone into the CRZ is generally unrestricted, except as required through access points controlled for administrative purposes. However, only uncontaminated/decontaminated personnel or materials may enter this zone from the CRZ.

The support van contains the necessary support facilities for site operations. It serves as the communications center and source of emergency assistance for operations in the Exclusion Zone and CRZ. In addition, certain safety equipment (e.g., emergency eye wash, fire extinguisher, and first aid kit) are staged in the support van. A log of all persons entering the site proper will be maintained by the HSO, the field operations leader, or project assistant.

5.2 COMMUNICATIONS

Field personnel will carry portable radios for communications only when performing work at full Level C or Level B personal protection. If this is the case, a transmission that indicates it is of an emergency nature will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communication is not available, the following air-horn signals will be used:

HELP	three short blasts	(...)
EVACUATION	three long blasts	(---)
ALL CLEAR	alternating long and short blasts	(_._)

5.3 WORK PRACTICES

General work practices to be used during ABB-ES field programs are presented in Appendix H, Part II. Specific work practices necessary for this project or those that are of significant concern are described in this section.

All ABB-ES and subcontractor personnel working on-site are expected to adhere to established safe work practices for their specialties (e.g., geophysics, surveying, test pitting, or drilling). The need to exercise caution in the performance of specific work tasks is frequently made more acute due to (1) weather conditions; (2) restricted mobility and reduced peripheral vision caused by the protective gear itself; and (3) the need to maintain the integrity of the protective gear. Work at the Becker Electronics Manufacturing site will be conducted according to established protocols and guidelines for the safety and health of all involved. Among the most important of these principles for working at the Becker Electronics Manufacturing site are the following:

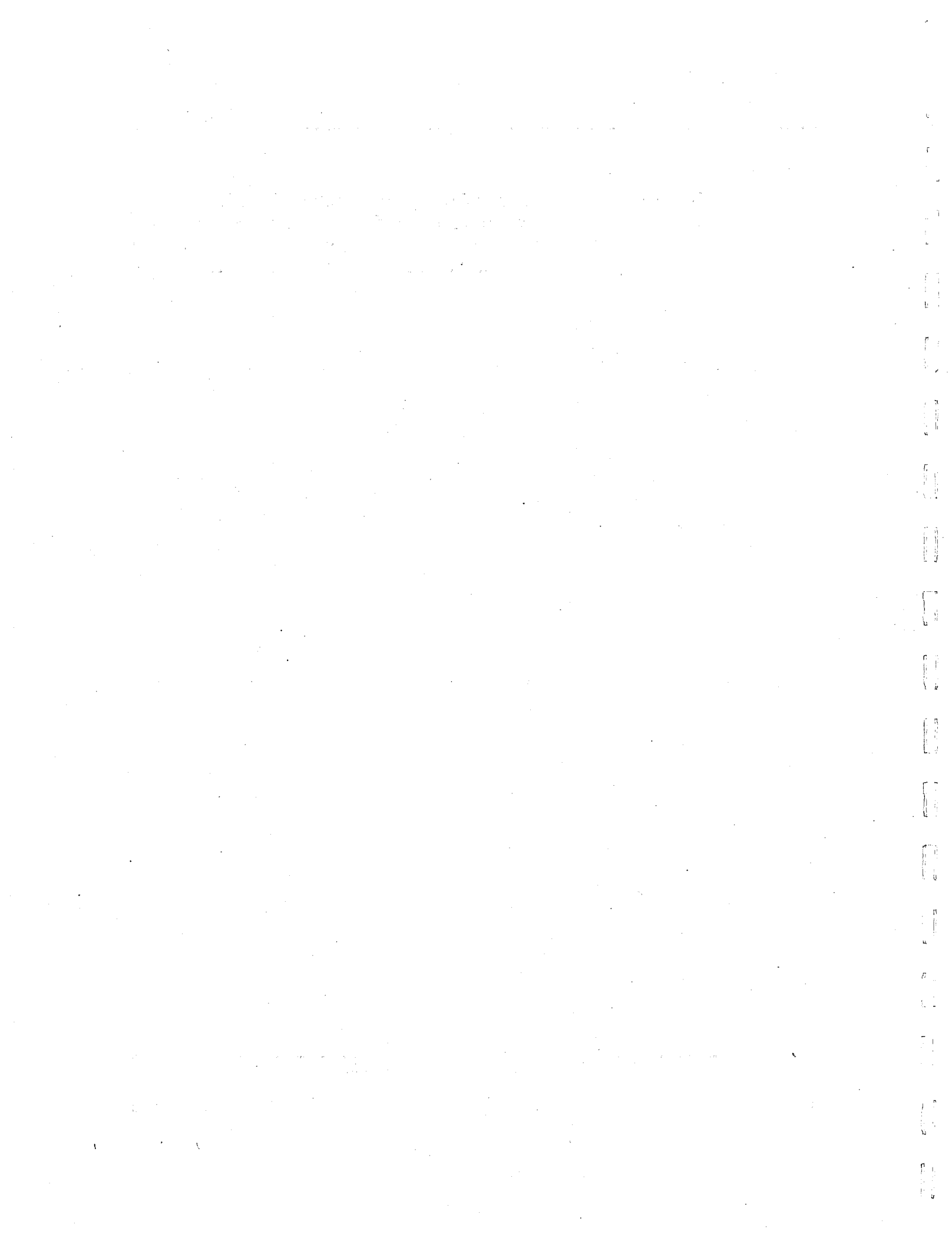
- In any unknown situation, always assume the worst conditions and plan responses accordingly.
- If personal protection is upgraded from Level C dermal, use the buddy system. Under no conditions will any person be permitted to enter an Exclusion Zone alone. Establish and maintain communication. In addition to radio communications, it is advisable to develop a set of hand signals, because conditions may greatly impair verbal communications.
- Personal protective equipment is never 100-percent effective, so all personnel must minimize contact with potentially contaminated materials. Plan work areas, decontamination areas, and procedures accordingly. Do not place equipment on potentially contaminated ground in the Exclusion Zone. Do not sit or kneel on the ground in the Exclusion Zone or CRZ. Avoid standing in or walking through puddles or stained soil.
- Smoking, chewing "smokeless tobacco", eating, or drinking in an Exclusion Zone, CRZ, or decontamination area or before personal decontamination, will not be allowed. Oral ingestion of

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contaminants is the second most likely means of introducing toxic substances into the body.

- Avoid heat and other work stresses related to wearing protective gear. Work breaks should be planned to prevent stress-related accidents or fatigue.
- To the extent feasible, handling of contaminated materials should be done remotely. Every effort should be made to identify the contents of containers found on-site before they are subject to material-handling applications.
- Personnel must be observant of not only their own immediate surroundings, but also those of others. Everyone will be working under constraints; therefore, a team effort is needed to notice and warn of impending dangerous situations. Extra precautions are necessary while utilizing personal protective gear because vision, hearing, and communication can be restricted.
- Contact lenses are not allowed to be worn on-site; if corrosive or lachrymose substances enter the eyes, proper flushing is impeded.
- All facial hair that interferes with respirator face piece fit must be removed prior to donning a respirator if full Level C or B protection is required.
- Rigorous contingency planning and dissemination of plans to all personnel minimizes the impact of rapidly changing safety protocols in response to changing site conditions.
- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol or working while feeling ill during field investigation assignments.
- The ABB-ES HSO or his/her designee will maintain project health and safety records in a bound notebook(s). Daily activities, health and safety meetings, drills, audits, and briefings, and incidents, will

be recorded. The health and safety notebook(s) will remain on-site for the duration of the project so that designated replacement personnel may add information, thereby maintaining continuity. The notebook(s) will become part of the permanent project file.



