473-06

USATHAMA

U.S. Army Toxic and Hazardous Materials Agency

DRAFT

REMEDIAL INVESTIGATIONS/ FEASIBILITY STUDIES

TASK ORDER 1 -- SENECA ARMY DEPOT
BURNING PIT/LANDFILL
SITE INVESTIGATION

Work Plan
(Technical/Management Plans)
Contract Number
DAAA15-88-D-0009

September 1988

SENECA ARMY DEPOT LANDFILL/BURNING PIT SITE INVESTIGATION

WORK PLAN

(TECHNICAL/MANAGEMENT PLANS)

ICF TECHNOLOGY INCORPORATED
9300 LEE HIGHWAY
FAIRFAX, VA 22031

SEPTEMBER 1988

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF EXHIBITS

SENECA ARMY DEPOT LANDFILL/BURNING PIT SITE INVESTIGATION

WORK PLAN
(TECHNICAL/MANAGEMENT PLANS)

1.0 INTRODUCTION

The United States Army Toxic and Hazardous Materials Agency (USATHAMA) is undertaking a preliminary assessment/site investigation (PA/SI) of the Seneca Army Depot Burning Pit/Landfill. The purpose of this PA/SI is to determine the nature and extent of potential contamination and to assess risks to human health and the environment. This investigation will be performed by ICF Technology.

This work plan summarizes existing data and background information, and defines the scope of the PA/SI activities. It is based on:

- Objectives presented in the Statement of Work (SOW), Seneca Army Depot, Task Order Number 1 issued in September, 1988;
- Evaluation of existing data as discussed in Section 1.1;
- Conversations with USATHAMA and SEAD personnel; and
- Results of a site visit that took place on September 13-14, 1988.

Section 1.1 of the work plan summarizes existing data; 1.2 and 1.3 detail the primary objectives and scope of the investigation. Section 2 presents the field operations plan and outlines the proposed work plan tasks and the rationale for the proposed work plan approach. Section 3 summarizes the laboratory analysis methodology. Section 4 summarizes the quality assurance and quality control program for the investigation, which is presented in detail in the Project QC Plan in Appendix A. The implementation of USATHAMA's data management program is summarized in Section 5 and detailed in Appendix B - Data Management Plan. A Health and Safety Plan has been developed to assure that field operations are conducted in a safe manner. This plan is summarized in Section 6 and is included as Appendix C. Assessment and reporting aspects of the investigation are discussed in Section 7. The management plan is provided in Section 8, and describes the management structure for the project, lists proposed personnel and duties, and presents a resource utilization plan.

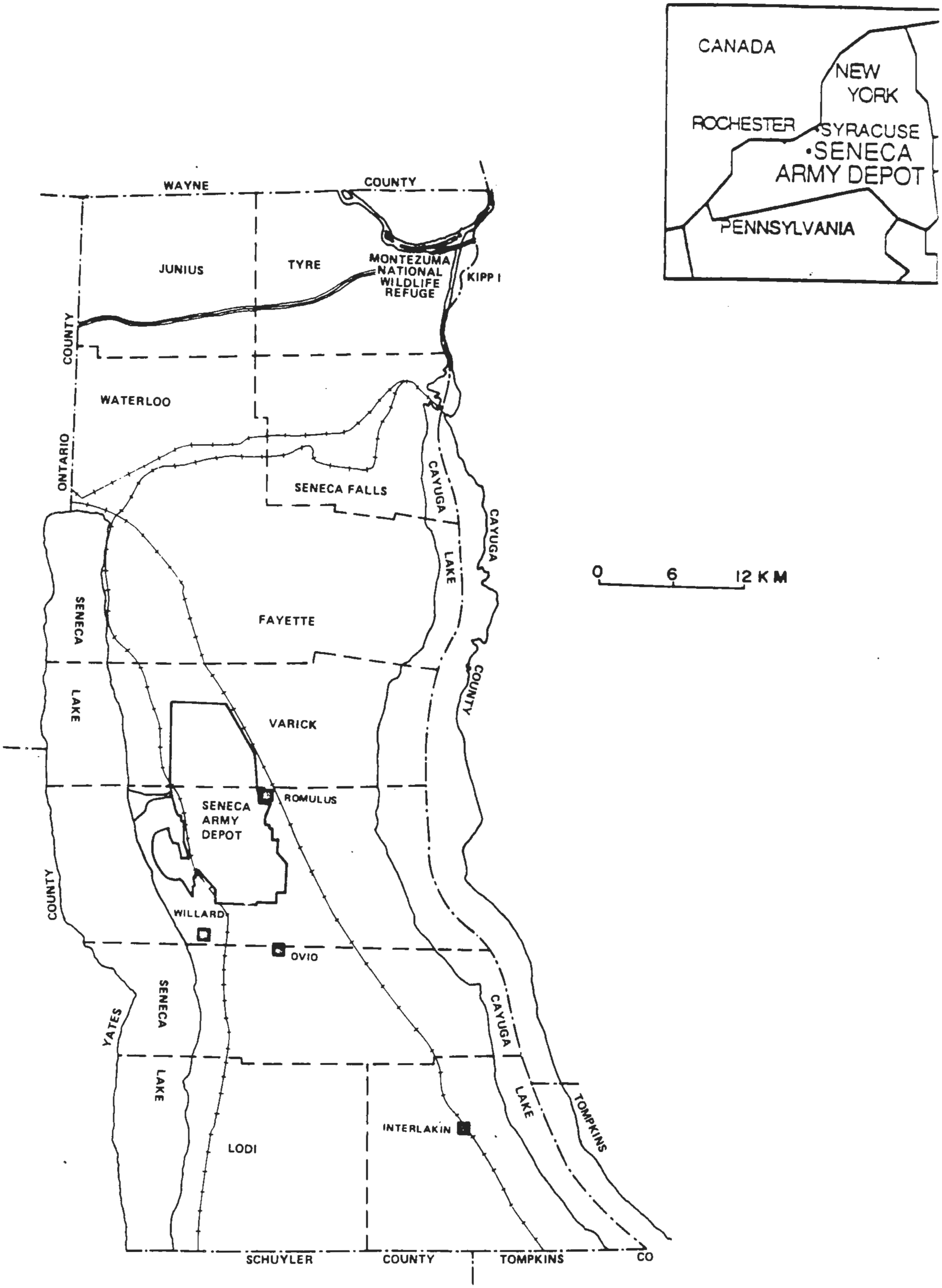
1.1 BACKGROUND

1.1.1 Site History and Characteristics

The Seneca Army Depot (SEAD) is located in the Finger Lakes region of Central New York State, Seneca County (Exhibit 1-1). It is on the west side of the highland separating Seneca Lake and Cayuga Lake. The Depot is approximately 80 kilometers (km) southeast of Syracuse and 50 km northwest of

EXHIBIT 1-1

AREA MAP - SENECA ARMY DEPOT



From: Report No. 157, USATHAMA, January 1980, subject: Installation Assessment of SEAD.

Ithaca. Geneva, the nearest city is located approximately 24 km northwest of the installation. The depot consists of 27,013 hectares of land and a 1524-meter airstrip. Much of the depot area is wooded. Sparsely populated farmland covers most of the surrounding area.

Construction of Seneca Ordnance Depot began in July 1941. Later expansion included the airstrip from the former Sampson Air Force Base. Civilian employment peaked in 1943 at 2,500, and reached its low in 1946 at 600. Military employment is approximately 300 to 400. Present civilian employment is near 700. In August 1963, Seneca Ordnance Depot was transferred from the Chief of Ordnance to the U.S. Army Supply and Maintenance Command and renamed Seneca Army Depot. On 1 July 1966, SEAD was reassigned to the Army Materiel Command (AMC). On 1 September 1976, the Depot and Supply Command (DESCOM) was activated with command and control over all AMC depots.

The general mission of the installation currently includes: providing for the receipt, storage, stock distribution, and care of conventional ammunition and explosives, General Services Administration Strategic and critical materials, and Office of Civil Defense engineering equipment; providing receipt, storage, and issue of items in regards to Special Weapons activity; and to perform Depot-level maintenance, demilitarization, and surveillance on conventional ammunition and special weapons.

The PA/SI of this task order is to be conducted at a region midway up the western edge of the Seneca Army Depot (Exhibit 1-2). This site is a level field that gently slopes to the west. The site is grass-covered, with a number of small drainage ditches running east-west across it. North of the site is a swampy area. The area to be investigated encompasses approximately 22.1 acres.

The site contains a number of possible sources of contamination. These sources include:

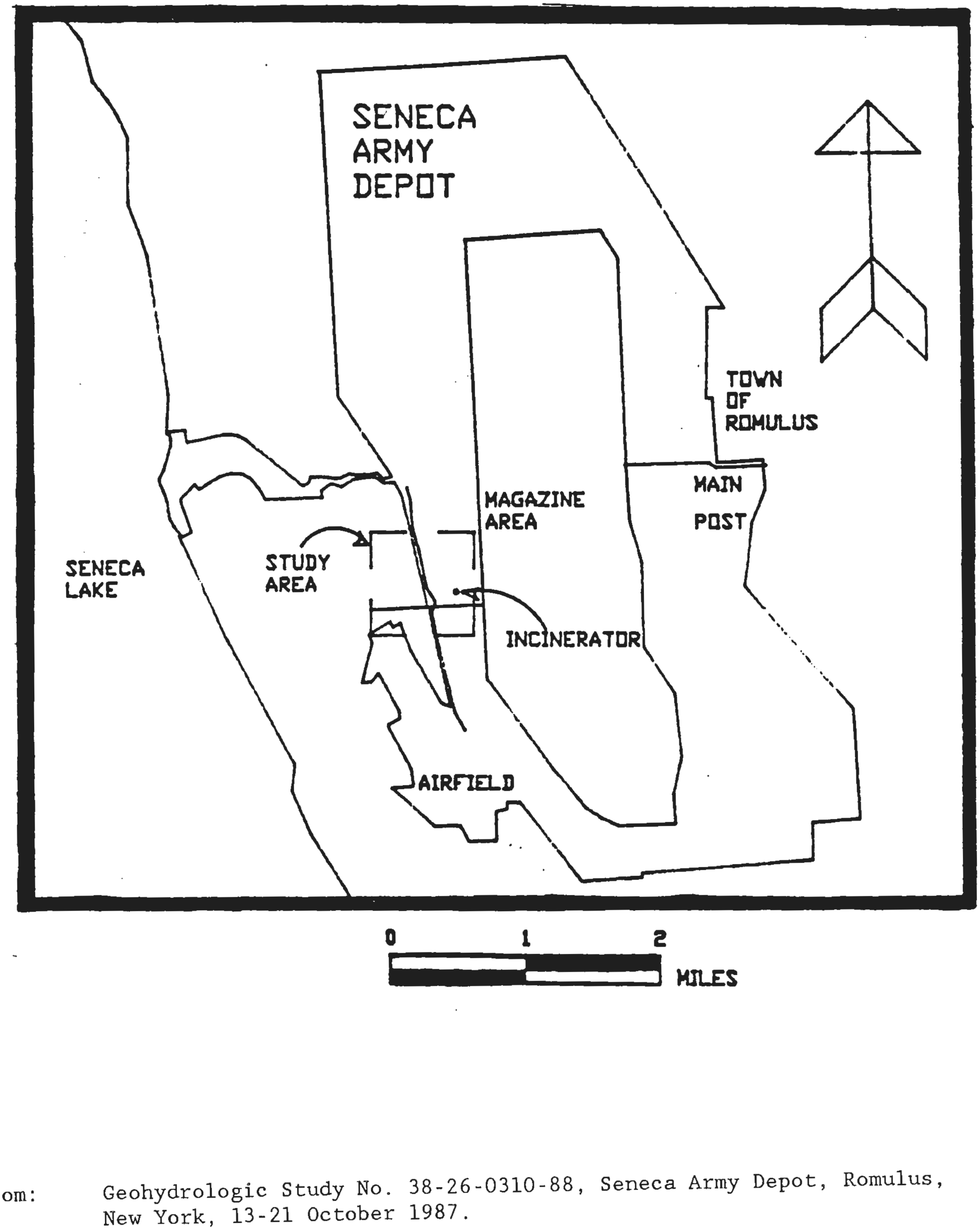
- A former incinerator, used to incinerate trash between 1974 and 1979, and its associated cooling water pond;
- A landfill adjacent to the incinerator on the east side used for disposal of ash, between 1974 and 1979;
- A burning pit, just to the north of the incinerator and within the landfill area, designated to burn noncontaminated trash from 1941 to 1974; and
- Grease pits - unlined pits used for the disposal of kitchen grease.

The landfill and ash pit areas encompass approximately 5 acres.

The SEAD has applied for a RCRA permit for storing hazardous waste and for operating a deactivation furnace. The Hazardous and Solid Waste Amendments of 1984 to the RCRA requires that a Part B permit must include identification and corrective action at solid waste management units (SWMU's) with continuing release of hazardous constituents. Recently, U.S. Army Environmental Hygiene Agency (USAEHA) performed a review of SEAD's SWMUs. The

EXHIBIT 1-2

LOCATION OF THE STUDY AREA



From: Geohydrologic Study No. 38-26-0310-88, Seneca Army Depot, Romulus, New York, 13-21 October 1987.

SWMUs in the area of this study include the old incinerator with its cooling water pond, the ash and burn pits, and two closed landfills. Corrective action at a SWMU site must be coordinated with and approved by the appropriate regulatory agency.

1.1.2 Physical Setting

Seneca Army Depot (SEAD) is located within the glacial till plain of the Central Lowlands Physiographic Province with the glacial lake plain on the north and the Appalachian Plateau to the south. Exhibit 1-3 is a physiographic map of Seneca County, New York.

a) Site Physiography

SEAD is situated 64 km south of Lake Ontario in the immediate vicinity of Romulus, New York. The Depot lies on the western side of a broad north to south trending series of rock terraces forming a divide that separates Cayuga Lake on the east and Seneca Lake on the west. Elevations of SEAD range from a low of 137 meters above mean sea level on the west boundary to a high of 232 meters in the southeast corner.

Surface runoff from SEAD generally flows in two directions. Most of the streams flow to the west into Seneca Lake; however, one stream in the northeast corner of SEAD flows northward into Kendig Creek, a tributary to the Cayuga-Seneca Canal. Surface runoff in the extreme southeast corner drains to the east for a short distance offpost and then turns west across the depot into Seneca Lake.

b) Surficial/Bedrock Geology

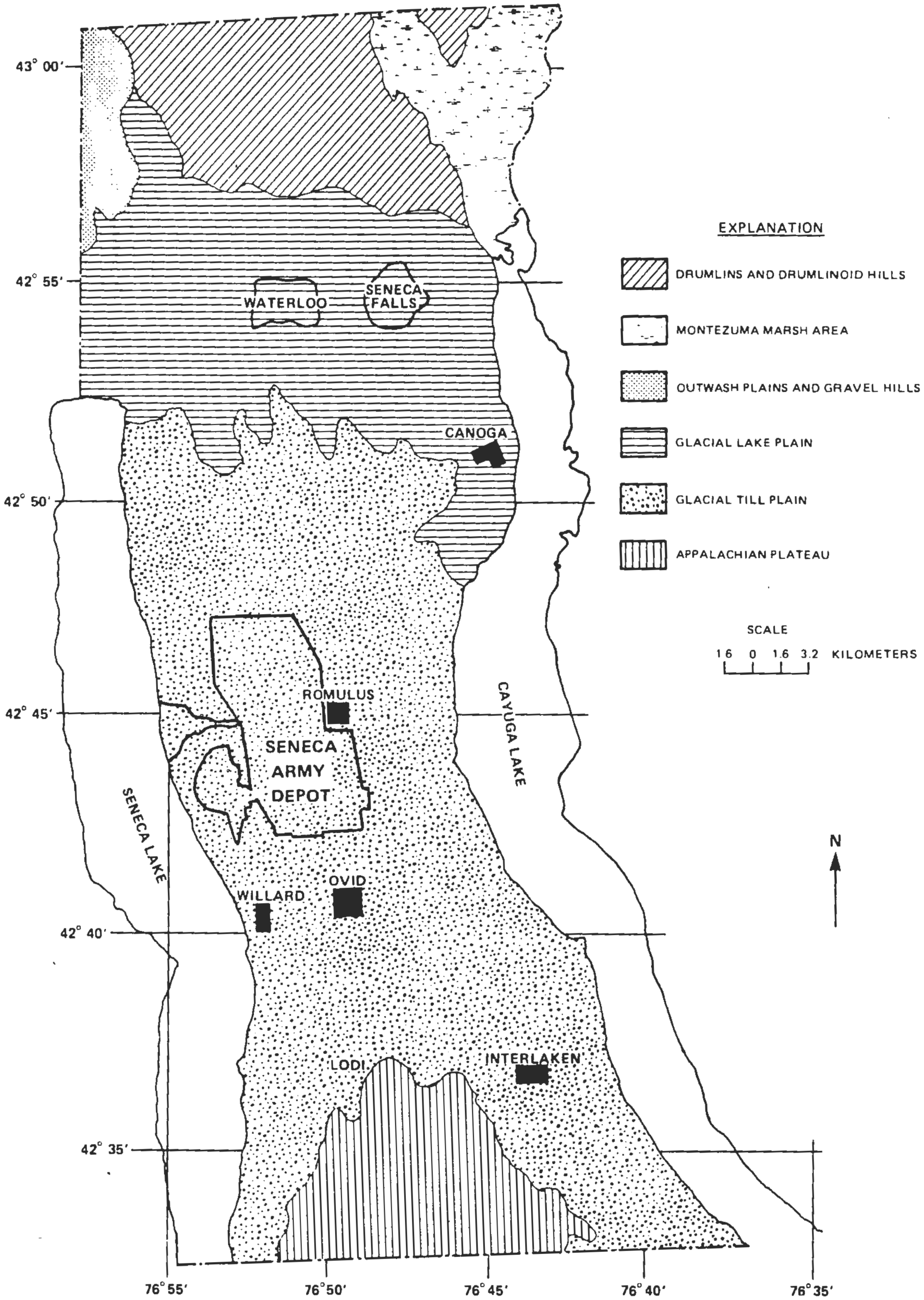
A mantle of consolidated glacial deposits overlies Middle Devonian Age bedrock throughout the southern two-thirds of Seneca County. These deposits range in thickness from less than 0.3m to 12m. The thickest of these deposits occurs over buried pre-glacial valleys to the north. In the vicinity of SEAD, surficial deposits consist of unsorted, nonstratified brown silky-sandy-gravely till, typically with a very low permeability. The maximum thickness of glacial deposits at SEAD is estimated to be 3m, which occur primarily in the southern part of the installation. Some alluvial sands and gravels occur along the streambeds. In general, the surface of SEAD consists of a west and north sloping eroded bedrock, or residual soil surface.

The SEAD is underlain by a series of Middle Devonian shales that make up the Hamilton Group. The composite thickness of the units beneath the depot is approximately 500 feet. They dip evenly at a shallow angle to the south at a rate of approximately 6m per km. Exhibits 1-4 and 1-5 delineate a geologic map and cross sections of Seneca County, New York, respectively.

More specifically, beneath the relatively impermeable glacial till lies highly weathered and fractured Moscow shale, usually about 5 feet thick. The shale becomes increasingly harder and less fractured and weathered with depth. The shale is generally massive, displaying very few if any bedding features.

EXHIBIT 1-3

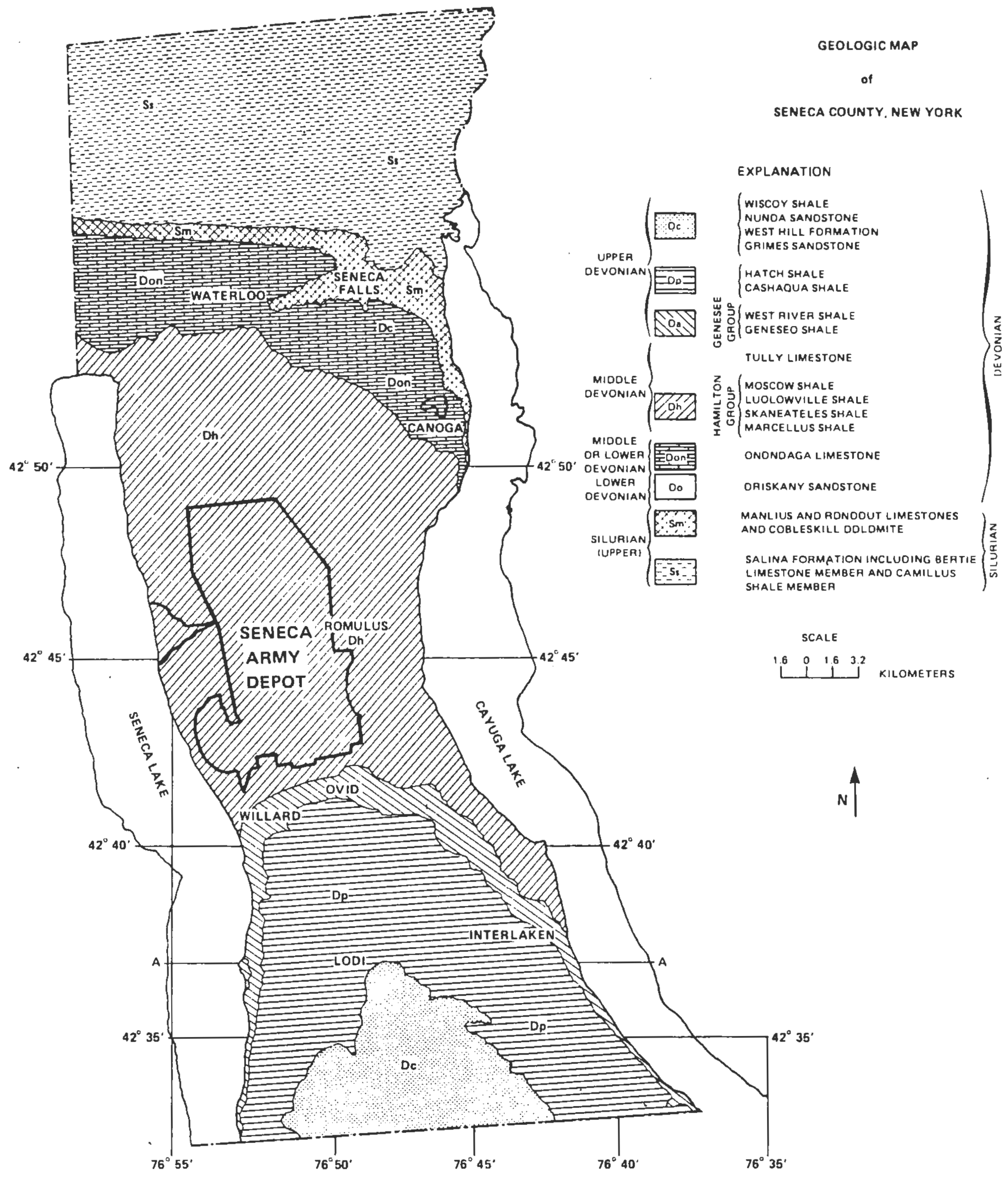
PHYSIOGRAPHIC MAP OF SENECA COUNTY, NEW YORK



From: Report No. 157, USATHAMA, January 1980, subject: Installation Assessment of SEAD.