6.0 DECONTAMINATION AND DISPOSAL

All personnel leaving or equipment and materials taken from contaminated areas of the site will be decontaminated, which will take place in the CRZ.

6.1 PERSONNEL DECONTAMINATION

The following decontamination procedures shall be followed by all personnel leaving the Exclusion Zones at the Becker Electronics Manufacturing site. Except for true emergency evacuation, personnel will not be allowed to leave the Exclusion Zones prior to decontamination. Generalized procedures for removal of protective clothing and equipment from the Exclusion Zones are as follows:

1. Drop tools, monitors, samples, and trash at designated drop stations (e.g. plastic trash bags, containers or drop sheets).
2. Step into the designated decontamination area and remove gross amounts of dirt from outer boots.
3. Scrub outer boots and outer gloves with decontamination solution or detergent and water. Rinse with water.
4. If disposable boot covers are used, remove tape from outer boots and remove boots; discard in disposal container.
5. Remove tape from outer gloves and remove gloves; discard in disposal container.
6. If full Level C or Level B are required, and the worker has left the Exclusion Zone to change the air tank or his/her SCBA, or the canister on his/her air purifying respirator, this is the last step in the decontamination procedure. The tank or cartridge should be exchanged, new outer gloves and boot covers donned, the joints taped, and the worker returns to duty.
7. Remove outer garments and discard in disposal container.

SECTION 6

8. Remove respirator and place or hang in the designated area.
9. Remove inner gloves and discard in disposal container.

NOTE: Disposable items (i.e., Tyvek coveralls, inner gloves, and latex overboots) will be changed at least once a day unless there is reason to change sooner. If used, Level C respirator canisters will be changed daily, unless more frequent changes are deemed appropriate by site surveillance data or personnel assessment.

Pressurized water sprayers, boot wash tubs, paper towels, and other designated equipment will be available in the decontamination area for wash down and cleaning of personnel, samples, and equipment.

If used, personnel will be decontaminate respirators daily. The masks will be disassembled, the cartridges set aside, and all other parts placed in a cleansing solution. Parts will be pre-coded (e.g., #1 on all parts of Mask #1). After an appropriate time in the solution, the parts will be removed and rinsed with tap water. Old cartridges will be marked to indicate length of usage (i.e., if means to evaluate the cartridges' remaining utility are available) or will be discarded in the contaminated trash container for disposal. The masks will be stored in the support van. At the start of the next work period personnel will reassemble his/her mask and install new cartridges, if appropriate. Personnel will inspect his/her own mask and readjust the straps for proper fit if necessary.

6.1.1 Small Equipment and Sample Container Decontamination

Small monitoring equipment will be protected from contamination as much as possible by draping, masking, or otherwise covering the instrument with plastic (to the extent feasible) without hindering operation of the unit. For example, a HNU can be placed and taped inside a clear plastic bag, keeping the sensor tip and intake port clear, so that the operator can still read the scale and operate the knobs.

Protective coverings on contaminated equipment taken from the CRZ drop area will be removed and disposed of in appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable towel or wipe. The units can then be taken into the Support Zone in a clean container, wiped off

again and dried. Units will be checked, standardized, and recharged as necessary for the next day's operation, and then prepared with new protective coverings.

In the CRZ, sample jars will be wiped with disposable towels or wipes until clean, then moved in a clean container to the support van for packing and shipping.

6.1.2 Heavy Equipment Decontamination

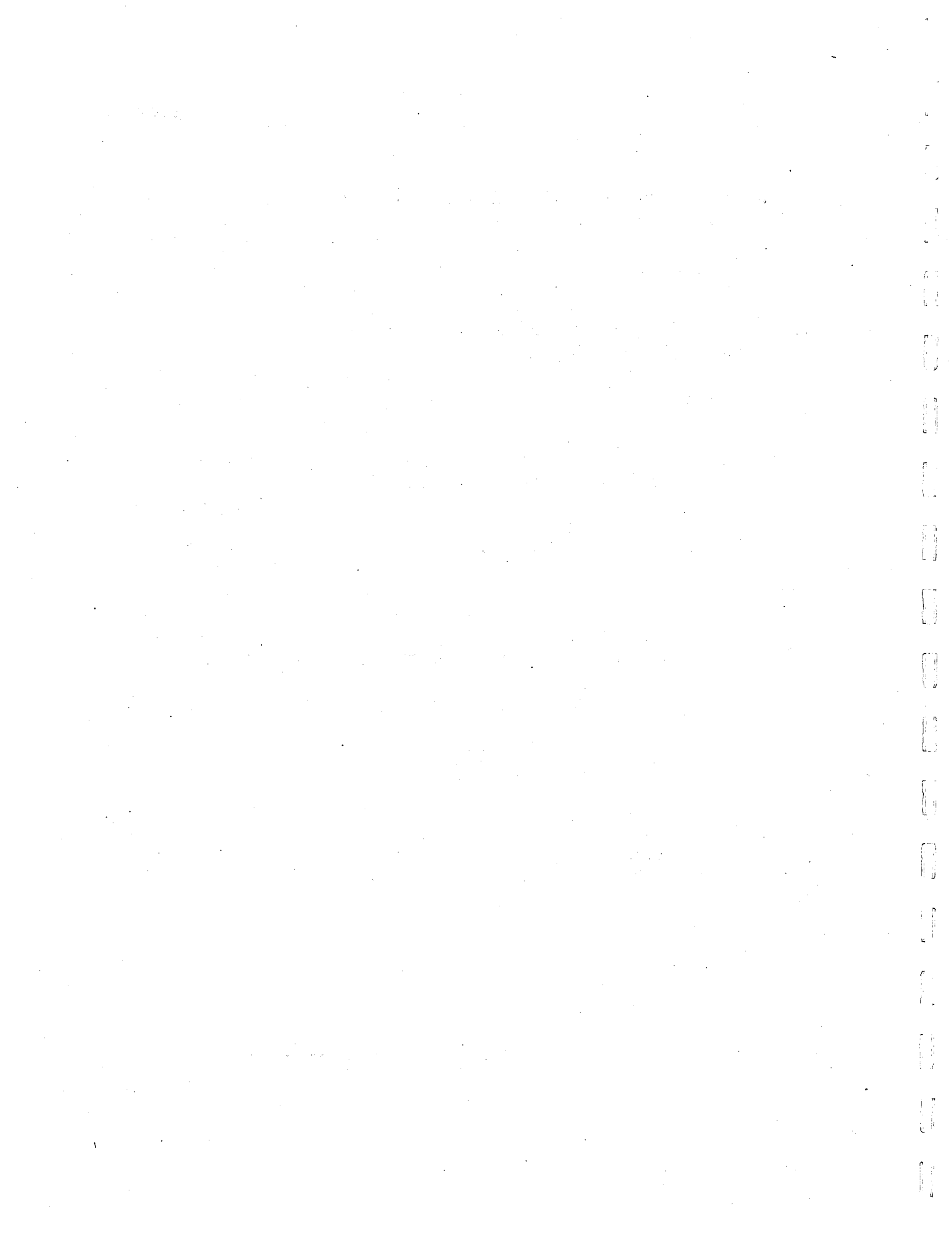
It is anticipated that drilling rigs, downhole equipment, test pitting equipment, and sampling equipment will be decontaminated during investigation activities. They will be cleaned with a high pressure steam-cleaner when they arrive at the site and between each exploration. Loose and/or clinging material will be removed with a brush. Subcontractor personnel performing this activity will usually use the same level of protection that was utilized during the drilling activity.