EXHIBIT 1-4

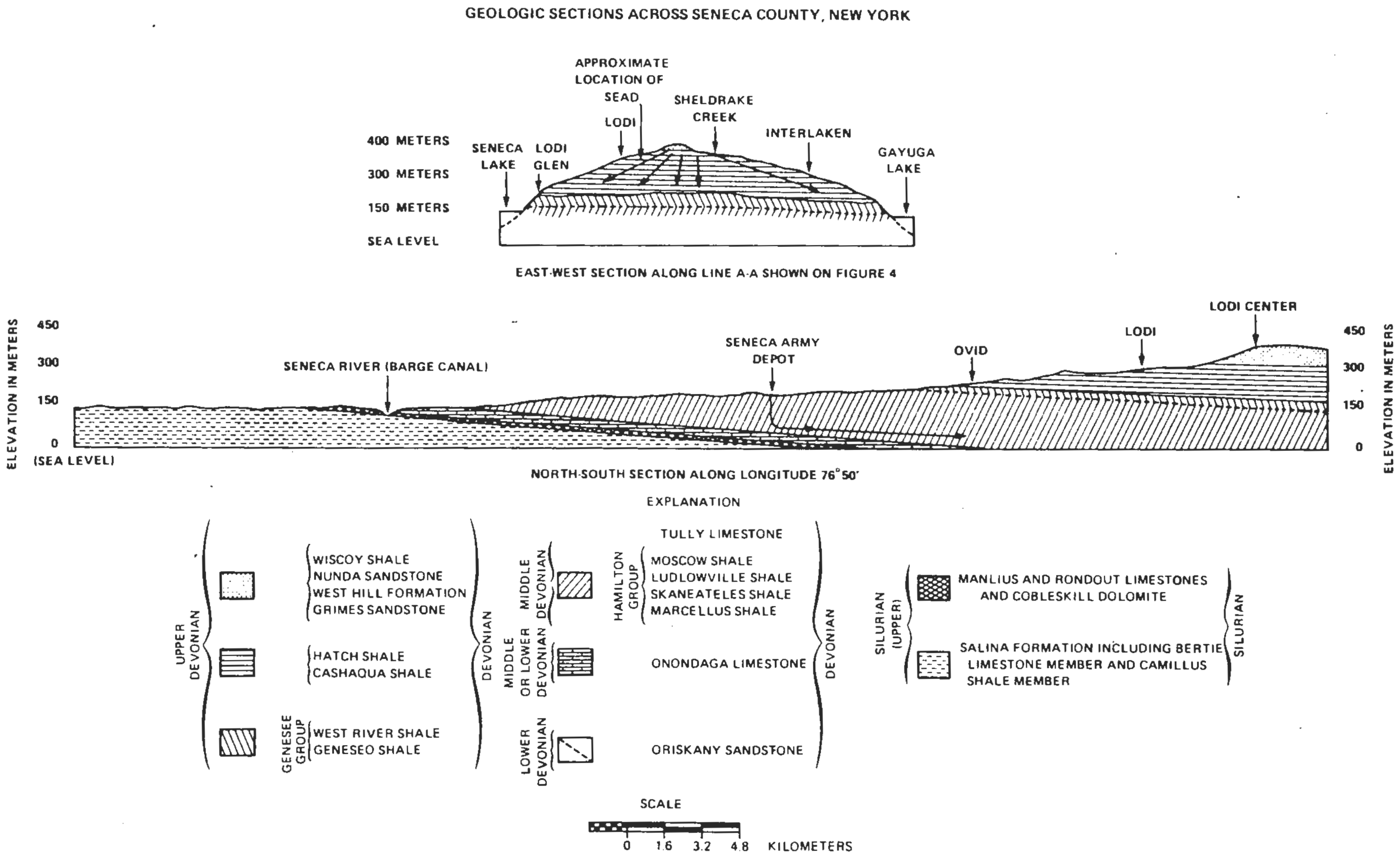
GEOLOGIC MAP OF SENECA COUNTY, NEW YORK



From: Report No. 157, USATHAMA, January 1980, subject: Installation Assessment of SEAD.

EXHIBIT 1-5

GEOLOGIC CROSS SECTIONS OF SENECA COUNTY, NEW YORK



From: Report No. 157, USATHAMA, January 1980, subject: Installation Assessment of SEAD.

c) Climate

Seneca County lies in the plateau district that parallels the southern shore of Lake Ontario. The average elevation in this area is lower than the surrounding elevations in New York State, with the exception of the Coastal region. SEAD is flanked by Seneca and Cayuga Lakes which, along with Lake Ontario, significantly moderate the local climate.

The average minimum and maximum temperatures recorded over a period of 23 years (1955 to 1978) in the adjacent town of Romulus are -3.8°C and 21.7°C, respectively. The hottest month of the year in the area is July, with an average temperature of 26.7°C. The coldest month is January, with an average daily temperature of -15.6°C. The average annual precipitation is 75.5 centimeters (cm).

The average growing season has a length of 159 days. The first and last killing frosts usually occur October 11 and May 5.

d) Soils

Poorly-drained silty clay loam and clay loam soils are predominant at SEAD. These poorly-drained soils have been mapped by the Soil Conservation Service as part of the Davies Angola Association. Well-drained and moderately well-drained silt loams of the Honeoye-Lima Association are present along the western edge of SEAD and all land between the depot and Seneca Lake. The soil associations have been developed from the glacial till or underlying shale bedrock. Exhibit 1-6 is a soil map of Seneca County, New York.

e) Hydrogeology

Except for an area in the southern part of the depot, groundwater occurs in the fractured and weathered shale confined to semiconfined between the glacial till and unweathered shale bedrock. In the southern part of SEAD, groundwater is encountered in glacial and alluvial sands and gravels, as well as in the shale. Depths to groundwater on SEAD are generally shallow (between 0.3 and 7m below the surface), and recharged by infiltration of rainwater, streams, or ponds. The shale below 10 feet is essentially dry, although some groundwater undoubtedly flows through fractures.

The hydraulic conductivity of the fractured and weathered shale is much higher than either the overlying glacial till or the underlying unweathered shale. Late winter to early summer is the time of higher groundwater levels. Groundwater levels appear to be lowest in late summer to early winter.

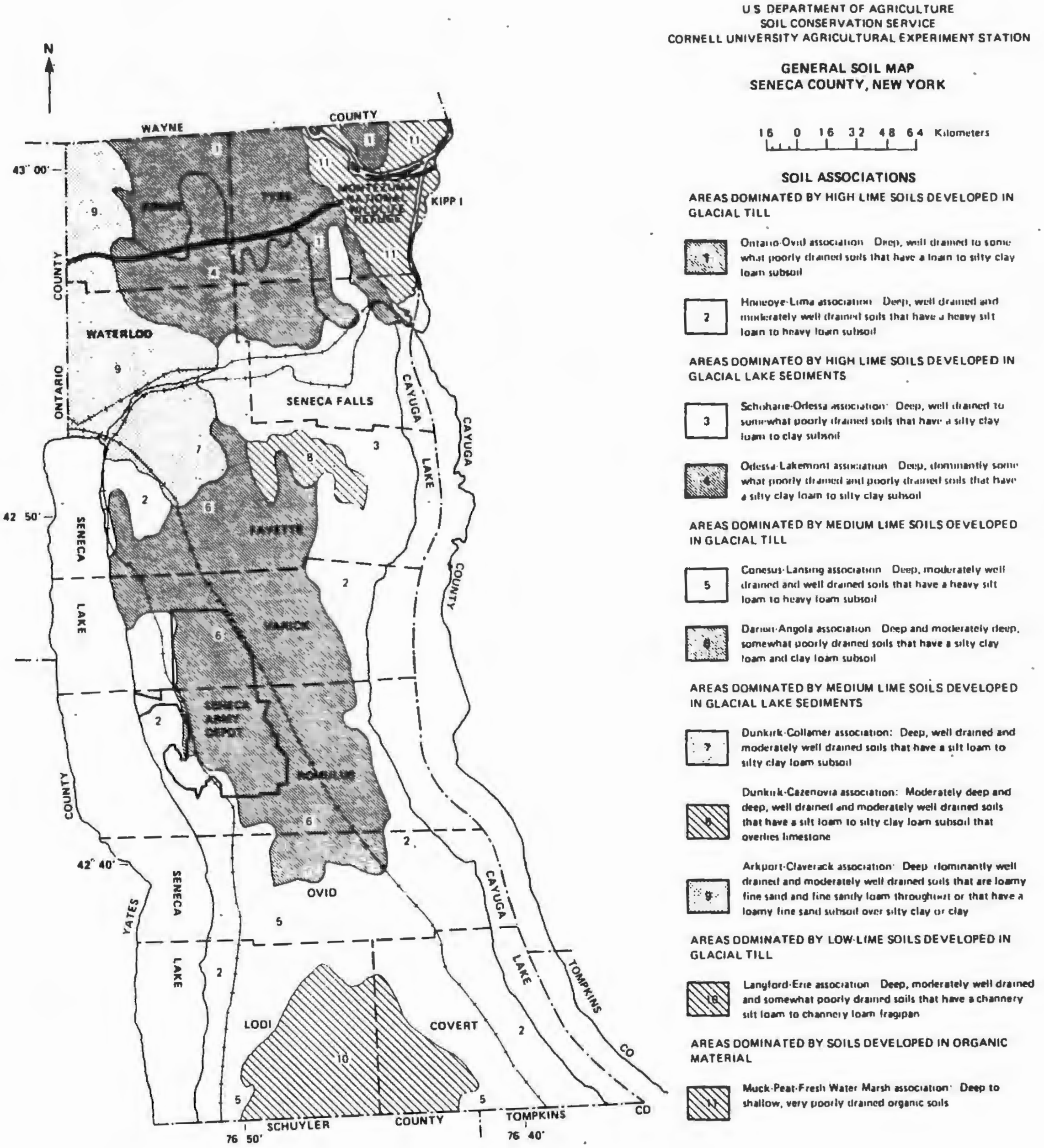
Exhibit 1-7 is a groundwater surface map of the site. The groundwater flows evenly across the site toward the west-southwest. North of the landfill is a swampy area. This does not appear to affect the flow of the groundwater.

f) Geological Aspects of Potential Migration

Migration of contaminants from the incinerator and adjacent landfill will flow as surface runoff west into Seneca Lake via streams, culverts, and/or ditches. Most drainage will enter the small stream located near the north end of the Seneca Army Airfield, which eventually flows into Seneca Lake.

EXHIBIT 1-6

SOIL MAP OF SENECA COUNTY, NEW YORK



U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
SENECA COUNTY, NEW YORK

SOIL ASSOCIATIONS

AREAS DOMINATED BY HIGH LIME SOILS DEVELOPED IN GLACIAL TILL

1 Ontario-Ovid association Deep, well drained to somewhat poorly drained soils that have a loam to silty clay loam subsoil

2 Honeoye-Lima association Deep, well drained and moderately well drained soils that have a heavy silt loam to heavy loam subsoil

AREAS DOMINATED BY HIGH LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

3 Schoharie-Odessa association: Deep, well drained to somewhat poorly drained soils that have a silty clay loam to clay subsoil

4 Odessa-Lakemont association Deep, dominantly somewhat poorly drained and poorly drained soils that have a silty clay loam to silty clay subsoil

AREAS DOMINATED BY MEDIUM LIME SOILS DEVELOPED IN GLACIAL TILL

5 Conesus-Lansing association Deep, moderately well drained and well drained soils that have a heavy silt loam to heavy loam subsoil

6 Darien-Angola association Deep and moderately deep, somewhat poorly drained soils that have a silty clay loam and clay loam subsoil

AREAS DOMINATED BY MEDIUM LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

7 Dunkirk-Collamer association: Deep, well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil

8 Dunkirk-Cazenovia association: Moderately deep and deep, well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil that overlies limestone

9 Arkport-Claverack association: Deep dominantly well drained and moderately well drained soils that are loamy fine sand and fine sandy loam throughout or that have a loamy fine sand subsoil over silty clay or clay

AREAS DOMINATED BY LOW-LIME SOILS DEVELOPED IN GLACIAL TILL

10 Langford-Erie association Deep, moderately well drained and somewhat poorly drained soils that have a channery silt loam to channery loam fragipan

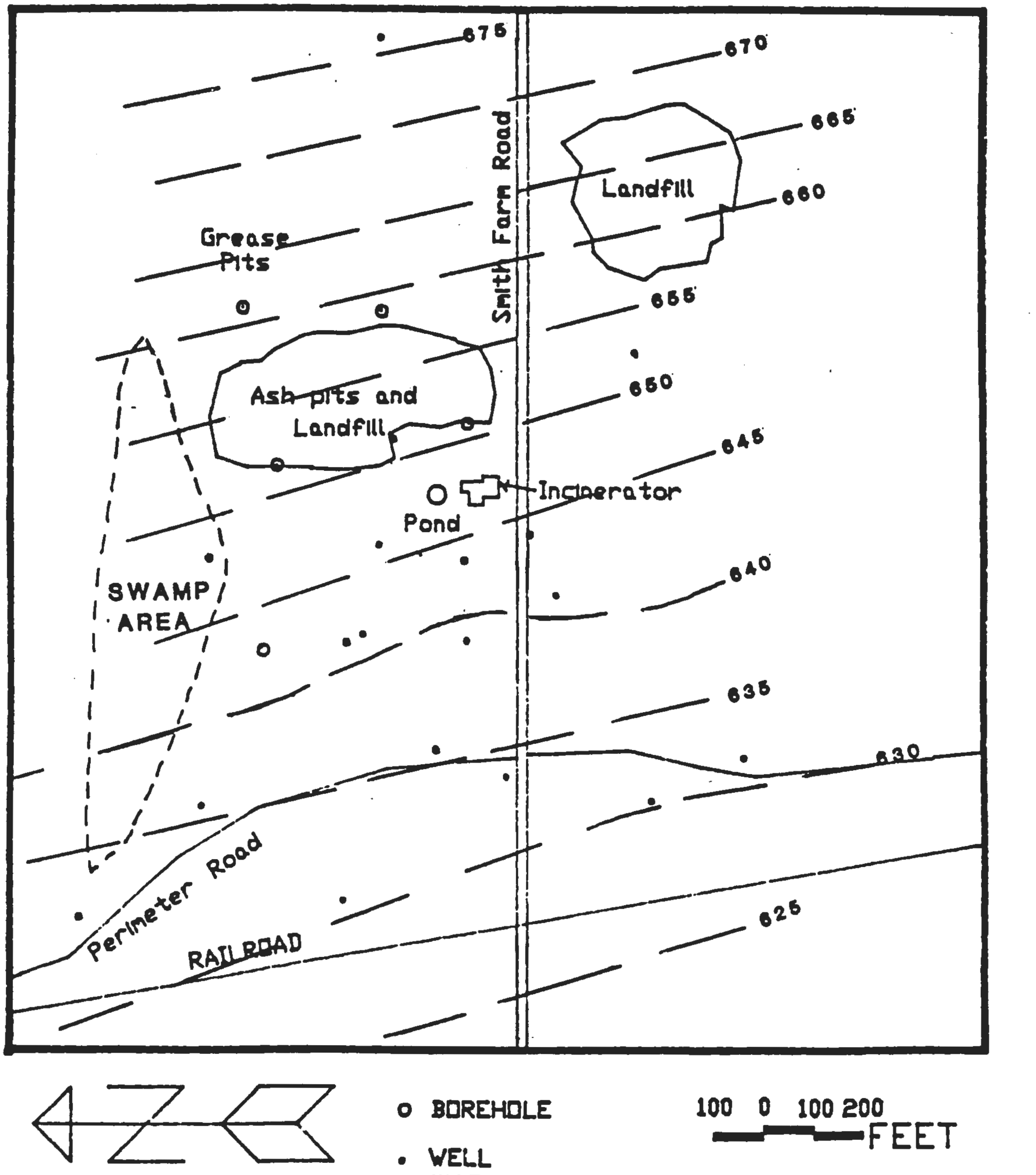
AREAS DOMINATED BY SOILS DEVELOPED IN ORGANIC MATERIAL

11 Muck-Peat-Fresh Water Marsh association: Deep to shallow, very poorly drained organic soils

From: Report No. 157, USATHAMA, January 1980, subject: Installation Assessment of SEAD.

EXHIBIT 1-7

MAP OF THE GROUNDWATER SURFACE AT SENECA ARMY DEPOT



From: Geohydrologic Study No. 38-26-0310-88, Seneca Army Depot, Romulus, New York, 13-21 October 1987.

The potential for contaminant migration into the subsurface exists at SEAD, especially in the western portions of the depot. In these areas, contaminants may migrate vertically through the permeable glacial till alluvial sands and gravels, or jointed shale bedrock, all of which occur near-surface. Horizontal migration would generally be to the west or southwest following bedding planes. Generally though, contamination would be limited to the upper water supplies. Deeper water-bearing strata beneath the shales of the Hamilton Group are much less susceptible to recharge from over-lying strata. Vertical migration of contaminants from the surface of SEAD would not be expected to reach these lower-lying aquifers.

1.1.3 Previous Investigations

An Initial Installation Assessment was conducted in June, 1979, by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), with a report published in January 1980. This investigation consisted of a records search and interviews conducted with present and former SEAD employees. The purpose of this program was to assess the environmental quality of SEAD with regard to the use, storage, treatment, and disposal of toxic and hazardous materials, and to define any conditions which may be adversely affecting health and welfare or result in environmental degradation.

This data review identified potentially contaminated areas at the facility including old landfills, the perimeter of the exclusion area, the demolition and burning area, radioactive burial sites, and certain areas which receive effluent from the sewage treatment plants. The potential for groundwater contamination was concluded to exist in the vicinity of the former incinerator at Building 2207 and it's adjacent landfill.

Potential contaminants at the SEAD facitlity were speculated to include heavy metals (lead, zinc, chromium, and nickel), herbicides, explosives, and radioactive residues. This assessment also suggested that the potential for contamination of shallow groundwater at SEAD is enhanced by the presence of shale, limestone, and alluvial deposits present on-site.

In March, 1988, USATHAMA published an update of the Initial Installation Assessment and recommended that a site investigation be conducted for the vicinity of the former incinerator and the adjacent landfill.

Subsequent to publication of the Initial Installation Assessment report, several programs were initiated by SEAD to evaluate report recommendations. The US Army Environmental Hygiene Agency (USAEHA) conducted a monitoring program at the demolition burning ground to determine the existence of groundwater contamination related to past burning and disposal operations at the site. This monitoring program extended to the area of the incinerator and landfill. USAEHA installed 14 groundwater wells in this vicinity, and samples have been analyzed from these wells on a semi-annual basis.

The most recent analytical results of the program in the area of the incinerator are presented in USAEHA Geohydrologic Study No. 38-26-0313-88 (October, 1987). The purpose of the monitoring program was to investigate the groundwater contamination associated with the former incinerator at SEAD and to determine the direction, extent, and nature of the contaminant plume, and the risk to human health. As presented in the study report, boreholes were installed across the incinerator site, and groundwater samples were drawn from these boreholes and sent to USAEHA labs and analyzed for volatile organic compounds. The data from these samples and from the existing monitoring wells indicated contamination by organic solvents, and outlined the general extent of a contaminant plume. New monitoring wells and additional sampling boreholes were completed at the site based on those samples.

The study report also concludes that contamination forms a definite plume, with two main constituents, trichloroethene and trans-1,2-dichloroethene. Chloroform, 1,2-dichloroethane, vinyl chloride, and a floating product that appeared to be diesel fuel were also detected.

Seneca Army Depot has instituted a sampling program for the privately-owned offpost well. No groundwater contamination has been detected offpost in private wells. As reported in the USAEHA Geohydrologic Study groundwater contamination was also not detected in the well installed in the far northeast corner of the airstrip. However, it is reported that based on the results from the wells onpost near the facility boundary, the contamination has probably migrated offpost at levels exceeding drinking water standards. Surface water sampling also shows that contamination may extend to surface water, and may have moved offpost. It was suggested that the offpost surface water contamination is probably due to contaminated groundwater seeping to the surface and not direct surface water flow.

The USAEHA Geohyrologic Study Report recommended that contaminated surface water be collected and sampled before it flows offpost; that appropriate technologies for the collection and treatment of contaminated groundwater be investigated; that contamination source areas be excavated and cleaned; that contaminated materials be properly disposed of; and that corrective actions be negotiated with regulatory agencies, and the extent of the plume offpost be investigated.

During an initial site inspection conducted on September 13, 1988, an examination of drawings and discussions with SEAD personnel revealed the presence of an underground diesel fuel storage tank at the site, and two dry/wet wells within the incinerator building. These additional potential source areas will be addressed during the planned site investigation.

1.2 TASK OBJECTIVES

The objective of this task is to conduct a site investigation in the vicinity of the former burning pits, incinerator and adjacent landfill at Seneca Army Depot. This study will encompass detailed investigations of the source area and will be directed toward developing specific interim remedial measures for the source areas and/or the contaminated groundwater.

1.3 SCOPE OF THE SITE INVESTIGATION

The work plan for this task encompasses several related activities within the study area, as follows:

- A soil-gas survey will be conducted within the landfill area and downgradient of the area to determine likely locations of major sources and contaminant plume information.

- An electromagnetic (EM) survey will be conducted across the study area to determine the limits of the disturbed soils within the landfill, to determine the presence and location of buried drums or other metallic containers, and to clear locations where soil-gas and soil samples will be collected. Both in phase and quadrature EM fields will be measured, so that a separate magnetometer survey will not be required.

- Soil samples will be collected for USATHAMA-certified laboratory analysis for volatile contaminants and metals, from locations dictated by the results of the soil-gas and geophysical surveys.

- Samples will be collected from several of the existing monitoring wells for USATHAMA-certified laboratory analysis for volatile conatminants and metals.

- Simple aquifer tests (slug tests) will be performed on several of the existing monitoring wells.

- Results will be interpreted to assess the nature and extent, of the contamination problem, and to evaluate alternatives for interim response actions at the site.

2.0 FIELD OPERATIONS PLAN

2.1 GENERAL APPROACH

All operations to be conducted during this task will be performed in accordance with the specifications contained in Contract DAAA15-88-D-0009 and Task (Delivery) Order No. 1 -- SENECA Army Depot Burning Pit/Landfill Preliminary Assessment Site Investigation. Specific requirements contained and referenced in the Task Order are addressed within this work plan and appendices.

2.2 GEOPHYSICAL SURVEY INVESTIGATION

2.2.1 Objectives

The objectives of the geophysical survey are: to detect the presence and/or absence of buried metal (drums) within the western-most Landfill and Ash Pit areas; to delineate areas of significant groundwater contamination alleged to be emanating from the Landfill and Ash Pit areas; and to define the boundaries of the Landfill and Ash Pit areas. The geophysical survey will complement and support further investigations by a soil-gas survey for groundwater contamination evaluation, and for locating any buried drums.

2.2.2 Site Characteristics

The site is underlain with glacial deposits consisting of a brown silty-gravely-clay, underlain by a weathered shale, which is underlain by a hard shale. Groundwater depths vary from 4 to 6 feet, depending on surface elevation, and no groundwater is encountered within the hard shale portion of the subsurface. Thickness of the silty-clayey material varies from 2 to 8 feet, while the weathered shale thicknesses varies from 1 to 8 feet. The site is perceived to have a shallow (< 10 feet) groundwater contamination problem with the depth of the landfill probably less than 7 feet, due to the shallow water table. Monitor wells drilled on the site reveal that the groundwater is contaminated with organics (solvents) from an unknown origin. There are no records of volatile organics being placed in the landfill.

Groundwater flow has been determined to be in a west-southwesterly direction, toward Seneca Lake. Groundwater contamination has been detected near the property boundary of the Depot. No groundwater contamination has been detected in private homeowner wells off-site. This may be partially due to the fact that the homeowners' wells utilize a deeper aquifer within the shale.

On the site a small incinerator facility exists which is no longer in operation. A road (Smith Farm Road) is adjacent to the site along the southern border. Above-ground power lines are parallel to the road. The western edge of the site is bounded by railroad tracks with Perimeter Road a couple of hundred feet east of the railroad tracks. Drainage ditches exist along both Smith Farm and Perimeter Roads. Vegetation on the site mainly consists of weeds, with some trees in the southwestern portion of the investigation area. Ground surface gently slopes to the west.

2.2.3 Methodology

Based upon the objectives of the survey and the site characteristics, ICF will employ electromagnetic induction (EM) techniques to meet the objectives. A host of geophysical techniques were considered to meet these objectives but it is our belief that EM is the most cost-efficient and less time-consuming technique available. ICF has had considerable success with the application of EM on similar sites with similar objectives.

The theory of EM is relatively simple. A small coil (transmitter) is placed on or near the earth's surface. A current at an alternating frequency is caused to flow through the coil, which produces a primary magnetic field. The primary magnetic field induces a current into the subsurface which, in turn, produces a secondary magnetic field. This secondary magnetic field within the subsurface is sensed by another coil (receiver) located at a specified distance from the transmitter coil. The primary field is read directly by a meter and is compared to the sensed secondary field. The ratio of the primary field to the secondary field is linearly proportional to the earth's terrain conductivity.

Terrain conductivity can be defined as the ability of a subsurface material to conduct an electrical current. Conductivity is a function of the geohydrologic section and is influenced by the presence and/or absence of water. For example, a dry sand would have a lower conductivity than a saturated sand and a saturated clay would have a higher conductivity than a saturated sand. Changes in terrain conductivity can be mapped and associated with subsurface conditions, both natural and man-made.

To perform this survey ICF will utilize the Geonics EM31DL Terrain Conductivity Meter. This apparatus can measure conductivities from 0 to 1000 millimhos per meter (mmhos/m). Depths of exploration vary from 0 to 3 meters (0.0 - 9.8 feet) and 1.5 to 6 meters (4.8 - 19.7 feet). This change in depth of exploration is accomplished by changing the orientation of the coils. Two coil orientations are possible with the EM31DL; horizontal dipole (HD) and vertical dipole (VD). The HD has a maximum exploration depth of 3m while the VD has a maximum exploration depth of 6m. It should be noted that each dipole has a different response to the subsurface. The HD response is the greatest at the surface and falls off monotonically with depth. In the VD mode near-surface materials add little to the total measurement with the greatest response coming from a depth of 1.5m and sharply decreasing response with additional depth.

In measuring the terrain conductance of the subsurface only one portion (phase) of the electromagnetic field is measured. This phase is known as the quadrature phase and it is this portion which is proportional to the earth's conductivity. The quadrature phase is the 90-degree component of the electromagnetic field. While the quadrature phase can adequately measure the earth's conductivity and is sensitive to high conductive zones or objects, another phase known as the in-phase is **extremely** sensitive to high conductive objects, such as buried metal. The in-phase measures the 180-degree component of the electromagnetic field. While the in-phase has no direct relationship to the earth's conductivity it can be exceedingly valuable in the detection of buried metal objects in highly conductive soils. If high conductive subsurface conditions exist, such as in a landfill, use of the quadrature phase alone might not be able to adequately distinguish a buried metal object unless that object was directly located at that particular measurement station. By employing the in-phase the effects of the earth's conductivity can be removed and the presence or absence of buried metal can be readily interpreted. For this survey **both** the quadrature and in-phases will be recorded and used for interpretation.

As with any geophysical method there are limitations to the use of EM. The EM will only be able to identify anomalies in the subsurface caused by change of conductance. It cannot definitively determine the cause of these changes, which can only be inferred. Therefore, there must be sufficient changes in the subsurface conductance at the site to be measured and interpreted. In addition, other interferences can affect the EM measurements. These include buried utilities, buildings, electrical power lines, and atmospherics (electrical storms). The initial site visit indicated that these interferences are minimal in the areas of the investigation, but the incinerator building will have a pronounced effect upon the EM readings. ICF will determine the effect of the building by making measurements at specified distances from the building. Similarly, the effect of the underground water and telephone lines on the site will be evaluated.

Prior to making any measurements, the EM31DL will be calibrated in strict accordance with the manufacturer's (Geonics Ltd.) instructions found in the EM31DL manual.

2.2.4 Field Measurements

Field measurements will be made on a survey grid established by a surveyor, Obosnenko Partnership. We are proposing that a 50 foot center to center grid be established on the Landfill and Ash Pit portion of the site and 100-foot center-to-center grid in the portion of the site downgradient from the landfill. Exhibits 2-1 and 2-2 indicate the anticipated location of the grid. The grids will be referenced to the railroad spike located in the center of South Farm Road, south of the site. Review of site documentation indicates that the railroad spike has been located by previous surveys over the years and is an excellent point of reference. Each grid point will be marked by means of a wire flag. Corners of the grid area will be marked by four-foot high wooden stakes for reference. Grid preparation will be made by standard surveying techniques. The grid will be used for both the soil-gas sampling and the EM surveys. A 50-foot center-to-center grid will also be established at a location shown as a test trench on Exhibit 2-2. This area is presumed to be the area where kitchen grease has been deposited and it warrants our investigation for possible groundwater contamination and burial of metal objects.

During the period of measurements with the EM31DL, calibration and quality control tests will be performed at a minimum rate of three times a day. These tests will be performed in strict accordance with the manufacturer's written instructions in the EM31DL Technical Manual. The tests will be performed prior to the initiation of the daily survey, once at noon at the lunch break, and at the end of the survey day. An area east of the landfill, near well PT-10, will be chosen for the quality checks because this location is thought to contain undisturbed soil.

Measurements on-site will be made in either the HD or VD modes, depending on depth to the water table at the time of the EM survey. (The depth to the

EXHIBIT 2-1

OVERALL SURVEY GRID AT THE LANDFILL AREA

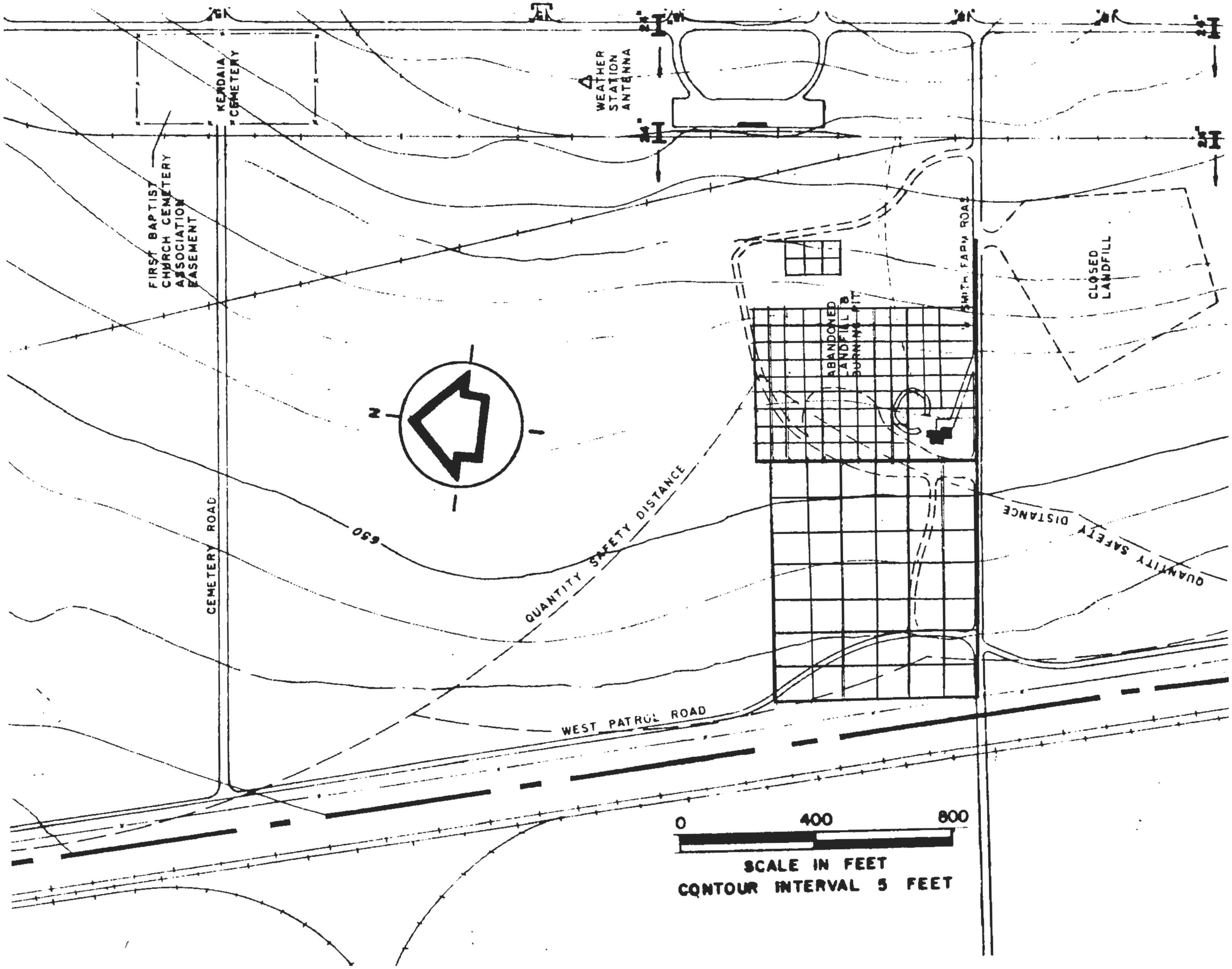
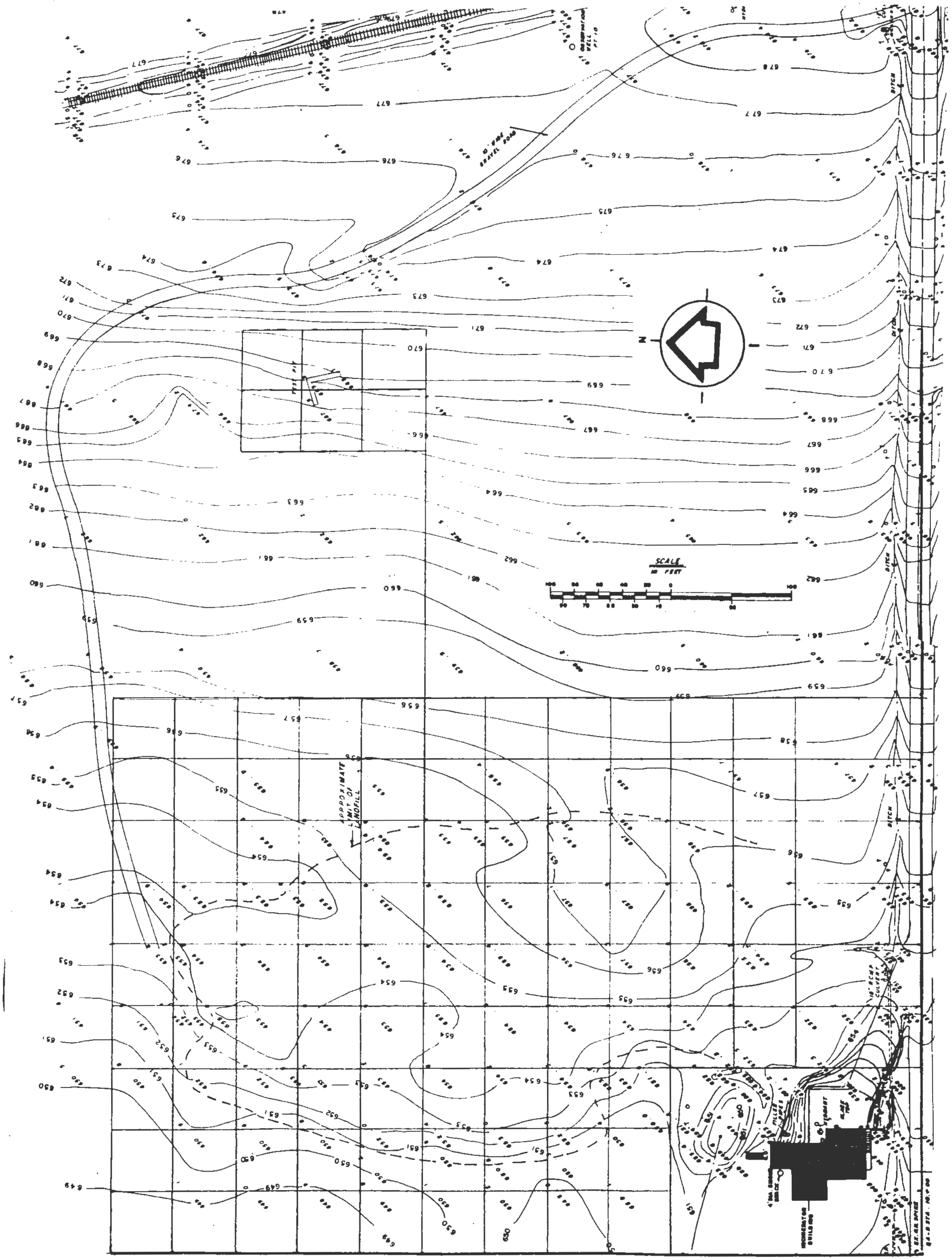


EXHIBIT 2-2

DETAILS OF 50-FT GRID IN THE LANDFILL AREA



water table will be measured, prior to initiation of the survey, in several wells.) Both the quadrature and in-phase measurements will be made. Both measurements will be made and recorded simultaneously by means of a digital recorder. ICF will utilize the Omnidata Polycorder to collect both the quadrature and in-phase measurements. The Polycorder allows for recording of the EM data, as well as designations of each survey line and direction.

Initially, measurements will be made on each 50-foot and 100-foot survey line every 20 feet in both the north-south and east-west directions. The increment of 20 feet along the survey line was chosen to ensure that complete coverage is obtained along each survey line.

The collected data will be "dumped" to a Toshiba 3100/20 personal computer (PC) on a twice-daily basis via manufacturer's (Geonics Ltd) supplied software. Backup copies of the data will also be made on 3 1/2 " disks and on the PC internal hard disk. The data will be interpreted daily and areas indicating buried metal anomalies will be re-surveyed on 20-foot center-to-center grids. These smaller grids will be established by measuring tape in the field. Data will be recorded with the Omnidata Polycorder.

Additional data measurements will also be performed on 10-foot centers in the area surrounding the diesel fuel tank adjacent to the incinerator building. It is believed that the diesel fuel tank could be contributing to groundwater contamination because hydrocarbons have been found in one of the on-site monitoring wells. The tank measurement stations will be established from the 50-foot grid centers by measuring tape. Since the stations will be in close proximity to the incinerator building, these data will be recorded in a field notebook. Measurements will be performed only in the quadrature phase and two (2) data values will be recorded at each station. The EM31DL will be rotated upon its common axis to ascertain the effect of the building upon the measurement station. The data values for each station will be averaged and recorded for subsequent interpretation.

2.2.5 Data Interpretation

The EM data will be interpreted to meet the previously stated objectives. Several approaches will be used in manipulating the data. For determining the boundaries of the landfill it is assumed that the landfill will have a higher conductance than the surrounding subsurface materials. The deposited ash likely will contain metals and organic acids in sufficient quantities to increase the conductivity. The data from each survey line will be plotted as distance versus conductivity (x-y plot). Both the quadrature and in-phases will be on each plot. Changes in subsurface conductivities are anticipated to be easily recognized for the landfill boundaries.

The buried metal will be reflected as high conductivity readings (both quadrature and in-phase), while high contamination by organic solvents will be reflected as low conductivities because of their non-ionic character. Even fairly low concentrations of organic solvents may be detectable because their effect on the glacial till material may be to alter the clays sufficiently to lower the conductivity. The data interpretation for the buried metal and groundwater contamination will entail the contouring of the data. This will be accomplished by software developed by Interpex. A program named Contix has the ability to grid the data and contour it using a variety of algorithms, including least squares, inverse power, Kriging, and Minimum Curvature. ICF will explore each different method to grid and contour the data. The choice of a particular method will depend on which method appears to be sensitive in defining the EM anomalies. The contoured data will be reviewed on a daily basis and it will be on this basis that additional readings will be performed to adequately identify an anomaly.

2.2.6 Geophysical Report

The geophysical survey portion of the final report will contain detailed descriptions of the methods used for conducting the survey and how data interpretations were performed. Maps, indicating location of grid points, x-y plots, and EM contours, will be produced. Maps indicating the landfill boundaries and the location of buried metal objects (if any) will also be provided. If the EM survey is able to detect areas of significant groundwater contamination, these locations will also be included in the report.

The report will also contain recommendations for corroborating the EM data anomalies by installing additional monitoring wells for groundwater contamination and by constructing test trenches for verifying the location of landfill boundaries and buried drums.

2.3 SOIL-GAS SCREENING SURVEY

2.3.1 Objectives

The primary objective of the soil-gas screening survey is to enhance the effectiveness of soil sample collection by providing indications of likely source locations within the landfill area. Secondary objectives of the survey are to investigate downgradient contaminant migration patterns and determine whether existing monitoring wells are properly located, and to determine whether a nearby underground diesel fuel storage tank is leaking.

2.3.2 Methodology and Application

Collection of subsoil air samples and testing for suspected volatile contaminants can be an effective method for determining probable source locations and, in some cases, the general direction and extent of contaminant migration. Volatile constituents from high-concentration sources, whether adsorbed onto the soil matrix, dissolved in groundwater, or directly released from leaking buried containers, will tend to volatilize into the interstitial air spaces within the unsaturated zone. The degree and rate of volatilization are complex functions that may require consideration of contaminant solubility, Henry's Law, Raoult's Law, the distribution coefficient of the contaminant between soil and water, and the porosity and degree of saturation throughout the aquifer and soil column. Although an exact quantitative description of this process generally is not tractable, soil-gas determinations can be a cost-effective tool for indicating the best locations for more precise and accurate sampling and analysis.

The Landfill and Burning Pit area at SEAD represents a good candidate for use of soil-gas surveys in defining probable source locations and for providing additional details on contaminant plumes. Available evidence suggests that the landfill may be only a few feet thick, and buried containers or contaminated soils are likely within 4-10 feet of the surface. Thus, shallow soil-gas samples should provide a good indicator of the source locations for the volatile chlorohydrocarbons and hydrocarbons that have been detected in the groundwater downgradient from the site. The shallow aquifer, consisting of a thin layer of weathered shale approximately five feet below the surface, is overlain with low-permeability glacial till. Volatilized contaminants from the more permeable aquifer zone will tend to be trapped within the less permeable unsaturated zone, and higher concentrations within the groundwater may be detectable by analysis of soil-gas samples.

The soil-gas surveys across the landfill and downgradient areas will be performed by collecting samples of air obtained from shallow holes placed into the unsaturated zone. Collected samples will be analyzed for the presence and relative abundance of suspected volatile constituents. Although the data quality objectives of the soil-gas determinations do not warrant analysis of samples by precise and accurate analytical methodology, it is desirable to provide a measure of discrimination between the various chlorohydrocarbon and hydrocarbon contaminants that have been found previously in groundwater samples. Multiple source locations, each with characteristic contaminant signatures, have been suggested by the previous work (reference USAEHA report). Thus, an ability to detect volatile chlorinated solvent species containing one, two, or three chlorine atoms may prove useful in evaluating source locations as well as potential degradation products arising because of the ash-laden, organic-rich landfill matrix. In addition, an inspection of drawings for the nearby incinerator building and discussions with SEAD staff revealed the presence of an underground diesel fuel storage tank which apparently contains several hundred gallons of product. Because the tank is 15-17 years old, is situated within a partially saturated, slightly acidic medium, and has no cathodic protection, leakage may be occurring, which could account for the observation of hydrocarbon product within a nearby monitoring well in 1987 . The soil-gas surveys will be used to investigate possible tank leakage, and the ability to detect volatile hydrocarbon constituents is required. For these reasons, we will use a portable capillary column gas chromatograph with a photo-ionization detector at the site to provide a modest degree of discrimination and sensitivity for the contaminants likely to be encountered.

Soil-gas sampling will occur across the same grid that will be established for the geophysical surveys (see Exhibit 2-1). Up to 140 samples will be collected in two phases. Initially, approximately 40 samples will be collected from the grid points located within the suspected landfill boundary and from locations where the EM survey indicates the potential presence of buried containers. In addition, 10 samples will be collected from the immediate vicinity of the diesel fuel tank and toward previous borehole BH-29, where a floating product was observed (reference USAEHA report); approximately 8 samples will be collected from the vicinity of the "grease pits" east of the landfill area; and two samples will be collected from within the former sludge pond. Following on-site analysis of these initial samples, up to 40 additional samples will be collected from areas where higher levels of volatile contaminants are observed. The second series of samples will include replicates of previously-sampled locations, as well as additional adjacent sampling points. All new points will be located by direct measurement to the established grid.

Beginning at a point near monitoring well PT-12, up to 30 samples will be initially collected along the 100-foot grid downgradient of the landfill.

This sampling will encompass the area of maximum contaminant concentration, as indicated by the USAEHA report and the soil-gas results from the landfill area. At least two transects will be sampled in an attempt to establish the limits of the plume(s) toward and parallel to the western boundary. Following analysis of these samples, up to ten samples will be collected to resolve any data gaps in the downgradient direction.

2.3.3 Procedures

At each sampling location, a 0.5-inch diameter hole will be punched into the soil, using a stainless steel bar with slide hammer, to a depth of about 3-4 feet. Each sampling location will be chosen to avoid underground utilities, and will have been previously cleared by the EM survey. The exact depth to be used for all measurements will be determined from the observed groundwater level in nearby shallow monitoring wells at the time the survey is conducted. All samples will be collected from the overburden and precautions will be observed to prevent penetration of the saturated zone.

After the stainless steel bar is removed from the hole, a 0.5-inch stainless steel probe will be inserted into the hole. Following evacuation of approximately 25 void-space volumes to the atmosphere, air from the hole will be pumped into a pre-evacuated, septum-capped glass vial at 2 atmospheres (15 psig) pressure. Sample vials will be immediately placed into labeled Whirl-pak bags, stored in darkness, and delivered several times daily to the on-site laboratory for analysis. Duplicate samples may be collected from the same hole without removal of the probe.

After all samples from a given location have been collected, the tube will be removed and the hole filled with a plug of clean soil. The bar and probe will be cleaned by scrubbing with Contrad cleaner in distilled/de-ionized water (if necessary), rinsed with distilled water, and dried with paper towels. The interior of the probe will be flushed for 30 seconds with ultra-zero grade air or nitrogen at 20 psig. Immediately prior to sampling, approximately 100 volumes of the sampling probe and associated tubing, valves, and injection needle will be flushed with ultra-zero grade or filtered ambient air. The system will then be flushed with 25 volumes of air from the sampling hole prior to collection of the next sample, as described above.

Samples will be taken to the on-site laboratory and immediately logged in and placed in the analytical batch queue. Analysis will be performed within 24 hours by withdrawing a portion of the sample with an air-tight syringe and directly injecting it into a gas chromatograph equipped with a photo-ionization detector.

Analyses will be performed by a trained technician, using a Photovac Model 10-S-70 portable gas chromatograph equipped with a photo-ionization detector and a capillary column. This machine performs ambient temperature analyses, and will be calibrated periodically during the day. The ambient conditions in the laboratory room will be maintained as constant as possible, considering the characteristics of the room available. The chromatograph will be calibrated using an instrument response curve and injection of known concentrations of the standards. Retention times of the standards will be used to identify the peaks in the chromatograms of the samples, and their response factors will be used to calculate the analyte concentrations.

It is anticipated that 20-25 samples per day can be analyzed by this procedure, and the sample collection will be adjusted to correspond to the limiting analytical step. Carrier gas blanks will be analyzed at the rate of one per 10 samples and prior to each batch, and target analyte standards (initially, trichlotoethylene, trans-1,2-dichloroethylene, and isopentane) at concentrations corresponding to expected sample concentrations will be analyzed prior to and following each batch. Duplicate analyses will be performed at the rate of one per 10 samples. It is expected that seven days will be required for on-site analysis of approximately 140 samples.

At the end of each day, analytical results will be interpreted and the concentration of target analytes and major "unknowns" will be tabulated and mapped. (Observation of high apparent concentrations of unknowns may require a change in the target analyte mix.) These preliminary results will be used to guide additional or replicate sample collection, as described above, and to determine the location for subsequent soil sampling for laboratory analysis.

All field sample collection and on-site laboratory activities will be documented in permanently bound logbooks. Each numbered page of the logbooks will be initialed and dated by the recorder, and reviewed daily and initialed by the site operations manager. These logbooks will be reviewed for completeness and adherence to approved procedures during the site Quality Assurance audit, and will be submitted with all raw data when the site work is complete.

Following the field efforts, all analytical results and limitations suggested by the associated quality control indicators will be tabulated. Maps will be prepared showing isoconcentration contours for the soil-gas results for each target analyte and major unknown compound. The likely identity of each major unknown will be estimated, and the rationale for such determinations will be presented.

2.4 GROUNDWATER SAMPLING

Groundwater samples will be collected from 10 existing monitoring wells at the site during the time that the field surveys are being performed. Wells that will be sampled include those designated as PT-10, PT-12, PT-15, PT-17, PT-18, PT-20, PT-21, PT-22, PT-24, and PT-25 in the USAEHA report. Wells will be sampled in the general order of increasing contaminant concentrations, as determined from previous analytical results. Wells will not be sampled in any area during the time that soil-gas determinations are underway. Samples from all 10 wells will be analyzed for volatile organic constituents and five wells (PT-10, PT-12, PT-18, PT-22, and PT-24) will be analyzed for metals, as described in Section 3.0.

Prior to sample collection, the water level with respect to the top of the casing will be measured with a clean electric well probe and recorded in the field notebook. An initial sample will be withdrawn for pH, conductivity, and temperature measurements. Wells will be purged using a clean PVC bailer until 5 equivalent volumes (including both well volume and sand pack) are removed, or until the well is evacuated. It is anticipated that most of the wells will go dry because of the short (5-foot) screen length and thin (approximately 2-foot) aquifer thickness. If wells which go dry during purging are found to recharge in a reasonable (less than 2 hours) time interval, the well will again be purged prior to sampling. Measurements of pH, temperature, and conductivity will be made at least once during the purging, and immediately after the purge/recharge is completed.

All well purging equipment will be thoroughly cleaned between wells using distilled water. All sampling equipment will be placed on disposable polyethylene plastic sheeting spread on the ground at the well in order to prevent contamination of groundwater samples. One set of water-level measurements will be taken prior to sampling during a 10-hour period for all monitoring wells used in this study. Additional water level measurements will be taken throughout the study.