6.2 DISPOSAL OF SITE-RELATED MATERIALS

The following will be containerized in DOT approved 55-gallon containers and staged at the site as directed by NYSDEC:

- All protective gear and decontamination fluids for both personnel and equipment, and other disposable sampling materials;
- Decontamination fluids such as steam-cleaning water, Liquinox, or deionized (DI) water used to decontaminate sampling equipment (e.g., split spoons and groundwater sampling pumps);
- Disposable personal protective equipment and clothing.

ABB-ES will dispose of the containers acting as an agent for the State. Reference jar samples will also be left at the site if not stored by NYSDEC.



7.0 EMERGENCY/CONTINGENCY PLAN

This section identifies the emergency contingency plan undertaken for operations at this site. Other sections of the HASP provide further information to be used under emergency conditions. Refer to Appendix M, Part II for general emergency planning information. Site-specific information, emergency telephone numbers, and routes to emergency medical facilities are presented in this section and in Appendix B-2.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION

The site HSO or Health and Safety designee is the primary authority for directing site operations under emergency conditions. All Health and Safety-related emergency communications both on- and off-site will be directed through the HSO.

7.2 EVACUATION

7.2.1 Withdrawal Upwind

All work parties will continually note general wind directions while on-site. When conditions warrant moving away from a work site, the work party crew will relocate upwind a distance of approximately 100 feet or farther, as directed by NYSDEC and ABB-ES. If site access is restricted, thus hindering escape, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

7.2.2 Site Evacuation

If conditions warrant site evacuation, the work party will proceed upwind of the work site and notify the HSO, FOL, and NYSDEC of their appraisal of site conditions. If the decontamination area is upwind and greater than 500 feet from the work site, the crew will pass quickly through decontamination to remove contaminated outer suits. Following decontamination, the work party crew will proceed to the support van with the HSO and FOL to assess the situation. As

SECTION 7

soon as is practical, and as additional information about site conditions is received from the field crew, the situation will be communicated to the HSS or HSM, ABB-ES and NYSDEC, and appropriate local agencies, if applicable. The advisability and type of further response action will be coordinated with NYSDEC and ABB-ES and carried out by the HSO.

7.2.3 Evacuation of Surrounding Area

Representatives of local emergency agencies will be informed of the proposed schedule and activities prior to initiation of on-site work. The emergency response capabilities of the local authorities and agencies will be assessed prior to inception of the field program. Prior to evacuation of the off-site area, the Exclusion Zone and CRZ will be expanded, as practicable, to reduce the potential for community exposure. Monitoring of the expanded CRZ will be conducted to determine if evacuation is necessary.

When the HSO determines that conditions may warrant evacuation of downwind residences and commercial operations, local agencies will be notified and assistance requested. Designated on-site personnel will initiate evacuation of the immediate off-site area without delay.

7.3 EMERGENCY MEDICAL TREATMENT/FIRST AID

First aid will be rendered to any person injured on-site, as appropriate. The injured person will then be transported to trained medical personnel for further examination and/or treatment. The preferred transport method is a professional emergency transportation service; however, when this is not readily available or would result in excessive delay, other transport is authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

When an injury occurs in a downrange position, provisions for decontamination of the victim will be made. However, life-threatening conditions may preclude normal decontamination procedures. In such cases, arrangements will be made with the medical facility and transporter to provide for the situation.

7.3.1 Medical Assistance

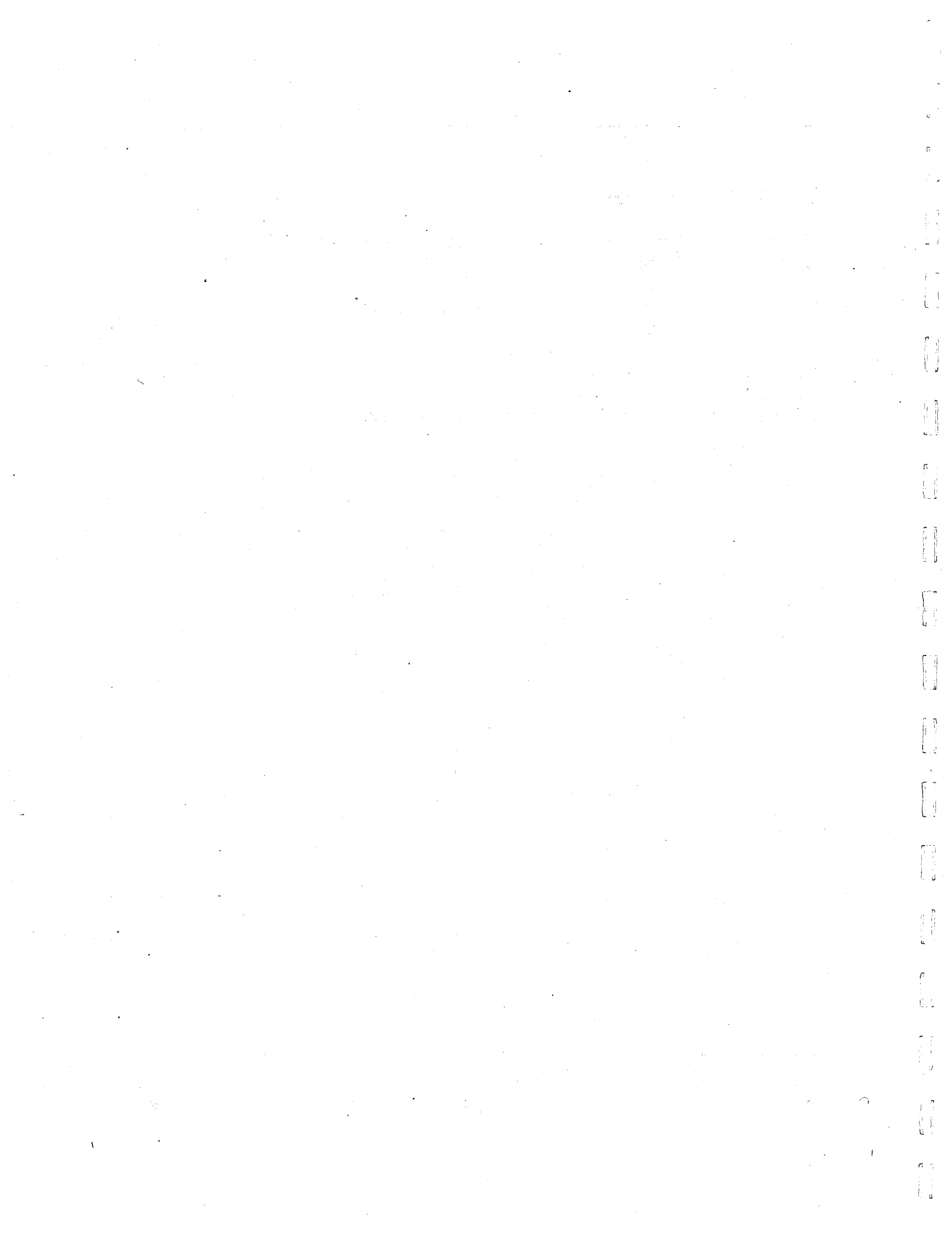
The primary source of medical assistance for the Becker Electronics Manufacturing site is:

- Hudson Columbia Green Medical Center
71 Prospect Ave.
Hudson, New York
(518) 828-7601

Directions to the primary source of medical assistance:

Exit site by turning right onto Route 145.
Follow Route 145 south (east)
Go through the town of Catskill, and over the Hudson River.
Follow Route 145 for approximately 1.5 miles.
Go Left, north, onto Route 9.
Continue to first flashing red light, Prospect Ave.
Go right on prospect ave, and continue up the hill.
The hospital is on the left.

The hospital route maps are presented in Appendix B-2.



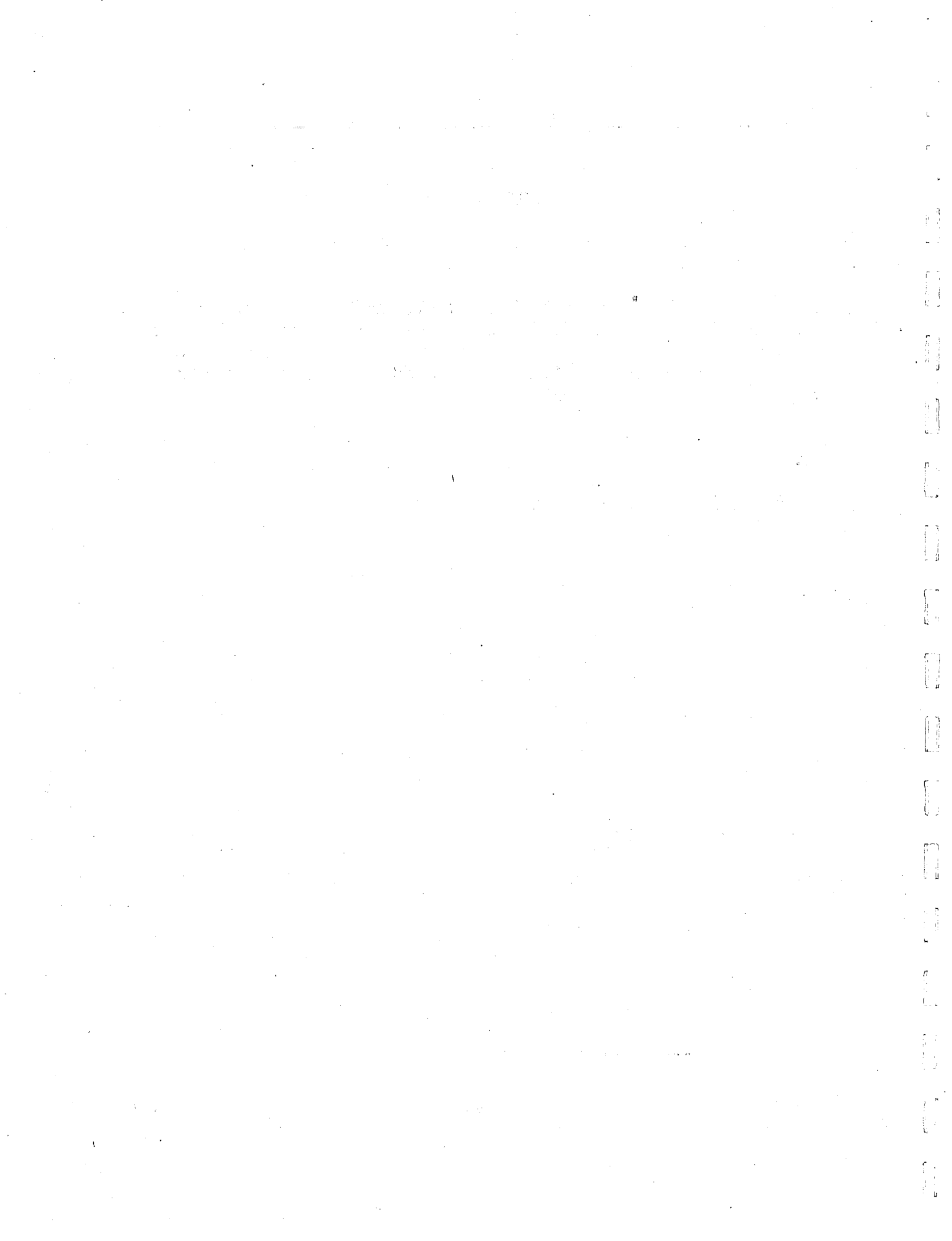
8.0 OTHER

8.1 ILLUMINATION

Site operations will not be permitted without adequate lighting. Therefore, unless provisions are made for artificial light, downrange operations must halt in time to permit personnel and equipment to exit the Exclusion Zone and proceed through decontamination before dusk. Conversely, operations will not be permitted to begin until lighting is adequate.

8.2 SANITATION

Portable facilities will be provided.



9.0 ADMINISTRATIVE

9.1 PERSONNEL AUTHORIZED DOWNRANGE

Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the PM and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must utilize the buddy system, and check in with the Site Manager and/or HSO before proceeding downrange.

Certified ABB-ES Co. Team Personnel:

<u>Brian Johnson ⁺</u>	<u>Health and Safety Officer</u>
<u>Brian Butler [*]</u>	<u>Field Operations Leader</u>
<u>Tony Delano ^{* +}</u>	<u>Scientist</u>

Other Certified Personnel:

_____	_____
_____	_____

*Current First Aid Training + Current CPR Training

SECTION 9

9.2 HASP APPROVALS

By signature, the undersigned approve this HASP for applicability in the protection of the health and safety of all persons entering the Becker Electronics Manufacturing site.

Bob Z...
Health and Safety Officer

6/7/94
Date

Robert C. Hardy
Project Manager

6/7/94
Date

Cynthia Surdgen
ABB-ES Health and Safety Manager

6/7/94
Date

9.3 FIELD TEAM REVIEW

I have read and reviewed the HASP for the Becker Electronics Manufacturing site, understand the information contained, and agree to comply.

NAME: _____

DATE: _____

SITE/PROJECT: Becker Electronics Manufacturing Site, East Durham, N.Y.