Samples for metals analysis will be filtered in the field through a clean 0.45 micron Millipore filter, and preserved with nitric acid to pH2. Samples for volatile organic analysis will not be filterd. All samples will be maintained at 4°C immediately after collection.

After the wells have been purged and/or after recharge has occurred, samples will be obtained with the same bailer used for purging. Duplicate samples will be placed in clean, pre-labeled 40-mL septum-topped, screw-capped VOA vials, and a single sample will be collected in a clean, pre-labeled 500-mL polyethylene bottle (for those wells where metals analysis is to be performed). Immediately after collection, samples will be placed in the sample shuttle maintained at 4°C by frozen Blue Ice packs. Blue Ice packs will be provided by the laboratory with each shuttle, which contains the sample bottles, pre-packaged preservatives as required, and associated Chain of Custody forms. The Blue Ice packs will be frozen for 24 hours prior to use in the refrigerator located in Building 4 at the Depot. Shuttles will be packed, together with a copy of the completed sampling and transmittal forms and fresh Blue Ice packs, and sent by Federal Express overnight service to the laboratory at least once every two days. It is expected that all 10 wells can be sampled in two days, and a maximum of two shuttles should be required for the water samples.

All measurements and a record of sampling activities will be recorded in a permanently-bound logbook with prenumbered pages and on the sample transmittal forms contained in the sample shuttle at the time of sampling. Information to be recorded includes: well identification, water level and total well depth measurements; calculated water purge volume; field measurement results for temperature, conductivity, and pH of the purge water; observations during purging activity such as water color, depth to water level, whether the well goes dry, and estimated recharge rate; and actual total quantity of water extracted from well. Groundwater sampling information to be entered into the logbook will include: date and time sample collected; decontamination procedures for sampling equipment; and the analytical parameters sampled for at the site and sampling procedures (i.e., samples filtered, chemical preservatives used).

All pages associated with each day's activities will be signed and dated by the samplers, and reviewed and signed by the Sampling Team Leader.

Equipment used during environmental sampling activities will be properly cleaned before use at each sampling location to prevent cross-contamination between sites. All sampling equipment will be rinsed thoroughly with bottled distilled water. If sediment or other materials adhere to any of the sampling equipment, scrubbing may be required in addition to rinsing. In no instance shall detergents, soaps, or solvents be used to clean equipment in the field.

2.5 SOIL SAMPLING

Ten subsoil samples will be obtained for volatile organic contaminant analysis from locations to be field-determined, based on the preliminary results of the soil-gas and geophysical surveys. These samples will be obtained from the general vicinity of the landfill, after most of the soil-gas sampling in that area has been completed. Five samples will be collected from locations within or near the landfill for metals analysis. If suspect materials are found during inspection of the incinerator building, one or more samples may be collected from that location.

Subsoil samples will be collected into clean 40-mL septum-topped, screw-capped VOA vials by the following procedure:

- A boring will be made to a depth of 2-4 feet (depending on the depth used for the soil-gas survey) using a 2.5-inch diameter stainless steel bucket auger. A sample will be collected within the auger, plugs will be subsampled with a clean 0.5-inch diameter metal cork borer, and the plugs placed into the VOA vial. The process will be repeated, with tamping of the vial contents using a clean glass rod, until the vial is completely full and minimal air space remains. Alternately, an intact sample from the boring may be obtained using a driven split-spoon sampler, with subsampling of the inner portion of the core. Traces of soil remaining on the vial top and threads will be carefully removed using a clean paper towel, and the cap immediately tightened. The entire process of auger removal, subsampling, and sample collection should require no more than 20 seconds.

Samples for metals analysis will be collected in clean 500-mL wide-mouth amber glass or polyethylene bottles, using the bucket auger and a clean stainless steel spatula. Packing of samples into their respective shuttles, completion of all logbooks and sample transmittal forms, and shipment of samples to the laboratory will proceed as described for water samples in Section 2.4. All sampling tools will be cleaned as described in Section 2.4.

2.6 BUILDING INSPECTION

The incinerator building will be inspected for the possible presence of contaminant sources within the Dry Well and Wet Well that are denoted on Depot drawings of the building. Entry will occur under Level C protection, using an OVA meter and Explosimeter to survey the interior. The OVA will be used to determine whether volatile organic contaminants are present within the sumps. If volatile contaminants are suspected following this procedure, samples of the air may be obtained using the soil-gas apparatus, or solids samples may be obtained for volatile organic contaminant and/or metals analysis. A similar inspection will be made of the area around the underground diesel fuel tank and associated piping.

2.7 AQUIFER TESTS

Aquifer tests will be conducted by performing simple slug tests in 15 monitoring wells at the site. A 1.25-inch diameter by 3-foot long slug will be used for both falling-head and rising-head slug tests. The variation in water level will be monitored with a pressure transducer and digital data logger, such as the Hermit 2000 or equivalent. The data acquisition rate will be adjusted for each well to permit recording of sufficient data for analysis. At least two cycles of the slug will be recorded.

Data will be interpreted from elevation-versus-time plots, using commercially-available software for the Toshiba 3100 microcomputer. Estimates of the aquifer transmissivity will be obtained from the data analysis.

2.8 SUMMARY OF PLANNED SAMPLING AND SURVEYING

A daily field plan for the sampling and surveying activities is provided in Exhibit 2-3. This schedule of events is contingent upon several factors, including the following:

- Relative ease in obtaining badges, allowing unrestricted access to the site, has been assumed. Standard SEAD security information sheets will be completed by all site personnel and sent to the Environmental Coordinator at least one week prior to the onset of site activities.
- Absence of inclement weather. EM surveys cannot be performed during rainy periods.
- Non-interference by the deer hunting season at SEAD, which begins the last week in November.

Severe limitations arising because of any of these factors will significantly affect both the schedule and budget for the field efforts. A start date (Day 0) not later than the last week in October has been assumed.

EXHIBIT 2-3

DAILY FIELD PLAN

Day 0. Travel of personnel and shipment of all materials and sampling shuttles to the site.

Day 1. Mobilize equipment to the Depot.
Meet with Environmental Coordinator and Project Officer.
Get picture badges for personnel.
Set up testing and equipment storage in Building 4.
Perform initial OVA survey across the landfill area.
Perform initial calibrations and run blanks on GC.
Lay out 10-point grid around the underground storage tank.
Lay out baseline grid system.
Begin laying out the Landfill grid.
Run background checks with the EM apparatus.

Day 2. Begin EM across Landfill.
Begin collection of soil-gas samples (20 samples).
Begin sample analysis.
Lay out downgradient grid.
Measure water levels in all existing monitoring wells.
Collect water samples from five wells.

Day 3. Complete EM survey across Landfill and Grease Pit areas.
Continue soil-gas testing in Landfill area (20 samples)
Collect water samples from 5 monitoring wells.
Pack and ship water samples to laboratory.
Collect one soil sample.
Perform QA audit of sampling procedures and other activities.
Analyze survey information, to date.

Day 4. Fill in EM survey points in Landfill area.
Begin EM survey in downgradient direction.
Complete Phase I soil-gas sampling in Landfill area.
Begin Phase II soil-gas survey in Landfill area.
Collect five soil samples from Landfill area.

Day 5. Complete basic EM surveys.
Collect soil-gas samples in Landfill area.
Collect remaining soil samples.
Inspect and survey incinerator building.
Ship soil samples to laboratory.

Day 6. Analyze results, to date.
Complete soil-gas survey in Landfill area.
Begin downgradient soil-gas survey.
Demobilize and ship all equipment except soil-gas apparatus.

Day 7. Continue soil-gas surveys.

Day 8 Complete soil-gas surveys and analyses.
Demobilize and ship remaining equipment.

3.0 LABORATORY ANALYSIS

Groundwater and soil samples will be analyzed for volatile organic contaminants and metals, for which ETC is currently certified. For volatile organic compounds, EPA Method 624 will be followed for analysis of compounds according to USATHAMA certified Methods EJ8 and EW9. Certified analytes and reporting limits are provided in Appendix A. Certified parameters include several of the site-specific target analytes (trichloroethylene, trans-1,2-dichloroethene, chloroform, carbon tetrachloride, xylenes) and 14 other related compounds.

Water and soil samples will be analyzed for metals (cadmium, chromium, copper, zinc) (also lead in soil) by ICAP-based USATHAMA-certified Methods EG8 and ER9. Reporting limits for these metals are provided in Appendix A. A summary of the number and types of analyses to be conducted is provided in Exhibit 3-1.

Sample bottles will be cleaned in the laboratory according to USATHAMA protocols, packed in specially-designed insulated, sealable shuttles, and delivered to the site at least one week in advance of the sampling. Each shuttle contains three-copy Field Parameter and Chain of Custody forms for the samples to be returned to the laboratory, and a tamper-proof, serialized chain of custdy seal. Sample tracking will begin when the sample bottles are shipped, and additions will be made to the tracking report when the samples are received by the laboratory. Received condition, analyses requested, analysis dates to meet holding time limitations, and any special instructions pertinent to each sample (e.g., possible high concentration or other characteristics obtained from the Field Parameter forms) are included in the tracking report. Copies of the tracking report are used by each analytical station to plan the analysis tasks, and each step of the extraction, analysis, and reporting process is reported into the tracking system. Samples and extracts are stored securely at 4 degrees Celsius until checked out by the analyst that will perform an analytical step.

Samples will be stored until release is obtained from the USATHAMA Project Officer. All samples that are determined to be hazardous under federal or New Jersey regulations will be disposed as hazardous waste.

Upon completion of an analytical procedure, the analyst will complete all calculations and prepare QC charts. The results will be reviewed by the laboratory supervisor and the QC Coordinator, who will determine whether the analysis was in control and reportable. Data are then entered into the tracking system and a case file, with all supporting information and paperwork, is prepared. The electronically-stored data are then checked against the case file before being entered into IRDMS Level 1 files.

EXHIBIT 3-1

SUMMARY OF LABORATORY ANALYSIS EFFORTS

Matrix	Method	No. Samples	No. Analytical Lots
Groundwater	EJ8	10	1
Rinse Blank	EJ8	1	-
Soil	EW9	10	1
Rinse Blank	EW9	1	-
Groundwater	EG8	5	1
Soil	ER9	5	1
Rinse Blank	EG8	1	-

No. of Amber Glass bottles - 5
No. of Polyethylene bottles - 6
No. of 40-mL VOA vials - 22 + 4 spares
No. of Shuttles (max.) - 4
No. of hazardous samples (max.) - 15

4.0 QUALITY ASSURANCE/QUALITY CONTROL

USATHAMA has developed a leading QA/QC philosophy and very specific QC implementation requirements over the past several years. Founded on the concept of project-wide procedures to determine and to ensure the reliability, completeness, traceability, and comparability of data and conclusions, specific methodologies for controlling and documenting laboratory and sampling procedures have been developed. We subscribe to the philosophy and have followed directly the requirements contained in the 1985 USATHAMA QA Program to prepare and implement the internal Project QC Plan (PQCP). THe PQCP for Task 1, which is provided in Appendix A, describes in detail the means by which we will implement the USATHAMA QA Program. Sections of the PQCP describe organizational responsibilities for data quality, specific procedures for collecting and analyzing data under controlled conditions, procedures for preventing and correcting out-of-control situations, and other aspects of QA such as training, documentation, verification, reporting, and record keeping.

ICF is totally committed to the precepts for implementation of this program, which are:

- Planning -- Organizing and developing procedures so that performance measures of systems are known, data quality objectives (i.e., the level of quality required to support each project objective) are established, and all personnel know who needs to be where, and when.

- Controlling -- Ongoing quality checks to ensure that all systems are performing as expected, and that personnel are operating the systems as planned and in a timely fashion.

- Documenting -- Ensuring that data quality is validated and is traceable through all project stages from collection to archiving.

- Improving -- Developing more efficient and more exacting procedures for given data quality objectives.

Project deliverables are based on an understanding of the environmental situation at a site, which is derived from data collected during various task activities. The PQCP encompasses and integrates the various aspects of the project (geotechnical, sampling, analytical, testing, and assessment) by requiring data to be representative, precise, and accurate, within defined limits. Documentation, prepared and maintained through a document/data control system, will provide the defensible evidence of traceability and adherence to prescribed protocols.

When applied to sampling and chemical analysis, the PQCP has the specific objectives of: (1) assuring that the analytical results correspond to the environmental situation at the time a sample was taken; (2) estimating the level of quality of each analytical system sufficient for meeting data quality objectives; (3) assisting in the early recognition of deficiencies which might affect data quality; (4) enabling the laboratory to take actions to ensure data validity; and (5) enhancing the utility of all data considered in the decision-making process, by requiring simultaneous expression of limitations on data quality.

The PQCP has been designed to comply with the requirements of the 1985 USATHAMA QA Program. Prior to any sampling effort, all methods intended for use will be certified according to USATHAMA procedures. Sample containers will be cleaned and samples preserved in accordance with USATHAMA procedures. Water and soil samples collection, shipping, and documentation will follow the guidance provided in Section 5 of the USATHAMA WA Program, December 1985 (2nd Edition, March 1987). All analyses will be monitored by the inclusion of QC samples, results from which will be used to evaluate data acceptability by linking each sample with controls. Results of analytical QC will define the criteria for the acceptance of data. Failure to meet these criteria, as monitored by the project QA personnel, will result in immediate cessation of analysis. Clarification and correction of the analytical difficulty may result in acceptance of the data, if justified, or re-analysis of all samples in the analytical lot.

Project activities will be defined in written plans (work plans, methods, protocols) and will then be monitored and documented for compliance with these approved procedures. All documentation, including field data, laboratory data, methods, chain-of-custody records, and logbooks, will be maintained according to the document/data control system, as defined in the Data Management Plan (Appendix B). Data will be validated and archived prior to use in final assessments supporting Army decisions.

5.0 DATA MANAGEMENT

One goal of the Remedial Investigation/Feasibility Studies (RIFS) program is to arrive at reliable and defensible conclusions, based on available data. Experience in conducting environmental surveys and assessments has shown that organization plays a key role in ensuring that the large quantities of data collected in support of a particular project are put into a form that is easy to review and understand. The Data Management Plan presented in Appendix B of this Work Plan describes the organization and procedures that will be used to ensure that the chemical and field screening data collected from the Seneca Army Depot (SEAD) Burning Pit/Landfill are efficiently collected, validated, and accurately transmitted to the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Installation Restoration Data Management System (IRDMS), then carefully archived for future reference.

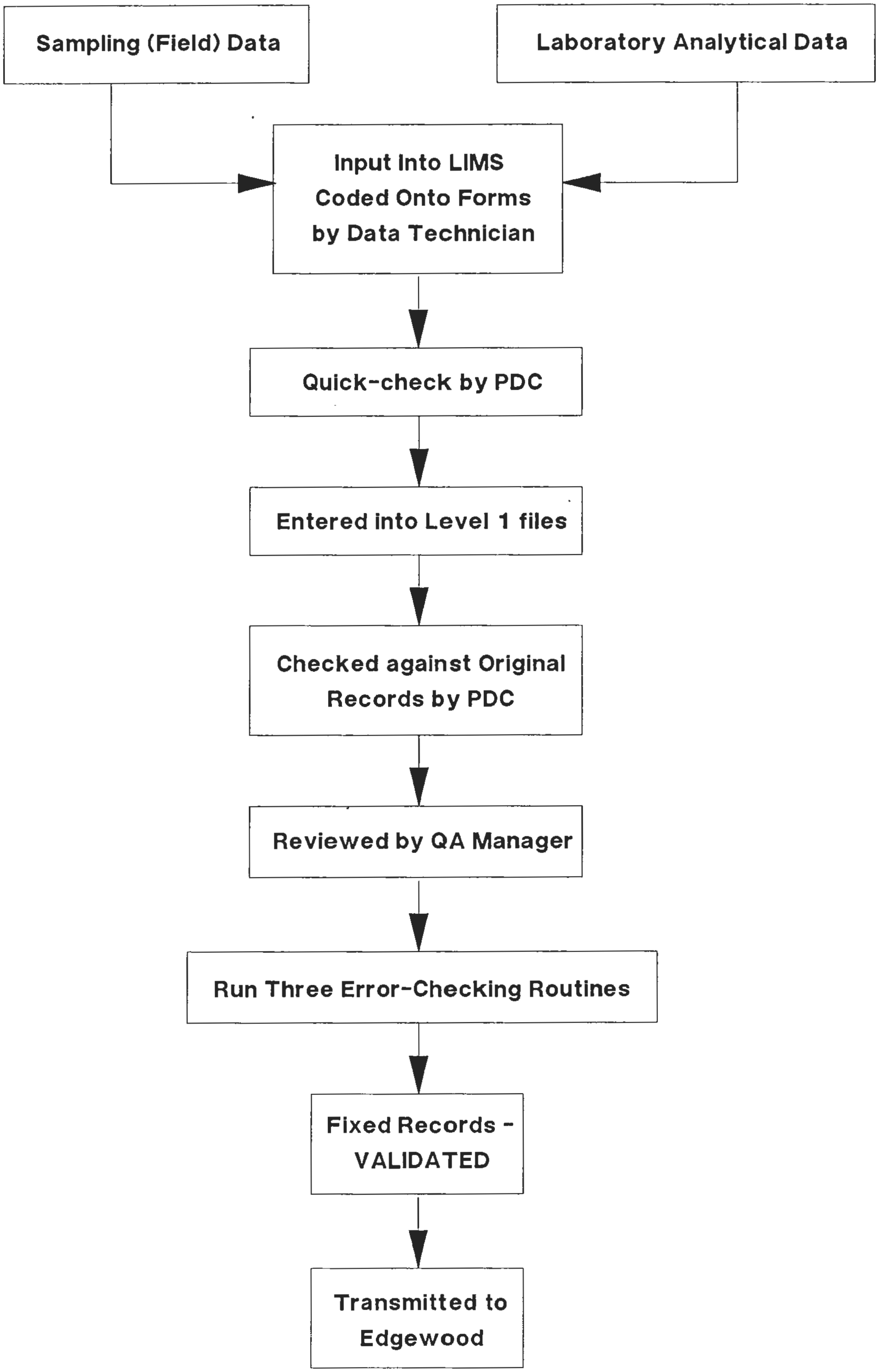
The Program Data Coordinator (PDC) will have the principal responsibility for implementing the Data Management Plan, which accounts both for the chemical data that are entered into the IRDMS and field screening data that are collected and analyzed, but not entered into the system. Data management will begin when the PDC transmits a request for analytical services to the Environmental Testing and Certification Corporation (ETC) laboratory in Columbia, MD, stating the number, type, sample numbers, methods for analysis, and any other information necessary for ETC to plan the job. Data files of initial input information, including map location files, a certification status check, sample ID number, parameters, dates, etc. will be established as sample containers and documentation are prepared for shipment to the Field Sampling Team.

While in the process of collecting, documenting, packaging, and shipping samples to ETC, the Field Sampling Team will transfer sample data from their own notebooks to field parameter forms. Once the samples arrive at ETC, this information will be used to create data files in the internal Laboratory Information Management System (LIMS). Status information (e.g., date sampled, date received, data extraction/analysis due) will form a part of the record.

Each step in the analytical process will result in updates to the data files. The operation performed (e.g., preparation, extraction, analysis, data review, data package prepared), the data obtained, and the date that each step was completed will be entered into the system and made available for status checks. Data files and hard-copy documentation will then be transferred from the laboratory to the PDC, who will create Level 1 IRDMS files, validate the records against original notebook and data entries, perform error-checking and correction using the USATHAMA routines, and transmit the Level 1 files to USATHAMA, via the 3COM communications network.

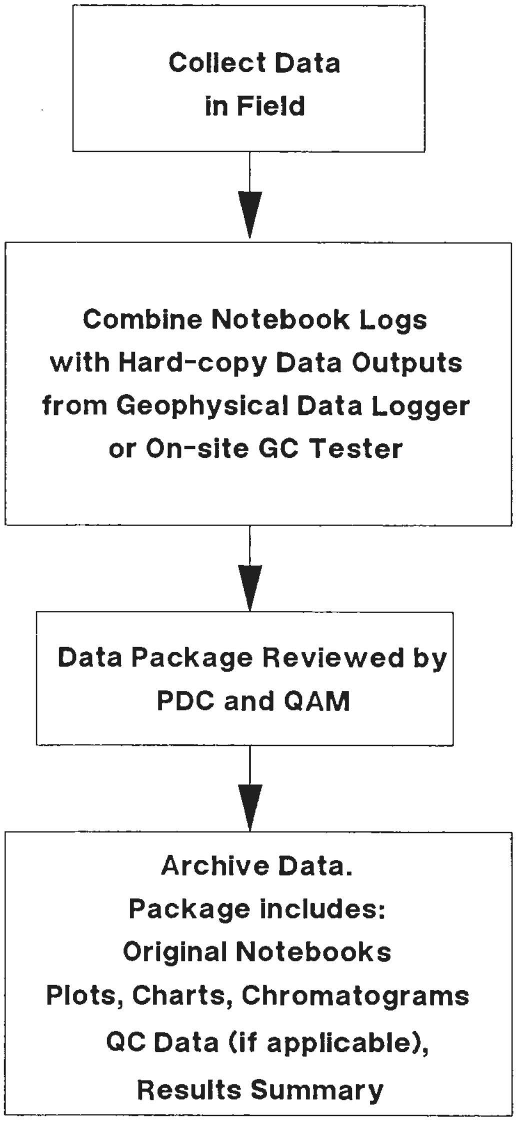
Once the Level 1 files have been processed at USATHAMA, the PDC will transmit any required corrections, then generate a backup tape copy. This step will be completed within 50 days after the samples have been collected. The laboratory will archive copies of all analytical data, including original instrument magnetic tapes, in perpetuity. Records will also be maintained, so that historical summaries of all analyses may be generated by site, by client, or by sample type. Refer to Exhibit 5-1 for a summary diagram of how these data will be handled.

Exhibit 5-1. Data Management Scheme (Chemical Data)



Data that are not entered into the IRDMS, such as results from geophysical and soil-gas surveys, will be logged into notebooks, then packaged with any hard-copy outputs (e.g., plots, charts) and sent to the PDC. Both the PDC and QA Manager will review these data, referred to as field screening data, before the PDC archives the information for future reference. Refer to Exhibit 5-2 for a summary diagram of how this information will be handled. A more detailed description of the data management system is contained in the Data Management Plan, presented in Appendix B.

Exhibit 5-2. Data Management Scheme (Field Screening Data)



6.0 HEALTH AND SAFETY PROGRAM

ICF Technology is committed to protecting the health and safety of its employees. All employees assigned to the Seneca Army Depot effort will receive, at a minimum, sufficient training for them to recognize and evaluate hazards they are likely to encounter during their field activities. In addition, any ICF Technology employee who will be working directly on the landfill itself or conducting operations within the exclusion zone(s) of the site will be medically monitored and receive basic health and safety training as specified under 29 CFR 1910.120.

ICF Technology has prepared a project specific health and safety plan (Appendix C), which will be approved by the Army and the ICF Technology Health and Safety Director, to address foreseeable hazards associated with on-site investigations at Seneca Army Depot. This plan will be enforced by the Project Safety Manager and Site Safety Officers and it includes:

- Identification of hazardous materials likely to be encountered at the site, their hazard potential, threshold and other exposure limits;
- Personal protective equipment requirements;
- Monitoring equipment requirements;
- Decontamination requirements and procedures; and
- Contingency procedures in the event of a fire, medical emergency, or other mishap/accident.

All ICF Technology employees participating in this effort will be required to read and review this plan. A signoff sheet will be maintained by the Project Safety Manager.

All accidents involving property loss and/or injury or death will be reported, per DID A012/DI-A-12963. In addition, an ICF Technology Exposure/ Incident Report will be completed for any incident involving ICF Technology or subcontractor employees.

ICF Technology is not directly responsible for subcontractor health and safety at the site; however, all subcontractor personnel and operations will be required to abide by the requirements contained in the Accident Prevention Safety Program Plan (APSPP). All subcontractors will certify that their field personnel are medically monitored and trained in accordance with 29 CFR 1910.120. A copy of the APSPP will be provided to all subcontractors.

7.0 ASSESSMENT AND REPORTING

Results of the geophysical surveys, aquifer tests, and soil-gas screening studies, as described in Section 2, will be combined with the laboratory analytical results for soil and groundwater samples to provide the basic data for contamination assessment. The location and, if possible, identity of contaminant sources will be provided. The extent and strength of groundwater contamination plumes will be identified. Contaminant levels will be compared to risk-based health criteria and to Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs), defined in state and federal regulations. The impact of the site listing (as an SWMU under RCRA) on cleanup requirements will be assessed. The status of the diesel fuel tank with respect to new Underground Storage Tank regulations also will be evaluated.