SECTION 9

9.4 MEDICAL DATA SHEET

This Medical Data Sheet will be completed by all on-site personnel and will be kept in the Support Zone during site operations. It is in no way a substitute for the Medical Surveillance Program requirements consistent with the ABB-ES Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more information is required, use the back of this sheet.

Project: Becker Electronics Manufacturing Site Field Investigation

Name: _____

Address: _____

Home Phone: Area Code () _____

DOB: _____ Height: _____ Weight: _____

In case of emergency, contact:

Name: _____

Address: _____

Telephone: Area Code () _____ Do you wear contacts? () Yes () No

Allergies: _____

List medication taken regularly: _____

Particular Sensitivities: _____

Previous/recent illnesses or exposures to hazardous chemicals:

Personal Physician: _____

Telephone: Area Code () _____

ABB Environmental Services

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services
CFR	Code of Federal Regulations
CRZ	contamination reduction zone
DI	deionized
eV	electron-volt potential
FOL	Field Operations Leader
HASP	Health and Safety Plan
HSM	Health and Safety Manager
HSO	Health and Safety Officer
HSS	Health and Safety Supervisor
IDLH	Immediately Dangerous to Life and Health
LEL	Lower Explosive Limit
mg/m ³	milligrams per cubic meter
NCIDA	Niagara County Industrial Development Agency
NCRDD	Niagara County Refuse Disposal District
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
ppm	parts per million
PID	photoionization detector
PM	project manager
SCBA	self-contained breathing apparatus
SLC	Secure Landfill Contractors
TWA	Time Weighted Average
VOCs	volatile organic compounds

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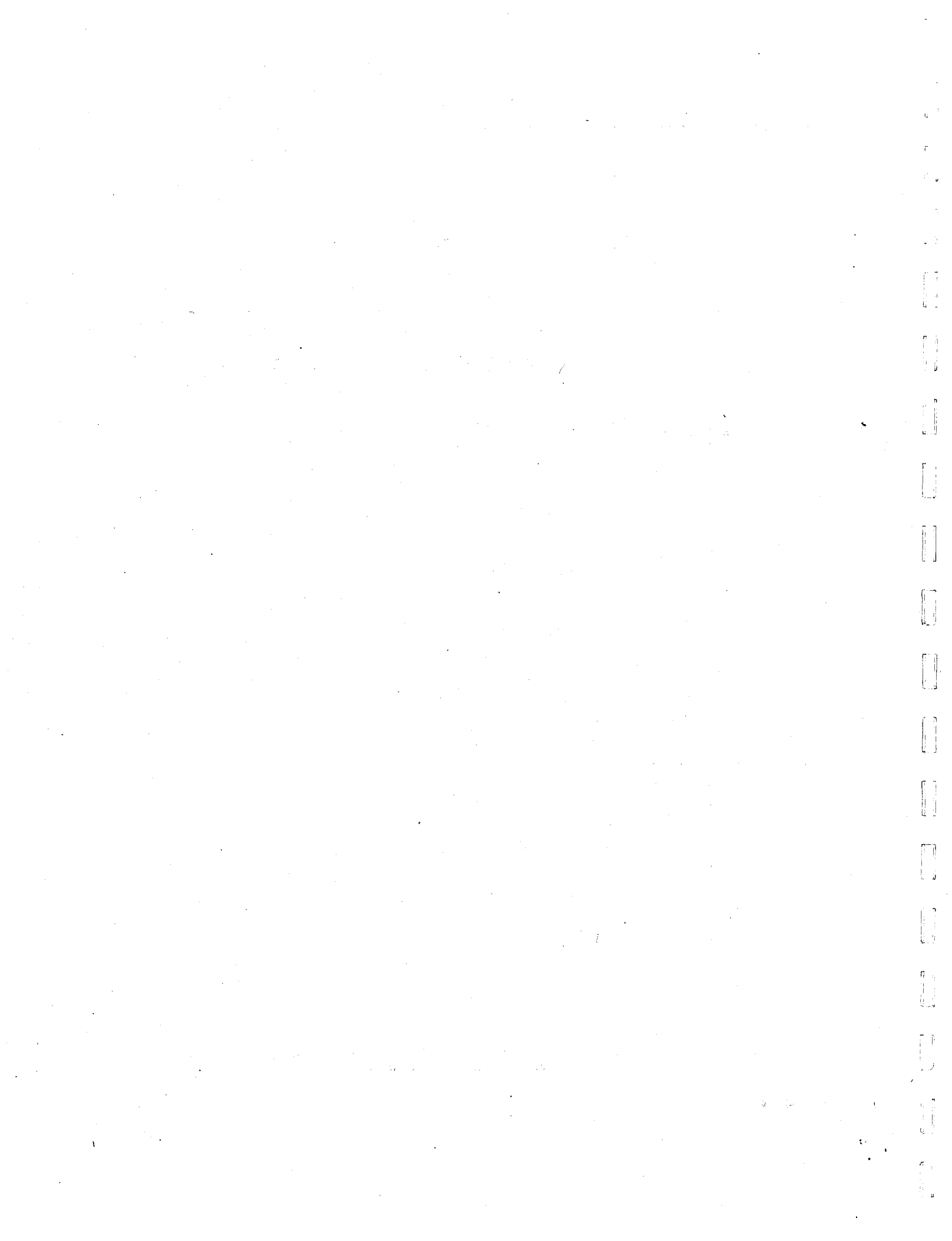
GLOSSARY OF ACRONYMS AND ABBREVIATIONS

USEPA U.S. Environmental Protection Agency
UV ultra-violet

ABB Environmental Services

Appendix B-1

OSHA JOB SAFETY & HEALTH PROTECTION POSTER



JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each

citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than \$10,000, or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

Such voluntary action should initially focus on the identification and elimination of hazards that could cause death, injury, or illness to employees and supervisors. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free consultative assistance, without citation or penalty, is available to employers, on request, through OSHA supported programs in most State departments of labor or health.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Kansas City, Missouri
New York, New York
Philadelphia, Pennsylvania
San Francisco, California
Seattle, Washington