Once regulatory requirements and action criteria have been established, the need for and extent of interim response measures (IRMs), and/or further investigations to delineate longer-term remedies, can be specified. Potential IRMs, including source removal and groundwater contamination control, will be evaluated for effectiveness in meeting the corrective action requirements. If available, a feasible alternative providing a cost-effective remedy will be specified and developed (to the extent possible) with the available data.

A draft final report, following the specifications and schedule of Contract Data Item Description (DID) A011, will be prepared and submitted to the USATHAMA Project Officer. All site investigations, results obtained (including validated IRDMS files) and conclusions reached will be described. A recommendation will be made for suitable interim response measures, and for any remedial investigations/feasibility studies (RI/FS) that may be dictated. The report outline denoted in the Task Order will be followed.

Following USTHAMA review of the draft report, revisions will be made to address all comments and corrections indicated by the review. Ten copies and the camera-ready original of a final report will be delivered to the USATHAMA Project Officer not later than 15 days after approval of the revised draft report. Presentations will be made to both USATHAMA and SEAD which discuss the investigations and the findings.

All data and documentation associated with the task will be archived by the Program Data Coordinator until requested by the USATHAMA Project Officer, or delivered to USATHAMA at the end of the contract.

8.0 MANAGEMENT PLAN

8.1 PROJECT ORGANIZATION

This initial task order under contract DAAA15-88-D-0009 will be managed by the program-task management structure shown in Exhibit 8-1.

The goals of the proposed Project Team are to provide responsible and responsive technical management, effective cost and schedule control, highly qualified technical personnel, effective communication with USATHAMA, and assurance that quality and safety standards are met, for this task assignment. To meet these goals, ICF and its subcontractors propose a project organization, shown in Exhibit 8-1, with the following features:

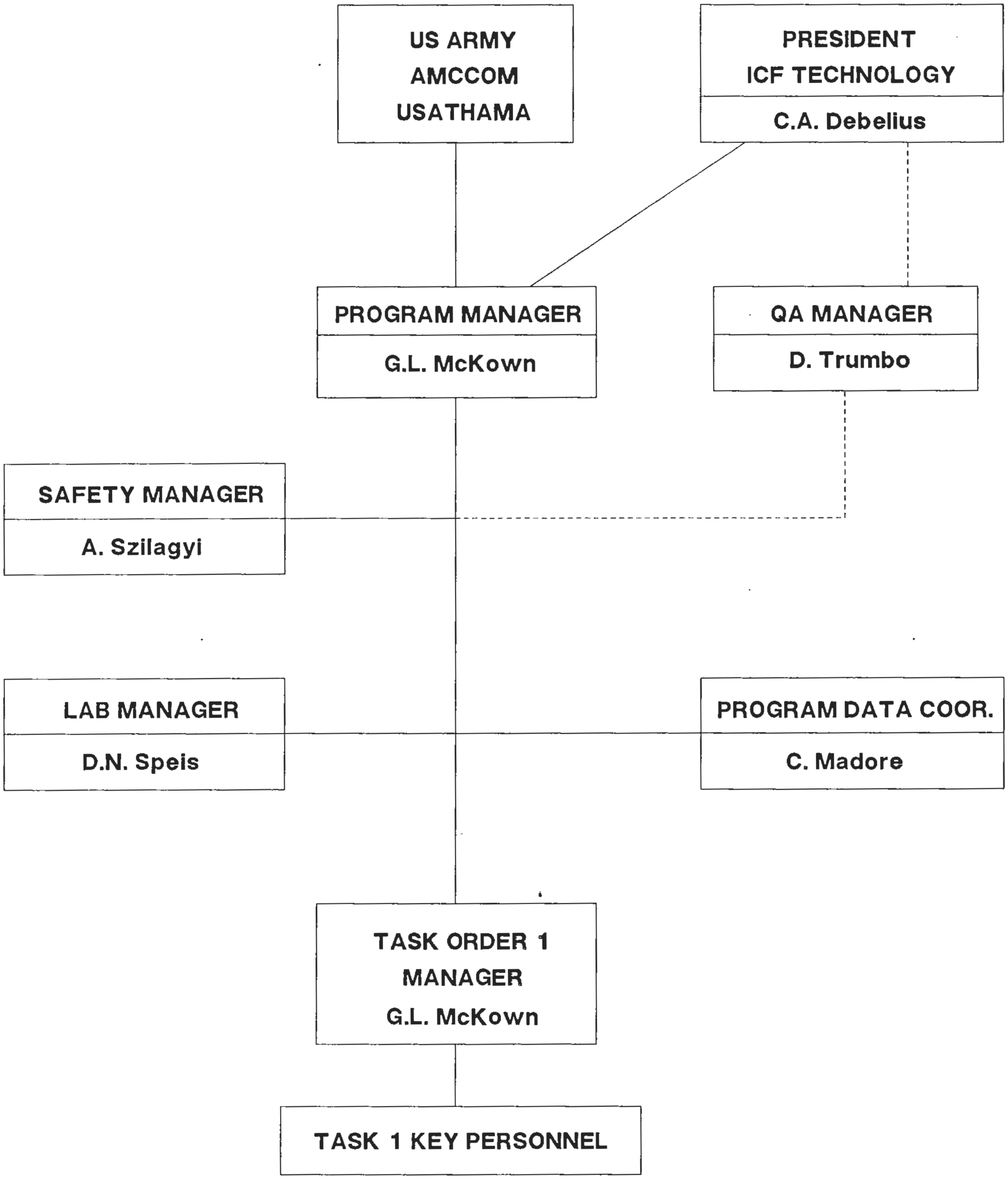
- The task will be managed by the Program Manager, who has extensive management experience on USATHAMA and RI/FS contracts.
- Direct reporting and technical supervision among various components, with clearly defined project control responsibilities and authorities.
- Experienced and qualified key technical personnel assigned to all major Work Breakdown Elements, for each task.
- Continuous, direct interaction of project technical personnel with USATHAMA, and frequent project review meetings.
- Independent quality assurance and safety functions interacting directly with USATHAMA and monitoring the activities and outputs of all project organizational elements.

All members of the Project Team are accustomed to working within a multidisciplinary framework utilizing the resources of ICF and subcontractors. As a result, potential interfacing problems and conflicts are minimized and are readily and quickly resolved when they occur. Other plans for ensuring the successful interface of various organizational elements are: (1) close coordination in planning stages; (2) firm definition of work and assignment of responsibilities through discrete work packages; and (3) regular communications among program personnel. Interactions among the technical work elements will occur continuously. Successful interactions depend on development of detailed plans, execution of the work according to plan, and early warning and immediate control when plans are disrupted.

Two subcontractors will be used for this initial task. ETC Corporation, Edison, NJ, will provide analytical services, including preparation and shipment to the site of bottles cleaned according to USATHAMA specifications, sample tracking, analysis of samples for volatile organic constituents and metals for which they are USATHAMA-certified, laboratory quality control; and data reporting, as required for the QA and data management functions.

Exhibit 8-1

USATHAMA RI/FS
TASK NO. 1 ORGANIZATION CHART



W. Saunders, Geophysicist - Field Operations Leader
F. Swahn - Sampling Team Leader
G. Morekas - Assessment Leader
K. Ranlett - Soil Gas Screening Leader

The proposed soil-gas surveys will be performed by Target Environmental Services of Columbia, MD. This subcontracted effort will include layout of the specified sampling grids, collection of up to 140 soil-gas samples, testing of the samples by on-site GC instrumentation, and preparation of a complete report providing the methodology and results of the survey.

8.2 PERSONNEL, ROLES, AND RESPONSIBILITIES

All personnel considered key to performance of the task are shown in Exhibit 8-1. The roles and responsibilities of these personnel are as follows:

Dr. Gary L. McKown, the Program and Task Manager, will be responsible for overall direction, coordination, technical consistency, and review of the entire contract. His responsibilities include:

- Formal communications with the CO and the COR;
- Final approval and review of work plans, all project deliverables, schedules, contract changes, and labor allocations for each task;
- Guiding the approach to particularly difficult problems which may arise on each task;
- Approving satisfactory completion of each work element of each task;
- Ensuring coordination among management, field teams, and support personnel to ensure consistency of performance; and
- Communication of program status and problems encountered/resolved to the President of ICF Technology.

In order to fulfill these responsibilities, Dr. McKown is vested with the authority to select personnel assigned to the project from the ICF staff, and to ensure their availability to the project for the duration of the contract. He may also alter personnel assigned to the project team, if necessary, due to performance difficulties or changes in project objectives, and can approve or disapprove all submissions of, or modifications to, budgets and schedules. In addition, the Program Manager will require interactions (e.g., peer review or written and oral technical deliverables) among Technical Managers to ensure consistency of work products, and will communicate, as necessary, with the CO and the USATHAMA COR to evaluate the progress of the program and to ensure the early resolution of any potential problem.

As task manager, Dr. McKown also will assume the following duties: (1) effective day-to-day management of all task operations; (2) review and approval of sampling design, test, and QA plans, including approval of monitoring site locations, chemical analysis parameters, geophysical techniques, schedules, and labor allocations; (3) preparation of cost and performance reports and the contamination assessment and presentation of the assessments for the survey, with the assistance of key support personnel;

(4) management of all funds for labor and materials procurement; (5) management of the team toward unified, productive project accomplishment; (6) direct communication and liaison with the COR; and (7) technical review of all task deliverables and technical leadership.

In order to supervise the day-to-day operations of the project, including the preparation and technical review of all project deliverables, management of funds, and management of daily field activities, Dr. McKown has the authority to allocate budgets among the work elements required for the project, and to establish and enforce work element milestones to ensure timely completion of the site survey. He may also approve or disapprove any labor, material, or subcontractor charges to the project; site locations and subcontractors recommended by the Site Geologist/Geotechnical Supervisor; and contributions to any technical deliverable for each work element. The Project Manager will communicate frequently with the COR with regard to day-to-day progress of the project, will authorize additional project support personnel as required, and will work closely with the Safety Engineer to ensure appropriate health and safety concerns are addressed by all project personnel.

Ms. Davida Trumbo, the Quality Assurance Manager, is responsible for all quality assurance and data/documentation control activities on the contract. The role of the QA manager will be to:

- Assure that all final project deliverables are based on defensible, documented data for which uncertainties can be quantified;
- Oversee the functions and activities of the subordinate Laboratory QA Coordinator and interface with the Program Data Coordinator;
- Prepare and gain USATHAMA approval of each Project QC Plan, Certification Documentation, and ongoing QC Performance;
- Monitor and periodically audit to assure that the QC procedures, as identified in the project and the USATHAMA QA plans, are followed by the chemical analysis and field sampling teams;
- Review all project chemical and radiological analysis data for compliance with QC requirements and technical accuracy;
- Perform a field QA audit of the sampling activities for each matrix type during each task;
- Assure that adequate QC documentation is provided for all project deliverables; and
- Assure that all QC problems are resolved in an expeditious manner and brought to the attention of the technical managers.

To fulfill these responsibilities, the QA Manager has the authority to demand quality performance from all project participants and to recommend solutions to observed quality problems to the Program Manager and, if necessary, to the President of ICF Technology. In addition, the QA Manager will conduct unannounced audits of analytical laboratory or field sampling procedures, and has the authority to approve or disapprove all laboratory and field data based upon its compliance with project quality control requirements prior to transmittal to the USATHAMA Installation Restoration Data Management System (IRDMS). The QA Manager may also require cessation of laboratory or field activities which are out of compliance with the Project Quality Control Plan (PQCP), and reject laboratory or field data not complying with project quality control requirements. The QA Manager will communicate directly with USATHAMA QA personnel regarding matters of data validation and other project quality control considerations.

Mr. David Speis, the ETC Laboratory Manager, will be responsible for production of quality and analytical data on the contract. Duties include: (1) supervising and directing laboratory certification analyses; (2) reviewing and developing final chemical data for all samples; (3) ensuring conformance with all applicable QC requirements for laboratory analysis; (4) providing technical direction of the chemical analysis tasks; (5) serving as liaison between the field sampling team and the laboratory; (6) writing and reviewing the chemical analysis sections of all sampling design plans and final reports. The Laboratory Manager has the authority to approve or disapprove selection of analytical methods for laboratory analysis, and all laboratory data based upon its technical quality and reliability with regard to the achievement of project objectives.

Mr. Wayne Saunders, the Field Operations Leader, will be responsible for all field activities at the site, including the geophysical and soil-gas surveys and soil and groundwater sampling. He will manage and oversee all on-site activities, including those performed by the subcontractor. Mr. Saunders will also perform the geophysical surveys and interpret the results.

Mr. Andrew Szilagyi, the Program Safety Manager, will perform the following functions, as required:

- Preparation and review of each project Accident Prevention/Safety Plan and safety SOPs;
- Training of project personnel in the hazards associated with specific work elements;
- Direct command and personal supervision of all high-hazard tasks defined in the Health and Safety Plan;
- Cessation of activities not in compliance with the Safety Plan or SOPs;
- Monitoring and auditing field operations for compliance with approved protocols and procedures;
- Performance of all accident and incident investigations and preparation of required reports; and
- Working with laboratory safety personnel to ensure safe

laboratory operations.

To fulfill these responsibilities, the Safety Manager has the authority to recommend and require safety systems and procedures commensurate with defined hazards at a site, and to demand compliance with all safety-related SOPs and plans, and dismiss from the site any personnel not acting in a safe and uncompromising manner. In addition, he can directly intercede to stop any activities deemed to be a threat to personnel health or property, and recommend/implement procedures for correcting safety problems. Responsibilities will also include identifying the required level of protection for personnel for any laboratory or field procedures, requiring the utilization of qualified personnel trained in necessary safety procedures, and ensuring that adequate emergency procedures and response capabilities are available.

Other Project Personnel

Other personnel assigned to the task and their functions are as follows:

Rick Swahn - Sampling Team Leader
Spence Smith - Geophysical survey assistant
Park Gilmore - Sampling assistant
Georgeann Morekas - Environmental engineering and assessment
Kim Green - Geochemical assessment
James Chang - Safety engineer
Catherine Madore - Program Data Coordinator
Joann Lawonn - Contract Specialist
Jack Jackson - Chemical technician
Jeff Martineau - Soil-gas sampler
Tim Niblet - Soil-gas sampler
T.J. Meyer - Soil-gas sampler
Ken Ranlett - Soil-gas team manager.

Brief resumes for proposed personnel will be found in Appendix D.

8.3 MANAGEMENT CONTROLS

We will provide constant technical communication, clear and complete definition of task subelements, and weekly comparison of level of effort expended to technical output, in response to the need for effective day-to-day management of each project. The schedule and work plan will be developed by the project team under the direction of the Task Manager. Technical supervision and conduct of each work element and cost-schedule performance control will be done by the technical leader assigned for each task. Technical management, coordination, and cost control parameters have been developed for each work element. This coordination will be affected on a day-to-day basis by the Task Manager, who has overall budget, schedule, and technical authority for each task.

The Task Manager will exercise day-to-day control of each task element. Each work element described in the Work Plan consists of subelements or tasks developed and scheduled jointly by the Task Manager and technical leaders with a level of effort and cost estimate. This detail provides the basis for the resource plans by work element which are used in the monthly status reports. Milestones have been included to monitor technical progress as a function of the level of effort estimates. Thus, the Task Manager can determine the technical and cost status of each task element on a weekly basis and resolve and correct any potential schedule slippage, technical difficulties, or cost growth before an uncontrollable situation develops.

Direct approval authority for cost reports and labor charges will be accorded the Task Manager. He will monitor these charges on a monthly basis, and will ensure that monthly status reports accurately reflect the reports prepared by each technical manager.

The Program Manager will review summaries of progress and will review/approve monthly technical and resource status reports. If costs are not in compliance with schedule or technical progress, the Program Manager will work with the technical managers to remove inappropriate labor or non-labor charges, and/or correct the problems causing the variances. The Program Manager and key technical managers will meet on a monthly basis, or more often as necessary, for thorough briefings and discussion of both technical and performance progress. Briefings and meetings with the COR will be held as needed or as required by each Task Order, and frequent communication with the COR will be maintained throughout the period of task performance.

The Task Manager will perform technical review of project status and quality using several methods, including the following:

- Review of all field notebooks, analytical results, calculations, and interim deliverables for completeness and quality;
- Discussion of quality problems with the QA Manager and technical staff performing work;
- Comparison of actual outputs with planned outputs in terms of number and type of activities;
- Communication with field and laboratory personnel to review in-progress work;
- Review of data-entry and data validation status on a weekly basis; and
- Review of QA reports, audit findings, and status of corrective actions.

8.4 RESOURCES PLAN AND SCHEDULE

The Resource Utilization Plan, showing work element labor and other costs by month and for the total task, is given in Exhibit 8-2. A schedule of activities for each major work element is provided in Exhibit 8-3. These management plans will form the basis of the monthly status reports which will be submitted to USATHAMA. Other management information summaries, including anticipated travel, materials and supplies, and subcontracted effort, are provided in Exhibits 8-4, 8-5, and 8-6, respectively.

Item	Contract-specified CDRL	Submission
Project QC Plan	A006	(Work Plan-APPX. A)-Sept. 26, 1988
Accident Prevention/Safety Plan	A009	(Work Plan-APPX. B)-Sept. 26, 1988
Data Management Plan	A010	(Work Plan-APPX. C)-Sept. 26, 1988
Quality Control Charts	A008	Weekly as required
Performance and Cost Report	A001	Monthly as required
Final Report	A011	Draft-NLT February 1989 Final-NLT April 1989
Logbooks and Software	A014	At close of contract

APPENDIX A

PROJECT QUALITY CONTROL PLAN

PROJECT QUALITY CONTROL PLAN
FOR RI/FS--TASK ORDER NO. 1
SENECA ARMY DEPOT BURNING PIT/LANDFILL
SITE INVESTIGATION

Davida Parker Trumbo
Quality Assurance Manager

Gary McKown, PH.D
Task Manager

Gary McKown, PH.D
RI/FS Program Manager

ICF TECHNOLOGY INCORPORATED
9300 LEE HIGHWAY
FAIRFAX, VIRGINIA 22031

SEPTEMBER 1988

Charge Code No. 30395-001-XX

TABLE OF CONTENTS

SECTION PAGE

1.0 INTRODUCTION

1.1 PURPOSE

Quality Assurance (QA) is defined as the overall system of activities for assuring the reliability of data produced. The system integrates the quality planning, assessment, and improvement efforts of various groups in the organization to provide the independent QA program necessary to establish and maintain an effective system for environmental analyses and related activities. The program encompasses the generation of valid and complete data and its subsequent review, validation, and documentation.

1.2 SCOPE

The Project QC Plan (QAPjP) is intended to delineate the purpose, policies, standard operating procedures, and organization of the QA Program. Implementation of the program will ensure the validity of data collected during sampling events and establish sound premises for decision making.

Inherent in the QA program is the implementation of quality control measures. These measures provide assurance that the monitoring of quality related events have occurred, and that analytical data is accurate, precise, and complete.

The QAPjP has established function-specific responsibilities and authorities for data quality. Procedures have been defined which will ensure that non-laboratory activities will not compromise analytical data quality.

2.0 PROJECT DESCRIPTION

The objective of this task is to conduct a site investigation in the vicinity of the former burning pits, incinerator, and adjacent landfill at Seneca Army Depot, Romulus, New York. This study will encompass detailed investigations of an area suspected of contributing to observed groundwater contamination in the vicinity.

The work plan for this task includes several activities related to definition of the sources of contamination and to corroborating previous non-USATHAMA analytical results. A soil-gas survey will be conducted within the landfill area and downgradient of the area to determine likely locations of major sources and contaminant plumes. An electromagnetic (EM) survey will be conducted across the area to determine the limits of the landfill, to detect the presence of buried containers, and to clear locations for the soil-gas survey and soil sampling. Soil samples will be collected for USATHAMA-certified laboratory analysis for volatile chlorohydrocarbon and hydrocarbon contaminants, and for metals. Groundwater samples from existing monitoring wells will also be collected and analyzed for the same parameters. In addition, slug tests will be performed in several of the wells to provide estimates of aquifer transmissivity. Results will be interpreted to assess the nature and extent of the contamination problem, and to evaluate alternatives for interim response actions at the site.

The planned soil-gas surveys have the limited data quality objectives of providing semi-quantitative indications for more precise and accurate sample collection and analysis. Therefore, this testing will be performed by non-certified methods, using a portable gas chromatograph on-site for analysis of principal volatile constituency in air samples collected from the vadose zone. Quality control for these methods will be limited to performance of blank and duplicate analyses, and to comparison of retention times and response factors with standards of compounds likely to be encountered. The soil and groundwater sampling and analysis will be conducted under the full purview of the USATHAMA QA Program, December 1985 (2nd Edition, March 1987).

3.0 PROJECT AND QA/QC ORGANIZATION AND RESPONSIBILITY

ICF's Quality Assurance goals will be achieved through proper planning, organization, review, communication of objectives, auditing, reporting, and corrective action. The QA Program will be carried out by personnel knowledgeable in QA theory and practice. Facilities, equipment, and services which affect data quality or integrity shall be routinely inspected and maintained, as required by standard operating procedures.

Implementation of the QAPjP requires that the project staff maintains a cognizant awareness of contractual procedures and goals. It is the policy of ICF Technology to provide a QA program to ensure that all information produced by its employees and subcontractors is valid and of known quality. QA program requirements cover all activities performed, supported or required by ICF which generate environmental measurement data. These requirements include statements of completeness, comparability, representativeness, precision, and accuracy.

Program personnel shall be familiar with the required conventions, formats, and schedules specified in documents pertinent to project activities. Data review personnel will be able to review data for accuracy and precision in accordance with guidelines specified in the 1985 USATHAMA QA Plan.

Field and analytical methods and procedures used in measurement and monitoring efforts will conform to USATHAMA-approved methodology, when available. Field team members will possess the appropriate certification and training prior to collecting environmental samples. All measurement methods will be fully documented and include quality control procedures.

The intended use(s) of the data and the associated acceptance criteria for data quality will be determined before the data collection effort begins. Reported data will include, when appropriate, statements of precision, accuracy, representativeness, completeness, and comparability. Data processing procedures will be documented, reviewed, and revised, as required to meet USATHAMA data quality requirements.

3.1 RESPONSIBILITIES

Responsibilities for implementation of the QA Program in accordance with field and laboratory QA/QC contractual obligations lies principally with the QA Manager. The QA Manager has the authority to ensure the reliability and validity of project deliverables and compliance with the QAPjP, as well as the 1985 USATHAMA QA Plan. Specific responsibilities include the following:

- Ensuring that sampling activities are consistent with the approach defined by the Project QC Program and USATHAMA guidelines;

- Monitoring laboratory QA/QC functions to ensure that practices are in conformance with approved policies and standard operating procedures;
- Initiating QA activities within the program to ensure that QC measures are being implemented and maintained;
- Ensuring all records, logs, standard operating procedures, and analytical results are maintained in a retrievable manner;
- Elucidating conditions requiring corrective actions and implementing the appropriate course of action;
- Conducting periodic performance and system audits to ensure acceptable analytical performance; and
- Preparing periodic quality reports.

4.0 SAMPLING

Samples collected must be representative of the matrix being sampled and adequate care should be maintained to avoid the potential for contamination during the sampling event. The procedures described in this section are designed to eliminate external contamination through the use of good sampling techniques.

During the sampling event at Seneca Army Depot, 10 aqueous samples will be collected from existing monitoring wells and 10 soil samples will be collected from the surrounding source area(s). Five samples from each matrix will be analyzed for volatile chlorohydrocarbons and hydrocarbons, and currently-certified metals. Rinsate water and blanks will also be collected and analyzed.

4.1 CONTAINERS

All sample containers will be cleaned prior to use according to protocols established in the 1985 USATHAMA QA Plan. Cleaning instructions are presented in Section 5.1.1 of this document. Wide-mouth amber glass bottles will be used for soil samples. Containers for aqueous samples will include:

- 40 ml Teflon septum sealed glass vials for volatile compounds;
- Amber glass bottles for organic constituents other than volatiles; and
- 500 ml polyethylene bottles for inorganic analytes.

4.2 SAMPLE LABELING

Each sample will be assigned a unique sequential number at the time of sampling, which will be permanently affixed to the sample container. The sample label will include the following information:

- Sample number;
- Sampling date;
- Preservative;

- Analyte(s);
- Sampler's initials; and
- USATHAMA project number.

Labels will be covered with polyethylene tape to prevent any losses during shipment. Chain-of-custody (COC) seals will be affixed to sample shipment containers, and completed COC forms and sampling information will accompany the sample shipment.

4.3 SAMPLE COLLECTION

4.3.1 Groundwater Samples

Groundwater sampling will occur after the wells have been developed in accordance with USATHAMA geotechnical requirements, and purged of five equivalent volumes, to ensure that the groundwater system has returned to chemical equilibrium prior to sampling.