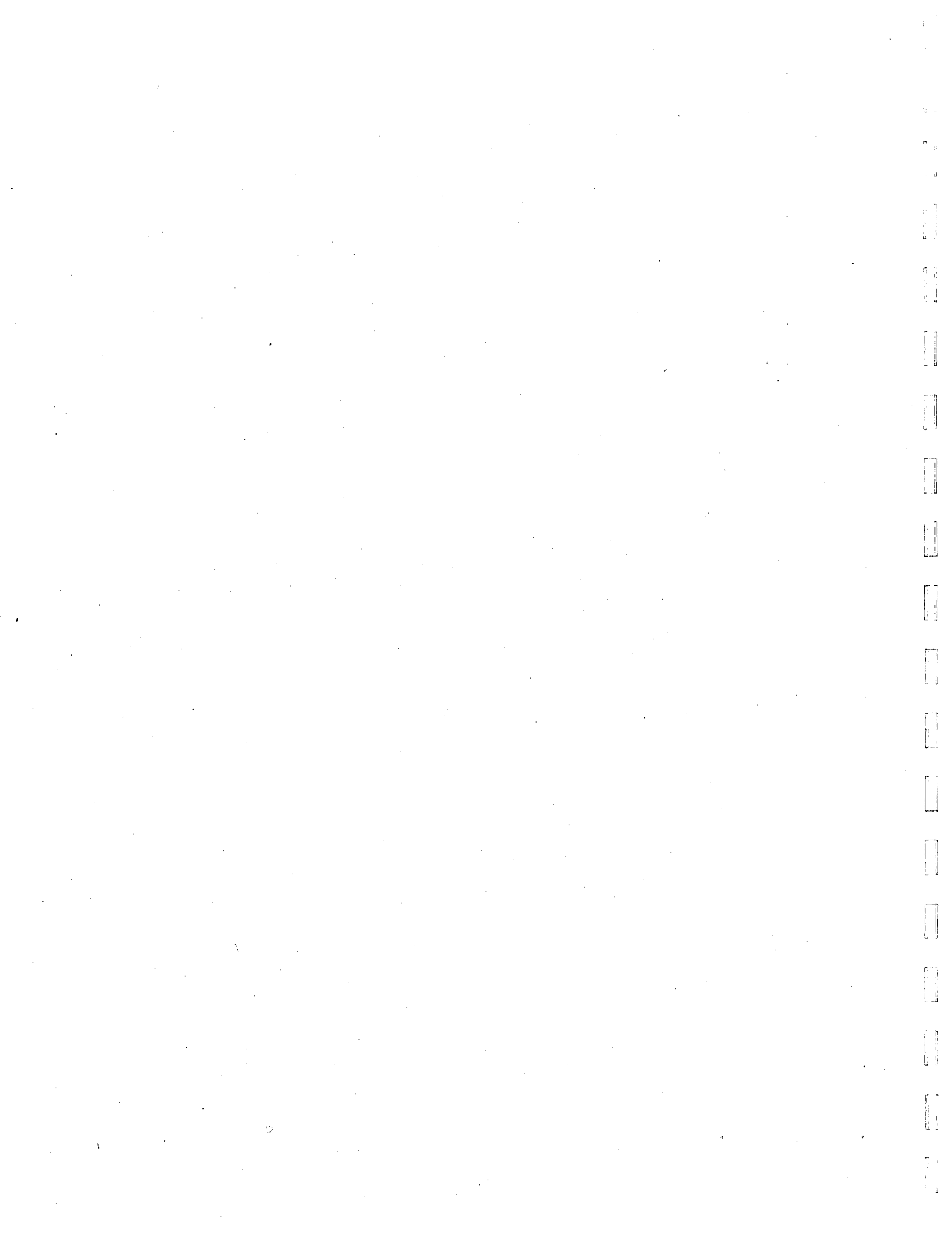
Telephone numbers for these offices, and additional area office locations, are listed in the telephone directory under the United States Department of Labor in the United States Government listing.

Washington, D.C.
1985
OSHA 2203



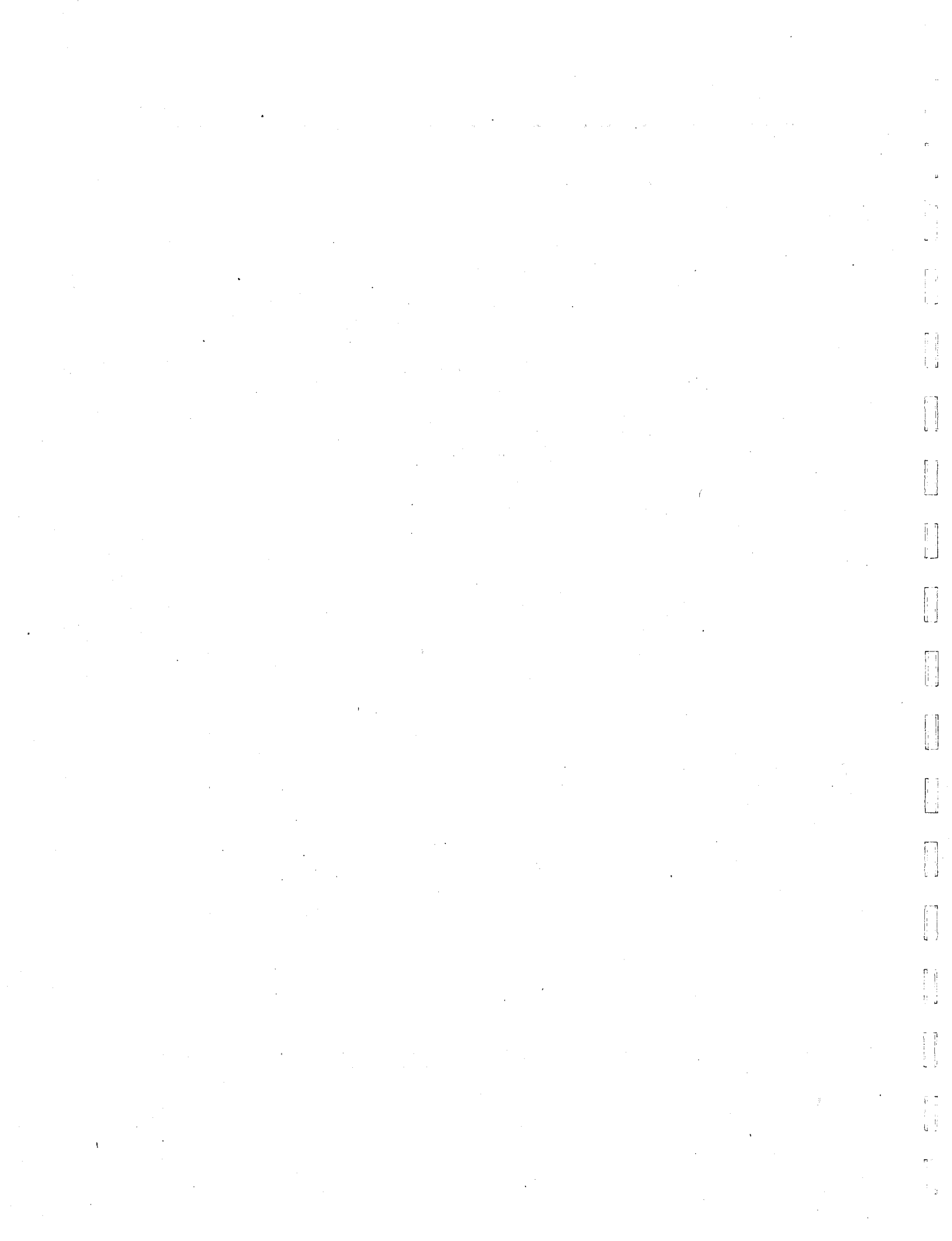
William E. Brock
William E. Brock, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration



Appendix B-2

**EMERGENCY INFORMATION
(TO BE POSTED ON-SITE)**



POST ON-SITE

EMERGENCY TELEPHONE NUMBERS

(Local) Police Department	(518) 634-7464
(Local) Rescue Service	(518) 239-6100
Primary Hospital - Columbia-Greene Medical Center	(518) 828-7601
EMR (Dr. David Barnes)	(800) 229-3674
(Local) Fire Department	(518) 943-9934
Off-site Emergency Services	(518) 239-6100
National Poison Control Center	(800) 926-1253
New York Poison Control Center	(516) 542-2323
National Response Center	(800) 424-8802
Chemical Manufacturers Association Chemical Referral Center	(800) 262-8200
Site HSO: <u>Brian Johnson</u>	(207) 775-5401
Project Manager: <u>Robert E. Handy</u>	(207) 775-5401
Regional HSS: M. MacLeod	(207) 828-3380
ABB-ES HSM: C.E. Sundquist	(207) 828-3609
NYSDEC Albany: Mr. John Stawski Project Manager	(518) 457-1641

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APPENDIX B

POST ON-SITE

Primary source of medical assistance for the Becker Electronics Manufacturing site:

- Hudson Columbia Green Medical Center
71 Prospect Ave.
Hudson, New York
(518) 828-7601

Directions to the primary source of medical assistance:

Exit site by turning right onto Route 145.
Follow Route 145 south (east)
Go through the town of Catskill, and over the Hudson River.
Follow Route 145 for approximately 1.5 miles.
Go Left, north, onto Route 9.
Continue to first flashing red light, Prospect Ave.
Go right on prospect ave, and continue up the hill.
The hospital is on the left.

Directions to the primary source of medical assistance (Figure B-1):

POST ON-SITE

EMERGENCY SIGNALS

Field personnel will carry portable radios for communications only when performing work at full Level C or Level B personal protection. If this is the case, a transmission that indicates it is of an emergency nature will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communication is not available, the following air-horn signals will be used:

HELP	three short blasts	(. . .)
EVACUATION	three long blasts	(_ _ _)
ALL CLEAR	alternating long and short blasts	(_ . _ .)