Equipment used to measure and sample groundwater systems must be rinsed prior to use in each well to prevent the potential for cross-contamination. Water used for rinsing equipment shall be bottled distilled water obtained from a USATHAMA-approved source.

A rinsate blank will be included in the sample lot to discern whether cross-contamination is occurring.

Care must be utilized in protecting sampling equipment from ground surface contamination. Protective sheeting should be placed around the well to achieve this condition.

4.3.1.1 Monitoring Wells. The following procedure should be utilized for collecting monitoring well samples in accordance with USATHAMA protocols:

- Measure the depth from the top of the well casing to the top of the water and record the depth in the sampling logbook.
- Measure and record the depth from the top of the casing to the bottom of the sediment/water interface.

- Subtract the depth to top of the water from the depth to the bottom of the sediment/water interface to determine the height of standing water in the casing and saturated annulus.

- Obtain a sample of groundwater for temperature, conductivity, and pH measurements. The results of these tests should be recorded in the sampling logbook.

- Bail a quantity of water from the well equivalent to five times the calculated volume of water in the well, including the saturated annulus.

- If the recovery rate for the well is rapid, allow the well to recover to its original level and evacuate a second time prior to sampling, or obtain the sample as sufficient water is available.

- When collecting samples for volatile analysis care should be taken to prevent analyte loss by evaporation. The sample is not filtered in the field, and no preservative is added to the sample vial. The following procedure should be adhered to when collecting these samples:

    1. Avoid excessive aeration and agitation of sample.

    2. Rinse vials with sample water prior to actual sample collection.

    3. Fill vial so that a reverse meniscus is present.

    4. Place septum on vial so that the teflon side is in contact with the sample. Be careful to avoid air bubbles in the sample.

    5. Immediately transfer the vial to the sample shuttle once it has been collected. Do not allow ice packs to touch the vials.

- Samples collected for metals analyses will be filtered and preserved in the field.

- Samples will be labelled in accordance with the 1985 USATHAMA QA Plan protocols.

- All samples will be placed in temperature controlled shuttles and delivered to the laboratory as soon as possible.

4.3.2 Soil Samples

Sampling locations for the collection of soil samples must be chosen prior to the event and known to be representative of the area under investigation. All locations must be marked with a stake, and labelled with the appropriate site identification criteria.

Samples shall be obtained by subsample methods using either a split spoon or solid barrel sampler. The sample must be collected in a manner which preserves the sample integrity and composition. Samples for organic and inorganic analyses will be placed in clean, wide-mouth, amber glass bottles with Teflon lined caps. Samples for volatiles shall be placed in 40 ml sample vials.

4.4 SAMPLE PRESERVATION

Preservatives are utilized to retard the degradation of constituents in the samples during transit and storage prior to laboratory analysis. Preservatives will be added to the sample at the time of collection for this project. The type of preservative required is illustrated in Exhibit 1.

4.5 SAMPLE CUSTODY

All information included on chain-of-custody (COC) forms must be complete. Evidence of custody shall be traceable from the time the COC seal is initially broken on the shuttle until it is subsequently received by the lab. It is imperative that the staff laboratory maintain constant communication with the Field Sampling Team.

All samples shipped shall be accompanied by COC form(s). The original and one copy will be placed in a plastic bag inside the secured shipping container. One copy of the COC form will be retained by the Sampling Team Leader. The original COC will be transmitted to the Program Data Coordinator (PDC) after samples are received by the laboratory. Receipts from post offices, copies of bills of lading, and air bills shall be retained as part of the COC documentation.

EXHIBIT 1. SAMPLE PRESERVATION FOR AQUEOUS AND SOIL SAMPLES

Parameter	Container		Preservative	
	Soil	Water	Soil	Water
Metals	G	P	Cool, 4°C	HNO_3 to pH < 2
Volatiles	G	G	Cool, 4°C	Cool, 4°C

4.5.1 Sample Receipt

The ETC employee accepting receipt of any sample from a customer or carrier shall be designated the "Sample Custodian". Chain-of-custody for laboratory receipt will be established in the following manner:

- The carrier and the time of arrival is documented in the daily receipt log. The number of items on the airbill is checked with the actual number received to ensure that all samples arrived.
- Notation is made as to whether the shuttle was sealed.
- The container is opened, the temperature taken, and the samples are itemized. All deviations are noted and reported to the applicable authority.
- ETC numbers will be assigned to the samples. Reference to USATHAMA field numbers will be documented in the appropriate logbook. All data are entered into the computer tracking system, with analyses required by holding-time specified dates.

4.5.2 Laboratory Receipt

Once the sample has been transmitted to the laboratory the following chain of events occurs:

- The samples are recorded on the Sample Log-In Form to summarize all the information pertaining to the sample/order to instruct the laboratory on the proper analysis and reporting of samples.
- After the samples are logged in, they are assigned to the appropriate walk-in refrigerator.
- All transfers of samples into and out of storage are documented.
- Samples remain in secured storage until removed for sample preparation or analysis.

5.0 SAMPLE ANALYSIS

5.1 SAMPLE MANAGEMENT

ETC shall provide the following for field sampling:

- Cleaned glassware;
- Appropriate preservation;
- Shipping containers with custody seals; and
- Coolants for maintenance of sample preservation.

5.1.1 Sample Container Cleaning

The integrity of containers for soil and water samples is ensured by using the appropriate cleaning techniques. ETC will clean the sample bottles for volatile and metals analysis according to the following USATHAMA approved methodology:

- Amber glass bottles and 40 ml vials:
    1. Wash bottles in detergent.
    2. Rinse with copious amounts of distilled water.
    3. Solvent rinse the bottles with acetone, followed by methylene chloride (Nanograde or equivalent), then hexane (Nanograde or equivalent).
    4. Allow bottles to air dry.
    5. Place bottle in a drying oven and heat to 200°C.
    6. Allow bottles to cool prior to sealing with clean caps and Teflon liners.

- Bottle caps:

  1. If applicable, remove paper liners from caps.

  2. Wash caps with detergent, followed by a distilled water rinse.

  3. Dry caps in a drying oven at 40°C.

- Teflon Liners:

  1. Wash liners with detergent, followed by a distilled water rinse.

  2. Rinse the liners with acetone, followed by hexane (Nanograde or equivalent).

  3. Allow liners to air dry prior to placing in cleaned caps.

  4. Heat liner and caps in a drying oven at 40°C for 2 hours.

  5. Allow caps and liners to cool prior to placing on clean bottles.

5.1.2 Shuttles

Cleaned bottles will be shipped to the field in specially-designed coolers denoted as shuttles, which will be used for return of samples to the laboratory. Each shuttle contains special packing and sufficient Blue Ice packs to ensure that cold (4 degrees C) and intact samples arrive at the laboratory. All shuttles are sealed with serialized chain of custody seals that require physical destruction for removal. Tracking of shuttles to and from the field is accomplished by reference to the seal serial number. Because the tracking is an inherent part of the laboratory data management system (LDMS), the status of a sampling or analytical step is known at any time after sample bottles are packed for shipment to the field.

Each shuttle contains the computer-generated paperwork and preservatives associated with the samples to be included in the return shipments. Bottles are pre-labeled with required information, requiring only initialing and dating by the sampling team. Pre-labeled three-copy forms for recording of field parameters of interest to the laboratory, and for maintaining chain of custody throughout all steps of the process, are contained in each shuttle. Appropriate preservatives in breakable-seal ampules are taped to each bottle.
These features are useful in maintaining an unbroken chain of quality control throughout the sampling and analysis program.

5.2 SAMPLE HOLDING TIMES

The time interval between sampling and analysis, in which a sample can be considered valid and representative of the sample matrix, is based on the analytes of interest. The allowable holding times for soil and water samples are shown in Exhibit 2. The laboratory tracking system contains required analysis-by dates, based on the sampling date as entered during the logging-in process, so that holding times are not exceeded.

5.3 SAMPLE PREPARATION

Once the samples have been received by the laboratory, the information on the sample labels will be transcribed to a bound notebook. Received condition, analytical methods and parameters, analysis-by dates, and storage locations are entered into the existing laboratory data management system files for each sample shipment. Analytical lots will be established and coding assigned in lot sequence during the logging-in stage. Samples will be securely stored at 4°C from the time of receipt through final analysis and reporting of validated results. Samples will be stored until released by the USATHAMA Project Officer or until the end of the contract.

Prior to analysis, groundwater samples for organic analyses will be filtered in the laboratory through a 0.4 micron Millipore filter. Spiking will be performed using either Standard Analytical Reference Materials (SARMs) or Interim Reference Materials (IRMs), and will be added to the aqueous matrix before beginning the extraction procedure.

Soil samples will be mixed and analyzed as received. Percent moisture will be determined for each sample.

Water used in the course of organic analyses shall conform to ASTM Type II grade in accordance with guidelines specified in the 1985 USATHAMA QA Plan. Inorganic analyses requires the use of ASTM Type I grade water.

5.4 CALIBRATION

Prior to sample analysis, chemical calibration of each target analyte must be performed to ensure analytical instrumentation is functioning within the established sensitivity range. Protocols defining the procedures and QC measurements for instrument calibration should be done in accordance with criteria specified in the 1985 USATHAMA QA Plan.

EXHIBIT 2. ALLOWABLE HOLDING TIMES FOR SOIL AND WATER SAMPLES

Parameter	Maximum Holding Time for All Matrices
Chlorinated Hydrocarbons	14 days
Metals	6 months with the exception of Chromium VI (24 hours) and Mercury (28 days)

5.4.1. Initial Calibration

Initial calibrations for the methods to be used in this project are performed routinely by the laboratory as part of other USATHAMA-governed programs. Additional initial calibrations are anticipated only in the event that an instrument fails the daily calibration procedure.

5.4.2 Daily Calibration

Prior to analysis, all instruments must be calibrated to ensure that the instrumental response has not changed from the previous calibration. Analysis should be performed on the highest concentration standard. A response within the required percentage or two standard deviations of the mean response for the same concentration, as determined from precertification, certification, and prior initial/daily calibrations, does not warrant recalibration of the system. Should the response fail the criteria, the daily standard must be reanalyzed. Failure of the second analysis requires initial calibration to be performed as specified in the 1985 USATHAMA QA Plan.

5.5 SOLUTION VALIDATION

All calibration solutions and standards to be used in this program will be prepared and maintained under the normal laboratory standards tracking system. This system ensures preparation, checking, documentation, storage, and disposal of standards according to specified procedures and schedules appropriate for each analyte of interest.

5.6 ANALYTICAL PROCEDURES

Only analytical procedures for which the laboratory is USATHAMA-certified will be used for analysis of samples in the laboratory. Exhibit 3 shows analytes for the certified volatile compound methods EJ8 (water) and EW9 (soil), and the associated detection limits and upper concentration ranges. Exhibit 4 lists the corresponding information for the metal analyte methods EG8 (water) and ER9 (soil).

Soil-gas analysis for volatile constituents will be performed by a procedure which is not a USATHAMA-certified analytical method. A description of the on-site procedure to be used is provided in Section 2.3 of the Seneca Army Depot Work Plan. Additional non-certified procedures that will be employed in the field include measurement of pH, temperature and conductivity during well purging and sampling, and aquifer testing by the slug-test method.

EXHIBIT 3

ETC CERTIFIED DETECTION LIMITS AND UPPER RANGES FOR VOLATILE COMPOUNDS

ANALYTE	DETECTION LIMITS Soil (ug/g)	Water (ug/l)	UPPER RANGE Soil (ug/g)	Water (ug/l)
Methylene Chloride	1.08	15.7	25.0	
1,1-Dichlororethane	0.61	2.0	25.0	
trans-1,2-Dichloroethylene	0.75	2.6	25.0	
Chloroform	0.61	2.1	25.0	
1,2-Dichloroethane	0.58	1.1	25.0	
1,1,1-Trichloroethane	0.71	1.7	25.0	
Carbon Tetrachloride	0.70	2.8	25.0	
Dimethyl Disulfide	0.97	4.6	25.0	
Trichloroethylene	0.90	2.4	25.0	
Benzene	0.73	2.2	25.0	
1,1,2-Trichloroethane	0.64	2.4	25.0	
Methyl Isobutyl Ketone	0.93	5.6	25.0	
Tetrachloroethylene	0.48	1.3	25.0	
Toluene	0.47	2.1	25.0	
Dicyclopentadiene	0.59	2.1	25.0	
Chlorobenzene	0.40	1.3	25.0	
Ethylbenzene	0.37	2.5	25.0	
1,2-Dibromo-3-Chloropropane	0.64	3.3	25.0	
m-Xylene	0.45	2.9	25.0	
(o,p)-Xylene	0.90	2.1	25.0	
Methylene Chloride-d2	1.13	2.0	25.0	
1,2-Dichloroethane-d4	0.71	2.6	25.0	
Ethylbenzene-d10	0.42	1.2	25.0	

EXHIBIT 4

ETC INORGANIC ANALYTES CERTIFIED FOR QUANTITATION BY USATHAMA PROTOCOLS IN SOIL AND WATER

ANALYTE	REPORTING LIMIT SOIL (ug/1)	 WATER (ug/g)	METHOD
Mercury	0.081	0.5	Cold Vapor
Arsenic	1.64	7.8	Furnace
Lead	-	2.5	Furnace
Cadmium	0.317	10.0	ICP
Chromium	7.65	23.0	ICP
Copper	3.37	26.0	ICP
Lead	7.84	-	Furnace
Zinc	14.9	21.0	ICP
Magnesium	-	510	ICP
Calcium	-	500	ICP
Sodium	-	2800	ICP
Potassium	-	620	ICP

5.7 REFERENCE MATERIALS

Reference standards are required to generate certification data, calibrate instruments, spike analytical surrogates or standards, and prepare QC samples. These solutions must be of known concentration and purity to achieve the criteria necessary for validation of analytical analyses.

Standards used to conduct analytical analyses will be either SARMs or IRMs. SARMs that are developed and distributed by the Central QA Laboratory from the National Bureau of Standards (NBS) Standard Reference Materials (SRMs) or traceable to NBS SRMS will be the preferred standard. IRMs are not as rigorously characterized as SARMs.

Reference materials for metal analyses may be stored at room temperature in a locked storage area. Materials for organic analyses must be stored in a locked refrigerator at or below 4°C.

5.8 DATA REDUCTION, VALIDATION, AND REPORTING

5.8.1 Collection

Data are initially collected, converted to standard reporting units, and recorded in standard formats by the project analysts. These project analysts conduct preliminary data analyses using a variety of methods and procedures. Because many analytical instruments are microprocessor controlled, some of the requisite analyses can be performed directly in the instrument's operating or outputting mode. Those instruments interfaced to stand-alone computers or microprocessors often permit data analysis programs to be written and modified to produce data formats specifically suited to end user requirements.

Data requiring manual recording, integration, and/or analysis may be converted to a more appropriate format prior to subsequent analyses. Through all stages and aspects of data processing, the data are double checked for translation or transcription errors and are initialed by both the recorder and the checker. The QA Manager or other designated individual not directly involved in the analysis, reviews the data for acceptability.

5.8.2 Validation

Data validation is the process whereby data are determined to be of acceptable or unacceptable quality based on a set of predefined criteria. These criteria depend upon the type(s) of data involved and the purpose for which data are collected.

An independent review of data packages will be performed to ensure compliance with specified analytical, QA, and data reduction procedures; data reporting requirements; and required accuracy, precision, and completeness measures. The following items may be reviewed to validate the data:

- Sample holding times;
- Documentation that the analytical results are within the control limits;
- Documentation that data and calculations were checked by a reviewer who was not involved in the performance sampling, analysis, or data reduction;
- Calibration of methods and instruments;
- Routine instrument checks (calibration, control samples, etc.);
- Documentation on traceability of instrument standards, samples, and data;
- Documentation on analytical methodology and QC methodology;
- Results of QC performance samples with appropriate QC materials;
- The control for interference contaminants in analytical methods (use of reference blanks and check standards for method accuracy and precision);
- Documentation of routine maintenance activity to ensure analytical reliability; and
- Documentation of sample preservation and transport.

All data generated will be assessed for accuracy, precision, and completeness. Data assessment techniques will include routine quality control checks, and system audits.

Precision will be assessed from measurements of replicates of the same measurement at different times. Control charts will be maintained to provide a timely assessment of precision for measurement functions.

The Standard Deviation (SD) will be used to assess precision. It is defined as the square root of the variance of a set of values. The standard deviation will be calculated at each target concentration incorporated into the USATHAMA Installation Restoration Data Management System (IRDMS).

Accuracy will be assessed from measurements of NBS-SRMS or samples spiked with known concentrations of reference materials. The assessment for accuracy will be independent of the routine calibration process (e.g., reference materials will be obtained from independent sources and will be prepared independently).

5.8.3 Reduction

Data reduction frequently includes computation of analytical results from raw instrument data and summary statistics, including standard errors, confidence intervals, test of hypothesis relative to the parameters, and model validation.

Procedures address the reliability of computations and the overall correctiveness of the data reduction. The numerical transformation algorithms used for data reduction will be verified against a known problem set to ensure that the reduction methods are correct.

The equations and the typical calculation sequence that should be followed to reduce the data to the acceptable format is instrument- and method-specific. Where standard methods are modified, data reduction techniques will be described in a report accompanying the data.

Auxiliary data produced for internal records and not reported as part of the analytical data include the following: laboratory worksheets, laboratory notebooks, sample tracking system forms, instrument logs, standard records, maintenance records, calibration records, and associated quality control. These sources will document data reduction and will be available for inspection during audits and to determine the validity of data.

Outliers will be identified as described in "Processing Data for Outliers," by W. J. Dixon, Biometrics, Vol. 9, No. 1, 1953.

5.8.4 Reporting

Data shall be reported in the USATHAMA IRDMS, as described in the 1985 USATHAMA QA Plan. The analyst shall quantify each analyte in the method blank and spiked QC sample each day of analysis. Processing of additional sample lots will not occur until the results of the previous lots have been calculated, plotted on control charts as required, and the entire analytical method shown to be in control.

Method blank data shall generally be reported as "less than" the CRL for each analyte. Values detected above CRL shall be reported as determined, with entry into the USATHAMA data management system in terms of concentration.

6.0 SYSTEM CONTROLS

6.1 DOCUMENT CONTROL

The goal of the ICF Document Control Program is to assure that all project documents issued or generated will be accountable upon completion of the project. The program includes a serialized document system, document inventory procedure, and a central filing system with a designated person(s) responsible for its maintenance.

All documents used or generated during the course of the project are accountable and become a part of the project files upon completion of the task. These may include but are not limited to the following:

- Sample identification documents;
- Chain-of-custody record;
- Project Deliverables (i.e., Work Plan, audit reports, etc.);
- Analytical logbooks, laboratory data, calculations, graphs, strip charts, field logs, and software;
- Reports, and correspondence material; and
- Photographs, maps, and drawings.

USATHAMA has in place a serialized coding system for sample analyses. For documents not having serialized numbers (e.g., laboratory bench sheets, data review checklists, and raw data sheets), each page shall show the analytical method number, date, name of recorder and any other pertinent information. In addition, each laboratory analyst is assigned a numbered, permanently-bound, logbook to record data review notes, sample control information, laboratory observations, and calculations not recorded on benchsheets or strip-chart printouts. Copies of relevant pages will be made upon completion of an analysis.

When an error is made on an accountable document, corrections are made by drawing a single line through the error and entering the correct information. The correction must also be initialed and dated.

After an analysis has been completed, all accountable documents generated or used for the task work will be assembled and placed in locked filing cabinets in the central offices. All accountable task documentation will then be inventoried by a Data Control Technician or Document Control Designee. The inventory consists of assigning a serialized alpha-numeric code to each document and generating a document inventory summary. The alpha character for each document number designates the document type.

Documents and summary reports generated will be designated a unique alpha-numeric document control number (e.g., MDLF-QA-I-0001). It consists of four parts:

- Contract name;
- M, T, or QA - type of report (i.e., M-management, T-technical or Q-quality A-assurance);
- I- I for ICF Office, HQ for Headquarters Work Team; and
- 0001 - chronological sequence.

All documents and summary reports will use a document control format in the upper right corner which includes:

- Alpha-numeric document control number;
- Section number;
- Revision number;
- Date of revision; and
- Page___ of ___.

6.2 QUALITY CONTROL SAMPLES

QC samples are analyzed to provide quantitative evidence supporting the performance of the analytical system, and demonstrate that the sensitivity is analogous to the level achieved during certification.

QC samples will be identified by the analyst conducting the actual analysis. Sample numbers should be assigned during the logging-in process for inclusion in the sample train as a check on analytical method performance.

The QC sample is prepared by the person conducting the first step of the analytical method. Solution concentration, standard matrix, spiking levels, and frequency of control samples will be specified in the certified method, as delineated in the 1985 USATHAMA QA Plan.

6.3 CONTROL CHARTS

Where applicable, control charts will be used to monitor the trends and variations in the accuracy and precision of analytical analyses. The control chart shall contain the following:

- Title, analyte, method number, and laboratory name;
- Spike concentration;
- Three-letter lot designation and analysis date for each point along the abscissa;
- Percent recovery (X charts) or Range (R charts) along the ordinate;
- Upper and lower control limits; and
- Upper and lower warning limits.

Criteria and formats for control chart construction can be found in the 1985 USATHAMA QA Plan.

6.4 OUT-OF-CONTROL CONDITIONS

Situations arising from failure to adhere to standard operating procedures, policies, and protocols mandated by the QA Project Plan and the 1985 USATHAMA QA Plan have the potential to adversely affect data quality and effect investigation and or corrective action. In the case of control charts, suspect data are indicated when:

- A value has been determined to be outside the control limits or classified as an outlier by a statistical test.
- A series of seven consecutive points lie on the same side of the central or mean line.
- A series of five consecutive points are going in the same direction.
- A cyclical pattern of control values exists.
- Two consecutive points appear between the upper warning and control limits or the lower warning and control limits.

The detection of either of the above conditions warrants some type of corrective action. The analyst and QA Coordinator must investigate the cause and document the appropriate action taken. Data acquired during the development of one of the above conditions will be discarded, and analysis will not resume until it is proven to be in control. Section 10.0 of this plan provides protocols for documenting corrective action.

7.0 PREVENTIVE MAINTENANCE

Instrument maintenance, both routine and preventive, will be performed as requested by USATHAMA. A preventive maintenance plan allows for periodic instrumentation checks for problems that occur frequently. The objective of a preventive maintenance plan is to rectify equipment problems before they become serious. Preventive maintenance also brings attention to those areas of the instrument susceptible to degradation from aging, toxic/corrosive attack, and clogging due to environmental factors.

Procedures for preventive maintenance are contained in each instrument's manual under the maintenance/troubleshooting sections. Each piece of equipment will have an associated standard operating procedure (SOP) detailing the calibration/maintenance instructions. Equipment failing calibration specification will be identified with a red warning label and will not be used for sample analysis.

Equipment requiring calibration will have an assigned record number which is permanently affixed to the instrument. A label will be affixed to each instrument containing the following information:

- Description;
- Manufacturer;
- Model number;
- Serial number;
- Date of last calibration or maintenance;
- Name of person who performed calibration or maintenance; and
- Date of next servicing.

7.1 CALIBRATION/MAINTENANCE FREQUENCY SCHEDULE

Schedules for calibration/maintenance must be accomplished at the manufacturer's recommended frequency, unless prior experience dictates a more frequent schedule. Should a schedule not be provided by the manufacturer, the calibration group servicing the equipment must provide a written calibration and maintenance frequency.

8.2.3.2 Sample Handling. All personnel involved in performing any aspect of the analytical protocol must maintain a record of the activities in a bound logbook. Although this logbook must be specific to the operation, it need not be operator specific. The logbook should be signed and dated daily and contain the following information:

- Samples handled;
- Standards used;
- QC samples prepared;
- Procedures used; and
- Resultant calculations.

8.2.3.3 Instrument Operation. Each instrument must have a dedicated logbook. Information in the logbook must reflect routine and emergency maintenance activities, tuning, absolute and chemical curve calibration, and all analytical activities conducted on the instrument. A new page must be started daily during equipment operation. Information to be included for each page consists of:

- Date, operator, and project name;

- Description of any instrument maintenance or modification;

- Tuning and calibration activities;

- Instrument settings;

- Instrument operating conditions; and

- Samples analyzed.

Should automated data acquisition systems be used, reference to the data file for each standard or sample should be recorded.

Hard copy data output from integrators and chromatograms should have the following information clearly evident on the printout:

- Analysis date and time;

- Test name and sample number;

- Reference to the calibration curve used for quantitation;

- Logbook reference to recorded analytical activities; and
- Identification of chromatographic peaks.