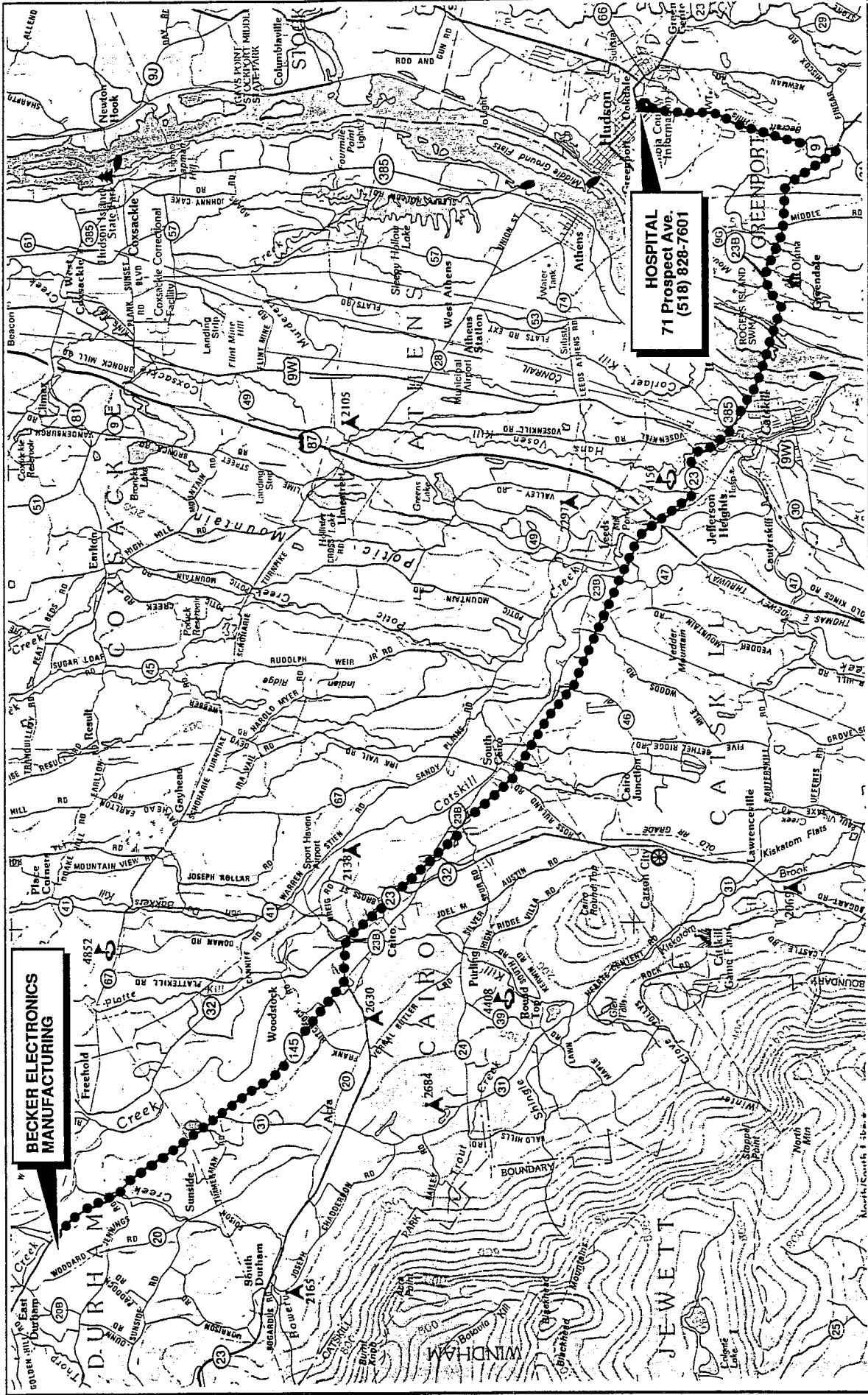


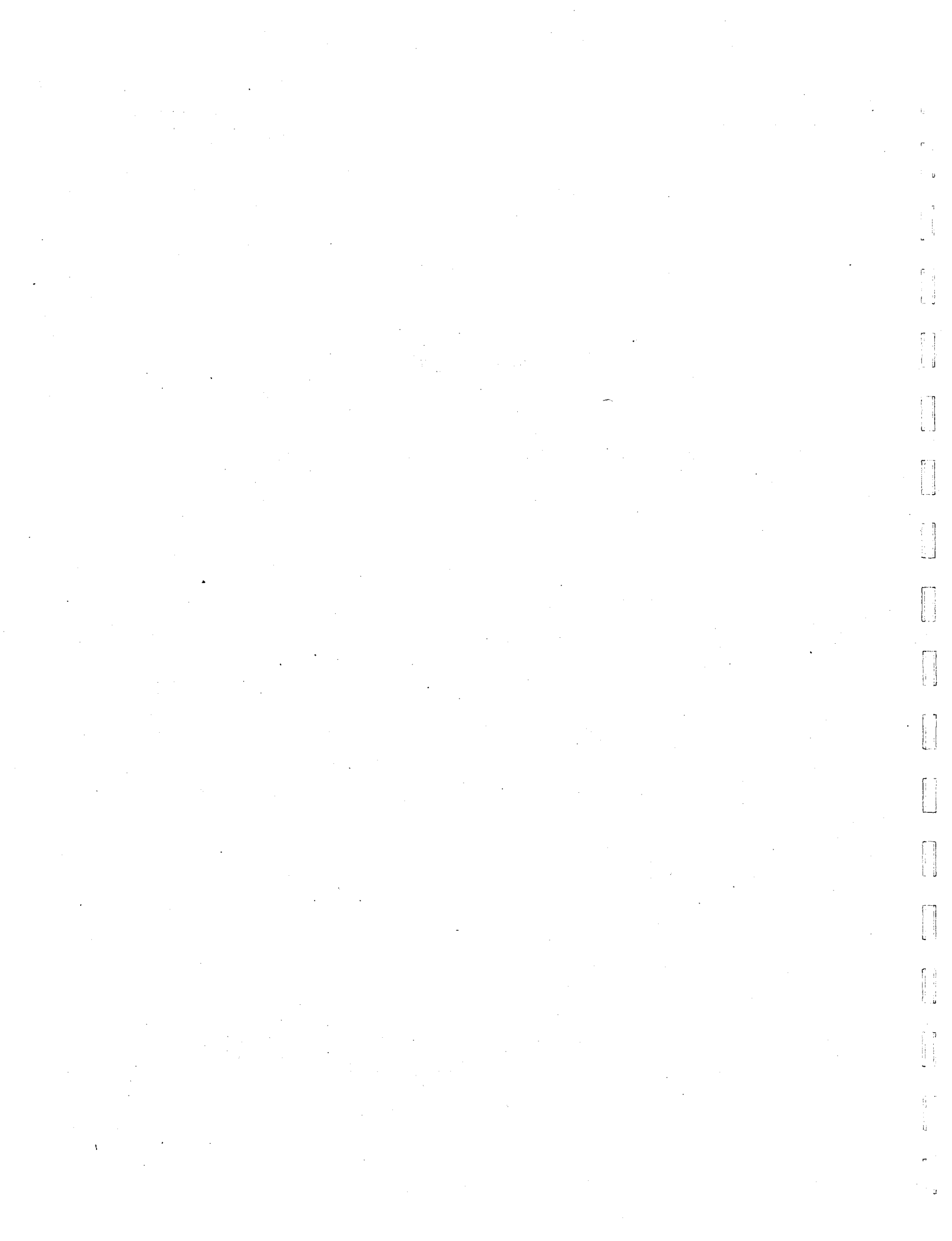
FIGURE B-1
HOSPITAL ROUTE MAP
BECKER ELECTRONICS SITE
HEALTH AND SAFETY PLAN
NEW YORK DEC

ABB Environmental Services, Inc.



Appendix B-3

**ACCIDENT REPORT FORM
AND
HSO CHECKLIST FOR FIELD OPERATIONS**



ACCIDENT REPORT FORM

Site: _____ Project No.: _____

Location: _____

Location of Accident if different from above: _____

Name and Address of Injured: _____

SSN: _____ DOB: _____

Sex: _____

Years of Service: _____ Time on Current Job: _____

Department No.: _____

Title/Classification: _____

Date of Accident: _____ Time of Accident: _____

Name of Witness: _____

Telephone No.: _____

Accident Category: Motor Vehicle Property Damage Fire
 Chemical Exposure Near Miss Other

Severity of Injury or Illness Non-disabling Disabling
 Medical Treatment Fatality

Amount of Damage: \$ _____

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APPENDIX B

Property Damaged: _____

CLASSIFICATION OF INJURY

- | | | |
|-----------------------------------------------|--------------------------------------------|------------------------------------------|
| <input type="checkbox"/> Fracture | <input type="checkbox"/> Heat Burn | <input type="checkbox"/> Cold Exposure |
| <input type="checkbox"/> Dislocation | <input type="checkbox"/> Chemical Burn | <input type="checkbox"/> Heat Stroke |
| <input type="checkbox"/> Sprain | <input type="checkbox"/> Radiation Burn | <input type="checkbox"/> Faint/Dizziness |
| <input type="checkbox"/> Abrasion | <input type="checkbox"/> Concussion | <input type="checkbox"/> Blister |
| <input type="checkbox"/> Laceration | <input type="checkbox"/> Toxic-Respiratory | <input type="checkbox"/> Bruise |
| <input type="checkbox"/> Puncture | <input type="checkbox"/> Toxic-Ingestion | <input type="checkbox"/> Poison Ivy |
| <input type="checkbox"/> Bite | <input type="checkbox"/> Toxic-Dermal | <input type="checkbox"/> Headache |
| <input type="checkbox"/> Respiratory Allergy | | |
| <input type="checkbox"/> Other(explain) _____ | | |

Parts of Body Affected: _____

Degree of Disability: _____

Date Medical Care Received: _____

Emergency Service?: _____

Name and Address of Medical Facility: _____

Follow-up Exam Required?: _____

Estimated No. of Days Away from Job: _____

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ACCIDENT LOCATION (use other side of sheet as needed)

Causative agent most directly related to accident (i.e., object, substance, material, machinery, equipment, and conditions):

Was weather a factor? How?

Unsafe mechanical/physical/environmental condition at time of accident (be specific):

Unsafe act by injured person and/or others contributing to the accident (be specific, must be answered):

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue, inattention, horseplay):

MODIFICATIONS

Level of personal protective equipment required in site safety plan: _____

Was injured person using required equipment? _____

If not, how did actual equipment use differ from plan?

Was personal protective equipment required in site safety plan adequate for site conditions? _____

If no, what additional equipment was needed?:

APPENDIX B

What can be done to prevent a reoccurrence of this type of accident (i.e., modification of machine, mechanical guards, modification of work practices, training)?:

DETAILED NARRATIVE DESCRIPTION (How did accident occur and why; objects, equipment, tools used, circumstances, assigned duties; be specific):

Signature of Preparer: _____ Date: _____

Signature of Site Manager: _____ Date: _____

**SEND COPIES OF COMPLETED FORM TO HUMAN RESOURCES
AND THE HEALTH AND SAFETY MANAGER OR SUPERVISOR.**

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HSO CHECKLIST FOR FIELD OPERATIONS

The following is a list of the minimum equipment and materials needed to fulfill the requirements for health and safety at a site. This list does not include monitoring equipment, decontamination equipment, or personal health and safety equipment (e.g., respirators, tyveks, and boots).

Need	Posted?	Paperwork
_____		Health and Safety Plan
_____		Health and Safety Plan Appendix
_____		Field Team Review Sheets
_____		Medical Data Sheets
_____	_____	OSHA Job Safety & Health Protection Poster
_____	_____	Emergency Information Sheet
_____	_____	Spare Hospital Directions
_____		Blank Accident Report Forms
_____		Visitors Logbook
_____		H & S Audit Form
_____		Confined Space Entry Forms
_____		Site-specific HASP Attachments
_____		MSDSs for Chemicals Taken On-site (other than those in HASP Appendix)
_____		1. _____
_____		2. _____

Need	Quantity	Equipment
_____	_____	First Aid Kit
_____	_____	Emergency Eye Wash Station
_____	_____	Fire Extinguisher
_____	_____	Emergency Horn
_____	_____	Emergency Stretcher/Backboard