9.0 AUDITS

9.1 EXTERNAL AUDITS

External audits will be conducted to determine whether the laboratory and field team are following protocols delineated in the Project QC Plan(QAPjP). For this project one field audit and one laboratory audit will be performed. The field audit will occur in conjunction with a sampling event, while the laboratory audit will occur during the time of actual sample processing.

Upon completion of the audit, a report of the findings will be reported to the USATHAMA Project Officer, the Contractor Project Manager, the Analytical Task Manager, the Contractor QAC, and the USATHAMA Analytical Branch. Deficiencies encountered will be listed in the report.

9.2 INTERNAL AUDITS

Internal audits will be performed on a more frequent basis, as mandated by the applicable analytical method or procedural policies. These audits are performed to verify the following conditions:

- Standards, procedures, records, charts, software, etc. have been properly maintained;
- Actual practice agrees with written instructions;
- QA records have been adequately filed and maintained, assuring documents are protected and retrievable; and
- Results of QC sample analyses have been assessed.

A formal audit report shall be distributed to the Project Manager, Analytical Task Manager, and USATHAMA. Results of the audit must be documented in a bound logbook, or permanently attached and maintained as part of the QA documentation.

10.0 CORRECTIVE ACTION

Corrective action will be initiated through the development and implementation of routine internal quality control checks. Specific limits beyond which corrective action is required will be established for each system. Corrective action requirements will be implemented in response to deficiencies encountered during system audits or failure to adhere to the Project QC Plan (QAPjP) or the 1985 USATHAMA QA Plan.

To enhance the timeliness of corrective action and thereby reduce the generation of unacceptable measurement data, problems identified by assessment procedures will be resolved at the lowest possible management level. Problems that cannot be resolved at this level will be reported to the QA Manager for resolution. The QA Manager will determine at which management level the problem can best be resolved, and will notify the appropriate manager. Weekly progress reports will detail all problems and subsequent resolutions.

Steps comprising a closed-loop corrective action system include:

- Defining the problem;
- Assigning responsibility for problem investigation;
- Investigating and determining the cause of the problem;
- Assigning responsibility for problem resolution; and
- Verifying that the resolution has corrected the problem.

Documentation on the corrective action requirements, the assignment of responsibility for corrective action, due dates for completion of corrective action, and validation of completion will be maintained. Such documentation will be reviewed during system audits. Exhibit 5 is a proposed corrective action report form.

EXHIBIT 5
CORRECTIVE ACTION REPORT FORM

Date of Problem:____________________Originator:______________________________

Description of Problem and Effect on System:______________________________

Persons Notified:______________________ Title______________ Date:__________

Description of Corrective Action:_____________________________________

Person Completing Action:

Signature__________________________ Title____________________ Date________

Approval:__________________________ Title____________________ Date________

11.0 QUALITY CONTROL REPORTS

The following documents are deliverables submitted to USATHAMA in support of the project work performed at the Seneca Army Depot:

- Pre-certification and certification data packages;
- Audit reports;
- IRDMS submissions;
- Results of QC activities;
- QC charts (during periods of analytical analyses);
- Logbooks; and
- Project final report.

The project final report shall be consistent with the following outline:

- Cover Page, disclaimer, and DD Form 1473 (provided by USATHAMA)
- Introduction
- Background
- Site Investigation
- Investigation Results
- Summary
- Conclusion
- Recommended Interim Response Action
- Appendix (containing analytical results)

12.0 REFERENCES

- Federal Register, Part VIII. October 26, 1984. "Guidelines Establishing Test Procedures for Analysis of Pollutants Under the Clean Water Act".
- U.S. EPA 1985. Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses. R-582-5-5-01, Hazardous Site Control Division, Washington, DC.
- U.S. EPA. 1985. Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses. Hazardous Site Control Division, Washington, DC.
- U.S. EPA. 1984. Procedures Manual for the Evidence Audit of Enforcement Investigations by Contractor Evidence Audit Teams. EPA 330/9-8/-003-R, National Enforcement Investigations Center, Denver, CO.
- U.S. EPA. 1982. "Standard Operating Procedure for On-site Laboratory Evaluations for the Contract Laboratory Program", Quality Assurance Division, Environmental Monitoring Systems Laboratory, Las Vegas, NV.
- U.S. EPA. 1984. "Standard Operating Procedure for Superfund Contract Laboratory Program's Laboratory Evaluation", Quality Assurance Division, Environmental Monitoring Systems Laboratory, Las Vegas, NV.
- U.S. EPA. 1983a. "Calculation of Data Quality Indicators." Office of Research and Development, Washington, DC.
- U.S. EPA. 1984c. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043, Environmental Monitoring Systems Laboratory, Las Vegas, NV.
- CLP-RAS Methods
- U.S. EPA. 1976 and 1977. Quality Assurance Handbook for Air Pollution Measurement Systems. EPA-600/19-76-005, EPA-600/4-77-027a, EPA-600/4-77-027b, EMSL, RTP, NC.

- U.S. EPA. 1977. NPDES Compliance Sampling Manual. Office of Water Enforcement, Washington, DC.

- U.S. EPA. 1979a. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. EPA-600/4-79-019, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

- U.S. EPA. 1979b. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

- U.S. EPA. 1980d. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018, Municipal Environmental Monitoring and Support Laboratory, Cincinnati, OH

- U.S. EPA. 1982a. Handbook for Sampling and Sample Preservation of Water and Wastewater. EPA-600/4-82-029, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

- U.S. EPA. 1985. NEIC Policies and Procedures. EPA-330/ 9-78-001-R, National Enforcement Investigations Center, Denver, CO.

- U.S. EPA. 1982e. Test Methods for Evaluation Solid Waste: Physical/Chemical Methods. SW-846, Office of Solid Waste and Emergency Response, Washington, DC.

- U.S. EPA. 1982f. Test Methods: Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. EPA-600/4-82-057, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

- U.S. EPA. 1982g. Test Methods: Technical Additions to Methods for Chemical Analysis of Water and Wastes. EPA-600/4-82-055, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

- U.S. EPA. 1983b. Preparation of Soil Sampling Protocol: Techniques and Strategies. EPA-600/4-83-020, Environmental Monitoring Systems Laboratory, Las Vegas, NV.

- U.S. 1984a. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II - Available Sampling Methods, Second Edition. EPA-600/4-84-076, Environmental Monitoring Systems Laboratory, Las Vegas, NV.

- U.S. Geological Survey. 1977b and subsequent revisions. National Handbook of Recommended Methods for Water-Data Acquisition. Office of Water Data Coordination, Reston, VA.

- Youden, W.J. 1964. Statistical Methods for Chemists. John Wiley and Sons, New York, NY.

- U.S. EPA. 1980. Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors, Draft, National Enforcement Investigations Center, Denver, CO.

- U.S. EPA. 1982. Pesticide Product Laboratory Procedures Manual. EPA-330/9-79-001, National Enforcement Investigations Center, Denver, CO.

- U.S. EPA. 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume III Available Laboratory Analytical Methods. EPA-600/4-84-038, Environmental Monitoring Systems Laboratory, Las Vegas, NV.

- U.S. EPA. 1980. Microbial Bioassay for Toxic and Hazardous Materials. EPA-330/9-80-002, National Enforcement Investigations Center, Denver, CO.

- U.S. EPA. Manual for Groundwater/Subsurface Investigations at Hazardous Waste Sites. EPA-330/9-81-002, National Enforcement Investigations Center, Denver, CO.

APPENDIX B

DATA MANAGEMENT PLAN

DATA MANAGEMENT PLAN
FOR RI/FS -- TASK ORDER NO.1
SENECA ARMY DEPOT BURNING PIT/LANDFILL
SITE INVESTIGATION

Catherine M. Madore
Program Data Coordinator

Gary L. McKown, Ph.D.
Task Manager

Gary L. McKown, Ph.D.
RIFS Program Manager

ICF TECHNOLOGY INCORPORATED
9300 LEE HIGHWAY
FAIRFAX, VA 22031

SEPTEMBER 1988

Charge Code No. 30395-001-XX

TABLE OF CONTENTS

SECTION PAGE

LIST OF EXHIBITS

1.0 INTRODUCTION

One goal of the Remedial Investigation/Feasibility Studies (RI/FS) program is to arrive at reliable and defensible conclusions, based on available data. Experience in conducting environmental surveys and assessments has shown that organization plays a key role in ensuring that the large quantities of data collected in support of a particular project are put into a form that is easy to review and understand.

The purpose of this Data Management Plan is to describe the organization and procedures that will be used to ensure that the geotechnical, chemical analysis, and field screening data obtained from the Seneca Army Depot (SEAD) Burning Pit/Landfill are efficiently collected, accurately transmitted to the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Installation Restoration Data Management System (IRDMS), and carefully archived for future reference.

2.0 ORGANIZATION

The Program Manager, who will also act as Task Manager for this project, is ultimately responsible for all activities, including data management. In addition to handling administration, coordination, and operations associated with the project, the Program Manager will periodically monitor the flow of data to ensure that schedule, technical quality, and resource requirements are met. He will also be responsible for briefing technical personnel on the requirements of the project, and for identifying and resolving any technical problems concerning data management.

The Quality Assurance (QA) Manager will be responsible for reviewing all data records that have been coded by the Data Technician and checked by the Program Data Coordinator to ensure that they are accurate, complete, and supported by adequate documentation.

The Program Data Coordinator (PDC) will handle the day-to-day monitoring of data management activities by ensuring that the collected data are properly coded and entered into the IRDMS by the Data Technician. The PDC will also have the authority to enforce proper procedures, as outlined in this plan, and to implement actions to ensure the accurate and timely flow of data.

The Data Technician will be responsible for coding the data onto standard USATHAMA IRDMS data management forms (see Attachment A) and entering that data into the IRDMS.

The Field Sampling Team, which is composed of Geologists, Samplers, and Chemical Analysts, will be responsible for collecting and documenting the data in their own notebooks and on field parameter forms (see Attachment A). The Sampling Team Leader will ensure that the completed forms are checked for accuracy and presented to the Data Technician in a timely manner.

Environmental Testing and Certification Corporation (ETC) in Columbia, MD, will have responsibility for analyzing all field samples according to USATHAMA analytical procedures for which they are certified. Field screening analyses will be performed by Target Environmental Services, Columbia, MD, using non-certifiable procedures.

3.0 PROJECT DATA

3.1 GEOTECHNICAL DATA

The IRDMS already contains a map file of Seneca Army Depot; however, if more detail is required, additional digitization may be necessary. ICF will notify USATHAMA at least one month before the beginning of sampling, if this need arises. Maps will then be provided by USATHAMA at the appropriate scale, coded on a map coding form (Attachment A), and entered into the system. In addition, the coordinates for any sampling locations, including new monitoring wells and borings, will be logged into the IRDMS, as they are identified.

The only other geotechnical data to be collected for this task are aquifer test data, which will be submitted to the Data Technician, who will code the information and create a transfer file using the data entry routine supplied by USATHAMA. When the transfer file has been checked and validated by the PDC, the data will be transmitted over 3COM communications network to USATHAMA.

3.2 SAMPLING AND ANALYSIS DATA

Sampling data will be collected in the field and both in a permanently bound sampling notebook. Portions of the information will be transferred to a three-part field parameter form. This information will include the site type, site ID, sampling date and time, field sample number, sample depth (if applicable), and the sampling technique. A complete list of required information is presented in Exhibit 1. In addition, each sample container will be annotated in waterproof ink with the installation name, sample number, sampling date, analytes, and preservatives. A chain-of-custody form will also be completed in the field and will accompany the samples to the laboratory, along with the field parameter form (see Attachment A for sample forms).

Collection of analytical data will begin when samples arrive at Environmental Testing and Certification Corporation (ETC). An ETC Technician will first verify that the samples noted on the chain-of-custody form coincide with the sample containers being delivered. If any containers are broken or missing, the chain-of-custody form will be annotated and the Sampling Team Leader will be notified immediately. Samples will then be logged into a project-specific notebook and the computerized laboratory data management system by parameter code, site ID, and laboratory sample number. The field parameter and chain-of-custody forms will then be submitted to an ETC Data Technician for later correlation with the analytical results.

EXHIBIT 1. SAMPLING DATA

- Installation
- Field Sample Number
- Matrix
- Sampling Depth (if applicable)
- Sampling Date and Time
- Sampling Location
- Method of Sampling
- Analytes
- Preservatives
- Significant Observations
- Printed Name and Signature of Sampler
- Number of Samples Taken
- Temperature, pH, and Conductivity of Well Water Sampled
- Groundwater Height Measurements and Calculations to Determine Standing Volume in the Well
- Number of Shipping Containers
- Date of Shipment

On receipt of the sample log information, the Data Technician will contact the ETC Quality Assurance Coordinator (QAC), who will assign analytical lot numbers to the samples in accordance with USATHAMA procedures. The first three letters of the six-character sample code will designate the analytical lot, while the remaining three digits will indicate the sample number within the lot (e.g., AAB006 indicates the sixth sample in lot AAB). All quality control samples required for each analytical lot (e.g., method blank, control spike at two times the certified reporting limit [CRL], and two control spikes at ten times the CRL) will also receive USATHAMA sample numbers. The Data Technician will enter the sample information into the IRDMS to generate partially-completed data coding forms.

When the samples are taken from storage for analysis, the chain-of-custody (COC) form will be signed by the Data Analyst to acknowledge receipt of the samples for processing. When analyses are complete, the Data Analyst will reduce the data for QC samples to determine if the analyses were in control. The QC results will then be reviewed by the ETC Laboratory Section Manager and forwarded to the QAC for verification. If the QAC agrees that the data are in control, the Data Analyst will be directed to proceed with data reduction for the samples. Concentrations of contaminants in extracts will be determined from instrumental responses of the extracts applied to the instrument calibration curve. The resultant concentration will then be modified by applying the appropriate dilution/concentration and sample weight or volume to obtain a final reportable concentration in the original matrix. For soils, results will not be corrected for moisture; however, percent moisture is reported with the result. Aqueous samples will be reported in terms of micrograms per liter and solid samples will be reported in micrograms per gram.

The data will contain no more than three significant digits and will be rounded to the appropriate number of significant digits, based on certification class and dilution, only after all calculations have been completed. When samples are diluted into a certified range, the reported concentration will contain one less significant digit than an undiluted sample. Values less than the certified reporting limit will be reported as "less than" the CRL. If a sample is diluted below the CRL, the value will be reported as "less than" the CRL multiplied by the dilution factor to more accurately reflect the observable limit. The dilution factor will be reported with the data. Method blank values will not normally be subtracted from sample results prior to entry into IRDMS; however, method blank corrections may be made in accordance with the USATHAMA QA Program (2nd ed., Subsection 7.3.1).

When data reduction has been completed for the samples, all data (whether on magnetic media or hard-copy) will be transmitted to the PDC, who will oversee the correlation of the analytical and field data. Data files will then be established, reviewed, and approved by the PDC. Exhibit 2 lists the information that is required for the IRDMS, the data available from the sample log, and the information available from the Data Analyst. Once the analytical

EXHIBIT 2. CORRELATION OF SAMPLING AND ANALYTICAL DATA

IRDMS	Sample Log	Analyst
Installation	X	X
Laboratory		X
Sample		X
Test Method		X
Measurement Units		X
Analyst		X
Sample Number		X
File Name	X	X
Site Type	X	X
Site ID	X	X
Field Sampler Number	X	X
Sample Date	X	X
Sample Prog.	X	
Sample Depth (cm)	X	
Sample Technique	X	
Lab Analysis Number		X
Sample Preparation Date		X
Analysis Date		X
Test Name		X
Measurement Bool		X
Uncorrected Measurement Value		X
Uncorrected Measurement Value		X
Dilution Factor		X
Dilution Factor		X
Percent Moisture		X
Internal Standard Code		X
QC Test		X
QC Spike Value		X
QC Spike Value		X

and field data files have been established, they will be sent to the Data Technician, who will finish entering the data into the system, using the data entry routine supplied by USATHAMA. Further data processing is described in Section 4 of this plan.

3.3 FIELD SCREENING DATA

Field screening data include results from geophysical surveys, soil gas surveys, or any other field investigations that produce results that are collected and analyzed, but not entered into the IRDMS. These data will be logged into notebooks and combined with any hard-copy outputs (e.g., plots, charts, chromatograms) to form data packages, which will be reviewed by the QA Manager and the PDC, before being archived for future reference and use in analysis and assessment tasks.

4.0 INSTALLATION RESTORATION DATA MANAGEMENT SYSTEM (IRDMS)

4.1 SYSTEM DESCRIPTION

The Installation Restoration Data Management System (IRDMS) consists of a distributed network of IBM microcomputers, or their functional equivalents, that provide for the entry, verification, and output of chemical, geotechnical, and map data, in support of the USATHAMA Installation Restoration Program (IRP). Each contractor is supplied with the appropriate microcomputer-based software to allow for record entry, error checking, and quality control for chemical analysis. Records accepted by the local error checking program are then transmitted through a microcomputer data storage and handling system (3COM file server network), which is centrally located at USATHAMA's Edgewood facility. Subsequent processing at the central site (duplicate error check) results in an elevation of the accepted records to a higher file "level" and the eventual updating of installation-specific data bases in a System 2000 (S2K) data base management system on a UNIVAC 1100/60 mainframe computer. It is understood that the Army is in the process of changing supporting hardware; however, it is expected that the procedures for data entry, validation, and archival will remain the same.

4.2 DATA MANAGEMENT

There are three levels of data recognized in the IRDMS. Level 1 consists of all files on the ICF microcomputer, that have been entered or generated by the error checking program. The only Level 1 files that are present on the UNIVAC are program files. Program files are composed of several elements. An element may contain various contractor-written utilities or programs, add-streams, or other recurringly used sets of commands.

It is anticipated that error-free files will be transmitted on a weekly basis to the UNIVAC mainframe. The ICF terminal will be linked to the network using software supplied by USATHAMA and a Hayes modem. Terminal usage logs will be established and maintained as a permanent record of communications. If communications cannot be established and maintained, ICF will seek optional means, where needed, for forwarding the data to USATHAMA. To verify acceptance, each file will be processed through an error checking program that is identical to the one on ICF's microcomputer. Accepted files will then be sent to the UNIVAC. Should any files fail this final error check, ICF will be notified and required to correct detected errors and retransmit the data.

Upon arrival at the UNIVAC, the files will be classified as Level 2 files. These records will be protected by write keys and, therefore, they may not be modified by ICF. They may be read by ICF, provided the appropriate read key is specified. All Level 2 files will be the responsibility of USATHAMA. Level 2 files will exist only until the data are loaded into the appropriate installation data base; normally within 10 working days.

Data in the installation data base are considered Level 3 data. They may be accessed by ICF using USATHAMA-supplied report programs and the appropriate read key; however they are protected from changes by a write key. The installation data bases are the responsibility of USATHAMA.

Data management will begin when the PDC transmits a request for analytical services to ETC, stating the number, type, sample numbers, methods for analysis, and any other information necessary for ETC to plan a particular job. Data files of initial input information, including map location files, a certification status check, sample ID number, parameters, dates, etc. will be established as sample containers and COC documentation are prepared for shipment to the field sampling team.

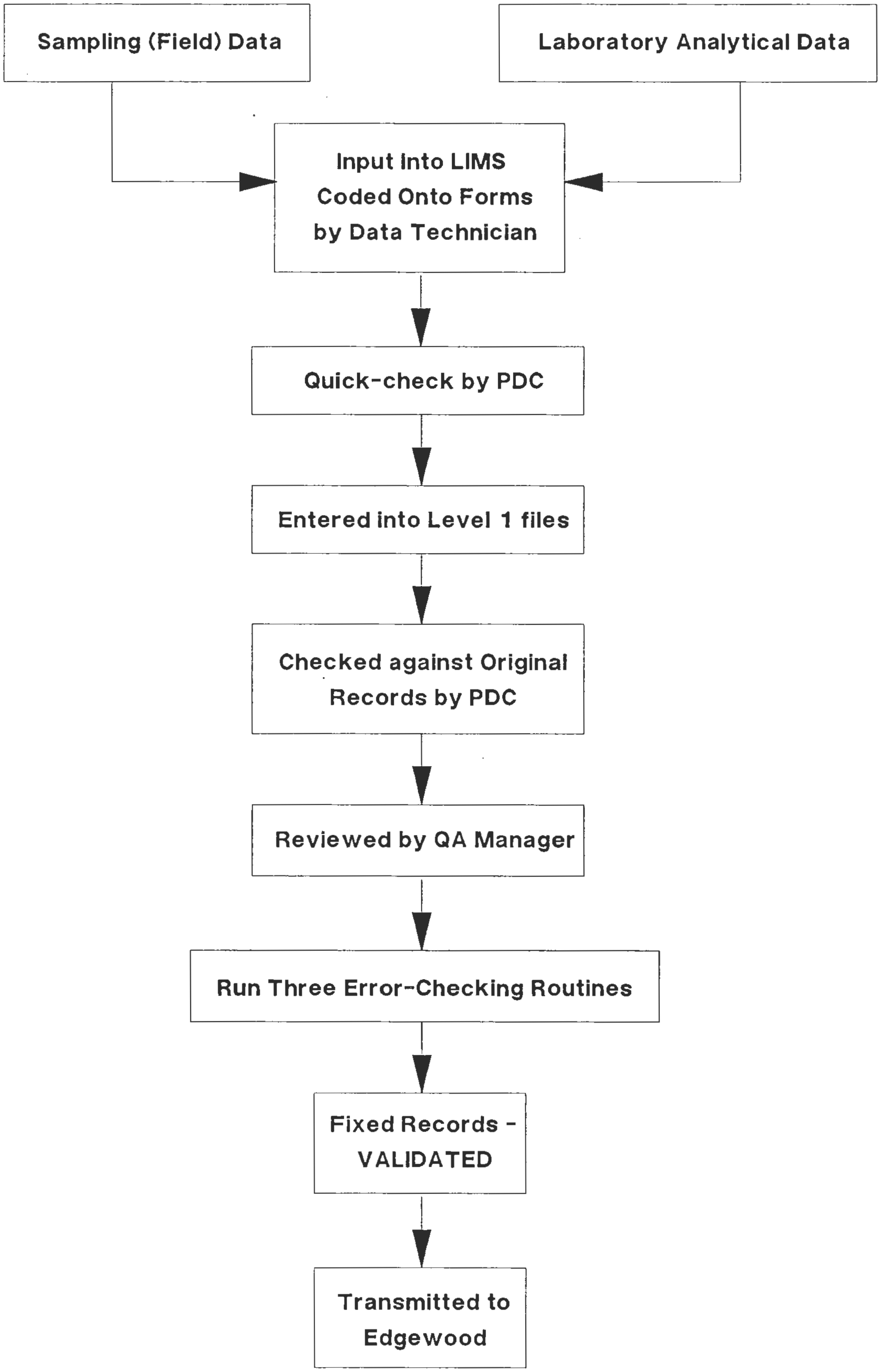
While in the process of collecting, documenting, packaging, and shipping samples to the laboratory, the Field Sampling Team will transfer sample data from their notebooks to field parameter forms. Once the samples arrive at ETC, this information will be used to create Level 1 data files in the IRDMS. Status information (e.g., date sampled, date received, data extraction/analysis due) will form a part of the record.

Each step in the analytical process will result in updates to the data files. The operation performed (e.g., preparation, extraction, analysis, data review, data package prepared), the data obtained, and the date that each step was completed will be entered into the system and made available for status checks. Data files and hard-copy documentation will then be transferred from the laboratory to the PDC, who will validate the records against original data entries, perform error-checking and correction using the USATHAMA routines, and transmit the Level 1 files to USATHAMA, via the 3COM communications network.

Once the Level 1 files have been processed at USATHAMA, the PDC will transmit any required corrections, then generate a backup tape copy. This step will be completed within 50 days after the samples have been collected. The laboratory will archive copies of all analytical data, including original instrument magnetic tapes, in perpetuity. Records will also be maintained, so that historical summaries of all analyses may be generated by site, by client, or by sample type. Refer to Exhibit 3 for a summary diagram of how these data will be handled.

Data that are not entered into the IRDMS, such as results from geophysical and soil gas surveys, will be logged into notebooks, then packaged with any hard-copy outputs (e.g., plots, charts) and sent to the PDC. Both the PDC and QA Manager will review these data, referred to as field screening data, before the PDC archives the information for future reference. Refer to Exhibit 4 for a summary diagram of how this information will be handled.

Exhibit 3. Data Management Scheme (Chemical Data)



ATTACHMENT A

SAMPLE IRDMS DATA MANAGEMENT FORMS

ETC ENVIRONMENTAL TESTING and CERTIFICATION

FIELD PARAMETER FORM (CC2)

ETC JOB # ______

Sample Point ☐ Source Code ☐☐☐☐☐☐☐☐☐☐ Sample Point I.D.

FIELD PROCEDURES

PURGE DATE (YY MM DD)	START PURGE (2400 Hr Clock)	ELAPSED HRS	WATER VOL. IN CASING (Gallons)	VOLUME PURGED (Gallons)

SAMPLING METHOD: ______

Sampler Type ☐	A-Submersible Pump B-ISCO C-Bladder Pump	D-Dipper/Bottle E-Bailer F-Scoop/Shovel	X-Other ______	(SPECIFY OTHER)
Sampler Material ☐	A-Teflon B-Metal	C-PVC D-Plastic	X-Other ______	(SPECIFY OTHER)
Tubing Material ☐	A-Teflon B-Tygon	C-Polyethylene D-Silicon	X-Other ______	(SPECIFY OTHER)

Sample Composited Y/N ______ Procedure/Proportions

FIELD MEASUREMENTS

Well Elevation (ft/msl) ☐☐☐☐.☐☐

Depth to Ground water (ft) ☐☐☐☐.☐☐

Groundwater Elevation (ft msl) ☐☐☐☐.☐☐

Well Depth (ft) ☐☐☐.☐☐

Sample Depth (non-well) (ft) ☐☐☐.☐☐

1st	ph (STD)	1st	spec. cond.	um/cm at 25° C	(other parameter)	value	units
2nd	ph (STD)	2nd	spec. cond.	um/cm at 25°C	(other parameter)	value	units
3rd	ph (STD)	3rd	spec. cond.	um/cm at 25°C	(other parameter)	value	units
4th	ph (STD)	4th	spec. cond.	um/cm at 25°C	(other parameter)	value	units

Sample Temp (°C)

Turbidity NTU

FIELD COMMENTS

Sample Appearance: ______

Weather Conditions: ______

Other: ______

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: ______ (Print) Employer: ______

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

______

(Date) (Signature)

MAP CODING FORM

Installation Site Type Site Id

Description Information :

Pointer Information:
Pointer Site Type: Pointer Site Id:
Aquifer id:
Area Information:
Coord Sys: Acc Source Code: Exp: No.Points:

Coordinate	X	Y		X	Y
1			10		
2			11		
3			12		
4			13		
5			14		
6			15		
7			16		
8			17		
9			18		

LSMP Information:
Coordinate System: Accuracy Source Code: Exponent:
Coordinate — X Y

Elevation Information:
Elevation Source:
Elevation Accuracy:
Elevation:

APPENDIX C

ACCIDENT PREVENTION SAFETY PROGRAM PLAN

TABLE OF CONTENTS

SECTION PAGE

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Site name and address:	Seneca Army Depot Romulus, NY
Site phone number:	601-869-5450
Contact person and phone:	Randy Battaglia 601-869-5450
Contract name:	USATHAMA RI/FS
Work assignment:	1-SENECA AD
Contract number:	Contract DAAA15-88-D-0009; Charge Code 30395-001

Note: This site health and safety plan is prepared for the exclusive use of ICF Technology and parties designated by ICF Technology. It is provided for informational purposes only to other interested parties and in fulfillment of contractual requirements. Any other use is unauthorized.

Purpose of Activity:

The objective of this contract task is to conduct a preliminary assessment/site investigation (PA/SI) at the region of the former burning pits, incinerator, and adjacent landfill located at the Seneca Army Depot.

1) Perform soil gas and geophysical surveys in the study area (see site map).
2) Sample subsoil and existing groundwater monitoring wells in the study area (see site map).
3) Visual inspection of the interior of the abandoned incinerator building. Sample any standing fluids and/or sludge found within the building/dry and wet wells.

Anticipated Duration of Activity:

Seven (7) days on site.

Overall Hazard Evaluation (and justification):

Low (Activities 1 and 2): Low hazard contaminants, limited spread of contamination, minimal intrusive activities.

Medium (Activity 3): Unknown contaminant concentrations within structure, no lighting present within structure, possible confined space, possible overhead hazards, possible rodent infestation., probability of climbing/descending ladders, presence of nearby underground storage tank with diesel fuel, possible presence of hydrocarbon fuels, possible presence of methane and other products of decomposition.

Fire/Explosion Potential:

Activities 1 and 2: Low - None.

Activity 3: Unknown - low.

Personnel:

Gary McKown, Project manager
Wayne Saunders, Geophysicist
Andy Szilagyi, Site Safety Officer (oversight for Level B operations only)
Rick Swahn, Site Safety Officer/Sampler (Level C and D operations only)
Park Gilmore, Sampler/Geologist
Spence Smith, Sampler/Geologist

Target Environmental Samplers and Analysts

Background Review:

Complete.

Description of Site:

Currently inactive. Flat gently sloping terrain, vegetated. Former municipal ash landfill/landfarm currently covered with soil and vegetation. Adjacent 1971-vintage incinerator building, inoperable since 1979, with nearby diesel fuel UST. Site approximately 10 acres in size, including down gradient area to be investigated.

Surrounding population:

Rural

Site History:

Previous site investigations and monitoring well installation have revealed low-level groundwater contamination by volatile chlorinated hydrocarbons. For additional detail, consult the work plan.

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Contaminant Type:

Halogenated hydrocarbon contaminated groundwater. No data on contaminant type(s) within the incinerator building.

A listing of known and likely contaminants is presented here. A listing of symptoms of exposure and other relevant data is presented in Attachment 1. Material Safety Data Sheets are presented in Attachment 2.

The following materials have been found in groundwater samples:

1,2-trans-dichloroethylene
1,2-dichloroethane
trichloroethylene
chloroform
vinyl chloride

Given the landfill nature of the site, hydrogen sulfide may or may not be present in sediments.

Waste Characteristics:

Volatile

Potential Hazards of Concern:

Activities 1 and 2:

Contact with contaminated soil/water/ash and inhalation of volatile and particulate contaminants: Use personal protective equipment (gloves). Avoid standing water and mud. Direct well purging discharge away from work area. Use tyvek coveralls, if necessary, to protect against dry particulate contamination. If splash is a hazard, use Saranex or poly coated tyvek coveralls. Use of respirators/self contained breathing apparatus as appropriate (dependent upon atmospheric monitoring results). Heat stress: Frequent rest breaks. Pace workload. Avoid working during the hottest part of the day. Avoid alcoholic or caffeinated beverages. Drink plenty of fluids.

Flora and fauna (poisonous vegetation, snakes and other wildlife): Personnel should avoid contact with unknown/poisonous vegetation. In the event of exposure, wash affected areas with soap and water; coveralls should be laundered alone in commercial laundromat to remove contamination.

Activity 3:

Same as above.

Confined space entry.

Falls/trip/overhead hazards.

Task Description:

Task 1a. Perform geophysical surveys in the study area (see site map).
Non intrusive.
Level D.

Task 1b. Perform soil gas surveys in conjunction with geophysical survey.
To be performed by Target Environmental.

Task 2. Sample subsoil and existing groundwater monitoring wells in the study area (see site map).
Intrusive.
Level C for initial well opening.
Downgradable to Level D (with gloves) for subsequent sampling (depending upon monitoring results).

Note: Attachment 3 is the operations procedure for Activities 3 a and b.
Attachment 4 is the operations procedure for well opening.

Task 3a. Visual inspection of the interior of the abandoned incinerator building.
Non-intrusive.
Level D-B (level of protection chosen will be determined by the Site Health and Safety Officer and will be dependent upon results of atmospheric monitoring.)

Task 3b. Sample any standing fluids and/or sludge found within the building/dry and wet wells.
Intrusive.
Level D-B (depending upon atmospheric monitoring, presence/absence of confined space).

Protective Equipment:

Task 1a.	Respiratory protection:	Not required
	Head and eye:	Not required, safety glasses or goggles are suggested.
	Boots:	Not required, overboots suggested.
	Protective clothing:	Not anticipated. Use uncoated tyvek coveralls for particulate exposure. Use poly coated or Saranex coveralls for splash/gross external contamination.
	Gloves:	Not required.

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Task 1b.	Respiratory protection:	Not required
	Head and eye:	Not required, safety glasses or goggles are suggested.
	Boots:	Not required, overboots suggested.
	Protective clothing:	Not anticipated. Use uncoated tyvek coveralls for particulate exposure. Use poly coated or Saranex coveralls for splash/gross external contamination.
	Gloves:	Not required.
Task 2.	Respiratory protection:	Respirators for initial well opening (modified Level C). May not be required for subsequent sampling.
	Head and eye:	Not required, safety glasses or goggles are suggested, for level D only
	Boots:	Not required, overboots suggested.
	Protective clothing:	Not required, coveralls suggested. Poly coated tyvek, if splash hazard present.
	Gloves:	Neoprene or butyl for sampler only, over surgical gloves.
Task 3a.	Respiratory protection:	Level B for initial entry into the structure[1]. Downgrade based upon air monitoring results.
	Head and eye:	Not required, safety glasses or goggles are suggested, for Level D only. Hard hat
	Boots:	Steel toed boots and overboots
	Protective clothing:	Saranex or poly coated tyvek
	Gloves:	Neoprene gloves over surgical gloves.
Task 3b.	Respiratory protection:	Dependent upon atmospheric readings. Level B for entry into wet/dry wells and any other confined space <u>with</u> indications of contamination (i.e., vapor concentration > 1 ppm.) Downgrade based upon air monitoring results.
	Head and eye:	Not required, safety glasses or goggles are suggested, for Level D only. Hard hat
	Boots:	Steel toed/shank boots and boot covers.
	Protective clothing:	Saranex or poly coated coveralls.
	Gloves:	Neoprene or butyl over surgical gloves.

---

[1] Prior to entry, the Site Health and Safety Officer will make a visual determination of conditions. If upon his/her determination, no IDLH conditions are likely to exist, entry may be made in Level C ensemble.

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Monitoring Instrumentation:

Activities 1 and 2: Foxboro Organic Vapor Analyzer or HNU Systems Photo-ionization Detector (depending upon availability).
Drager tubes for vinyl chloride.

Action Levels above background (breathing zone):

0 to 1 ppm	No action necessary, continue to monitor
> 1 ppm	Determine presence/absence of vinyl chloride by using Drager tubes and/or gas chromatography. If presence of vinyl chloride is confirmed, withdraw from the site, contact ICF Technology Corporate Health and Safety Director for guidance. In the absence of vinyl chloride, continue monitoring. Work may proceed.
>5 ppm	Withdraw from site. Attempt to determine the source of airborne contaminant. Allow contaminant to dissipate; if this is unsuccessful (i..e., sustained levels > 5 ppm, contact the ICF Technology Health and Safety Director for guidance.

Activity 3: Combustible gas indicator/oxygen deficiency meter
Hydrogen sulfide direct reading instrument
Foxboro Organic Vapor Analyzer or HNU Systems Photo-ionization Detector (depending upon availability).
Drager tubes for vinyl chloride

Action Levels (breathing zone) (as total Hydrocarbon):

0 to 1 ppm	No action necessary, continue to monitor
> 1 ppm	Determine presence/absence of vinyl chloride by using Drager tubes and/or gas chromatography. If presence of vinyl chloride is confirmed, withdraw from the site, contact ICF Technology Corporate Health and Safety Director for guidance. In the absence of vinyl chloride, continue monitoring. Work may proceed.
5 - 50 ppm	Withdraw from site, ventilate structure

	further using natural or forced ventilation. Continue to monitor using Level C protection. Cautious reentry, with continuous monitoring is permissible.
50 - 500 ppm	Withdraw from site, ventilate structure further using natural or forced ventilation. Continue to monitor using Level B protection. Evaluate source of vapor. Do not renter except upon decline of readings and consultation of ICF Technology Corporate Health and Safety Director.
>20 percent LEL	Evacuate the structure immediately. Ventilate structure using natural or forced ventilation. Contact ICF Technology Corporate Health and Safety Director for guidance.

Action Levels (breathing zone) (hydrogen sulfide):

0-5 ppm	No action required, continue to monitor
>5-50 ppm	Cease activities. Withdraw from the structure. Ventilate the structure using natural or forced ventilation. Continue to monitor in Level C ensemble with acid gas cartridges. Cautious reentry is permissible.
>50 ppm	Cease activities. Withdraw from the structure. Ventilate the structure using natural or forced ventilation. Continue to monitor in Level B ensemble. Contact ICF Technology Corporate Health and Safety Director for guidance.

Decontamination Procedures:

Personnel: Activities 1 and 2. None anticipated. If outer boot covers are used, dispose in hazardous waste disposal (HWD) bags. In the event of gross external contamination (e.g., mud, contaminated water) proceed as per "Activity 3" below.

Activity 3. Establish Hot, Decontamination Reduction Zone, and Support Zones per guidance in the Occupational Safety and Health for Hazardous Waste Site Activities manual. Gross external decontamination with soap/water and brushes. Remove outer garments and dispose of in hazardous waste disposal (HWD) bags. Hand and face wash.

HWD bags and other wastes are to be secured at the end of each work day. These materials shall be disposed of at the host facility.

Sampling Equipment: Sampling equipment shall be decontaminated/prepared for reuse in accordance with the USATHAMA QA Program Manual, December 1985, page 5-4. Disposal of contaminated waters/residue shall be captured and secured at the end of each work day.

Air monitoring equipment shall be dry decontaminated using paper towels to remove external (particulate) contamination. Spray detergent may be used to remove stubborn contamination. Care should be taken not to contaminate sensing elements or moving parts.

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Site Layout

(attach site map here)

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

In Case of Emergency

All actions taken will reflect life as the number one priority, property and environment are secondary.

Medical emergencies: ABCs. If it is safe to do so, ensure airway, breathing and circulation. Stop any gross bleeding. Prevent further harm to the victim. Move only if necessary. Call for trained help (i.e., ambulance/EMTs, paramedics, doctors, helicopters etc.).

Fire: Evacuate the area. Call for trained help. Isolate, if possible to do so safely, the fire from exposures. Attempt to extinguish only if sufficient resources are available and you know what you are doing. Use extreme caution in fire involving flammable liquids and pressure vessels (e.g., gas cylinders).

Confined space/trench rescue: Call for trained help. Entry into these environments without proper training and equipment will likely make you a casualty. Prevent others (untrained well meaning coworkers) from entering the hazard area. Don't turn a single body recovery operation into a multiple body recovery.

Emergency Contact:

Fire/Rescue:	**117**
Ambulance:	**117**
Police:	**117**
State Police:	**1-800-962-0810**
USATHAMA Project Officer:	Dominique Edwards 301-671-3240
SEAD Coordinator:	Randy Battaglia 601-869-5450
SEAD Safety Manager:	Tom Battaglia x41-261
Site clinic	x41-242
Corporate Health and Safety Director:	Andrew P. Szilagyi 703-934-3774 Work 703-629-2620 Beeper 703-644-0626 Home
Poison Control Center	x117
Georgetown University Hospital	202-625-3333
Hospital Name:	Geneva General Hospital
Hospital Address and phone:	198 North Street

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

789-4222

Route to Hospital: (attach map)	North on 96A 3 miles to Route 5/20. Left 1 mile on North Street to Hospital Entrance.

Note: All accidents and injuries occurring at Seneca Army Depot will be reported to the proper authorities as per Department of the Army, USATHAMA, requirements (DID A012/DI-A-12963) within 24 hours of occurrence. Immediate notification by telephone to the Mr. Joseph Craten, USATHAMA Safety Office (301) 671-3225 will be done as soon as possible after any incident.

In addition, an ICF Technology Exposure/Incident Report will be completed for all accidents involving ICF Technology or subcontractor personnel. This form must be completed within 24 hours after the incident.

Date plan prepared:	September 19, 1988
Plan prepared by:	Jim Chang

Plan approved by: ______________________

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Attachment 1

Contaminants of Concern
TBD

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Attachment 2

Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET OHS24940

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 75-01-4
RTEC-NUMBER KU9625000

SUBSTANCE: VINYL CHLORIDE

TRADE NAMES/SYNONYMS:
CHLOROETHYLENE: CHLOROETHENE: VC: CHLORETHENE: TROVIDUR: ETHYLENE MONOCHLORIDE: MONOCHLOROETHYLENE: EXON 470: MONO CHLORO ETHENE: VINYL CHLORIDE MONOMER: VINYL CHLORIDE, INHIBITED: RCRA U043: UN 1086: OHS24940

CHEMICAL FAMILY:
HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C2-H3-CL MOLECULAR WEIGHT: 62.50

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

COMPONENTS AND CONTAMINANTS

COMPONENT: VINYL CHLORIDE PERCENT: 99.9

OTHER CONTAMINANTS: WATER, ACETALDEHYDE, ACETYLENE, IRON, HYDROGEN CHLORIDE, HYDROGEN PEROXIDE

EXPOSURE LIMIT:
VINYL CHLORIDE:
1.0 PPM OSHA TWA; 5 PPM OSHA 15 MINUTE CEILING;
0.5 PPM OSHA ACTION LEVEL AS AN 8 HOUR TWA
5 PPM ACGIH TWA
ACGIH A1-CONFIRMED HUMAN CARCINOGEN.
LOWEST FEASIBLE LIMIT NIOSH RECOMMENDED EXPOSURE CRITERIA

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)

PHYSICAL DATA

DESCRIPTION: COLORLESS, SWEET SMELLING GAS; LIQUID BELOW 7 FARENHEIT

BOILING POINT: 7 F (-14 C) MELTING POINT: -245 F (-160 C)

SPECIFIC GRAVITY: 0.9 SOLUBILITY IN WATER: 0.1% @ 25 C

FLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.304; 49CFR173.314 AND 49CFR173.315
EXCEPTIONS: 49CFR173.306

TOXICITY

VINYL CHLORIDE:
500 MG/KG ORAL-RAT LD50; 20 PPM/30 MINUTES INHALATION-GUINEA PIG LCLO; 20 PPM INHALATION-HUMAN TCLO (DPIRDU); MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS); HUMAN CARCINOGEN (OSHA); POSITIVE HUMAN CARCINOGEN (IARC, NTP); POSITIVE ANIMAL CARCINOGEN (IARC). STUDIES SHOW OCCUPATIONAL EXPOSURE RESULTED IN A SIGNIFICANT INCREASE IN ANGIOSARCOMAS OF THE LIVER, AND ALSO TUMORS OF THE BRAIN, LUNG, AND HEMATOPOIETIC SYSTEMS. VINYL CHLORIDE WAS CARCINOGENIC IN RATS, MICE, AND HAMSTERS FOLLOWING ORAL AND INHALATION EXPOSURE, PRODUCING ANGIOSARCOMAS OF THE LIVER AND ALSO TUMORS AT VARIOUS SITES, AND WAS CARCINOGENIC IN RATS FOLLOWING PRENATAL EXPOSURE.

VINYL CHLORIDE IS A SKIN, EYE AND MUCOUS MEMBRANE IRRITANT, CENTRAL NERVOUS SYSTEM DEPRESSANT, AND SIMPLE ASPHYXIANT. POISONING MAY AFFECT THE LIVER, LYMPHATIC SYSTEM, BLOOD, AND RESPIRATORY SYSTEM.

HEALTH EFFECTS AND FIRST AID

INHALATION:
VINYL CHLORIDE:
IRRITANT/NARCOTIC/ASPHYXIANT/CARCINOGEN.

ACUTE EXPOSURE- MAY RESULT IN A PLEASANT TASTE IN THE MOUTH, AND MAY CAUSE CENTRAL NERVOUS SYSTEM DISTURBANCES INCLUDING EUPHORIA, DROWSINESS, NARCOLEPSEY, HEADACHE, NAUSEA, STAGGERING GAIT, PARESTHESIA OF THE HANDS AND FEET, DULLING OF VISUAL AND AUDITORY RESPONSE, ANESTHESIA, AND DEATH DUE TO RESPIRATORY PARALYSIS WITH CARDIAC ARREST. CONCENTRATED VAPORS MAY RESULT IN ASPHYXIA DUE TO THE DISPLACEMENT OF OXYGEN. HUMAN AND ANIMAL PATHOLOGIC REPORTS SHOW PULMONARY EDEMA, HYPEREMIA OF KIDNEYS AND LIVER, AND HEPATIC DEGENERATION.

CHRONIC EXPOSURE- REPEATED EXPOSURE MAY RESULT IN DOSE-RELATED SENSORY DISORDERS, AUTONOMIC NERVOUS SYSTEM POLYNEURITIS, SPASTIC ANGIONEURITIS, THROMBOCYTOPENIA, SPLENOMEGALY, HEPATITIS-LIKE LIVER CHANGES, LIVER MALFUNCTION WITH PORTAL FIBROSIS, AND PULMONARY INSUFFICIENCY. WORKERS INVOLVED IN THE ACTUAL POLYMERIZATION PROCESS MAY EXHIBIT A PECULIAR TRIAD OF SYMPTOMS: MODIFICATION OF PERIPHERAL CIRCULATION RESULTING IN ATTACKS OF PALLOR, CYANOSIS, AND THEN REDNESS (RAYNAUD'S PHENOMENON); SKELETAL CHANGES OF DISTAL PHALANGES (ACRO-OSTEOLYSIS); AND SCLERODERMA-LIKE SKIN CHANGES. PSEUDO-CLUBBING OF THE FINGERS MAY ALSO OCCUR. ANIMAL STUDIES SHOW THAT VINYL CHLORIDE PRODUCES TUMORS AT DIFFERENT SITES, INCLUDING ANGIOSARCOMAS OF THE LIVER, AND IT IS CARCINOGENIC IN RATS FOLLOWING PRENATAL EXPOSURE. AN INCREASED RATE OF BIRTH DEFECTS, ESPECIALLY CENTRAL NERVOUS SYSTEM ANOMALIES AMONG CHILDREN OF PARENTS RESIDING IN COMMUNITIES WHERE VINYL CHLORIDE PRODUCTION AND POLYMERIZATION PLANTS ARE LOCATED, HAVE BEEN REPORTED IN SEVERAL STUDIES.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD

VAPOR DENSITY: 2.2 VAPOR PRESSURE: 2300 MMHG @ 20 C

ODOR-THRESHOLD: 260 PPM

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
ETHANOL, ETHYL ETHER, BENZENE, CARBON TETRACHLORIDE,
ETHER

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
DANGEROUS FIRE HAZARD AND A MODERATE EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME. LARGE FIRES OF VINYL CHLORIDE ARE PRACTICALLY INEXTINGUISHABLE. VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT. VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASHBACK.

FLASH POINT: -108 F (-77 C) (CC) UPPER EXPLOSION LIMIT: 33%

LOWER EXPLOSION LIMIT: 3.6% AUTOIGNITION TEMP.: 882 F (472 C)

FLAMMIBILITY CLASS (OSHA): IA

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE OR HALON
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. STAY AWAY FROM STORAGE TANK ENDS. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES, ELSE WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK FROM FIRE. LET STORAGE VESSEL BURN UNLESS LEAK CAN BE STOPPED; FOR SMALLER TANKS OR CYLINDERS, EXTINGUISH/ISOLATE FROM OTHER FLAMMABLE MATERIALS (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 17).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING QUNATITIES AS FOG. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING TOXIC VAPORS, KEEP UPWIND. EVACUATE TO A RADIUS OF 2500 FEET FOR UNCONTROLLABLE FIRES. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

STOP FLOW OF GAS (NFPA FIRE PROTECTION GUIDE ON HAZARDOUS MATERIALS, EIGHTH EDITION).

TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICTION 49CFR172.101:
FLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:

PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
VINYL CHLORIDE:
IRRITANT.

ACUTE EXPOSURE- CONTACT MAY CAUSE IRRITATION, REDNESS, PAIN, AND FROSTBITE.

CHRONIC EXPOSURE- WORKERS HANDLING VINYL CHLORIDE HAVE EXHIBITED A PECULIAR TRIAD OF SYMPTOMS: RAYNAUD'S PHENOMENON, ACRO-OSTEOLYSIS, AND SCLERODERMALIKE SKIN CHANGES.

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.

IN CASE OF FROSTBITE, WARM AFFECTED SKIN IN WARM WATER AT A TEMPERATURE OF 107 F. IF WARM WATER IS NOT AVAILABLE OR IMPRACTICAL TO USE, GENTLY WRAP AFFECTED PART IN BLANKETS. ENCOURAGE VICTIM TO EXCERCISE AFFECTED PART WHILE IT IS BEING WARMED. ALLOW CIRCULATION TO RETURN NATURALLY. (MATHESON GAS, 6TH EDITION) GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
VINYL CHLORIDE:
IRRITANT.

ACUTE EXPOSURE- MAY CAUSE FROSTBIE, IMMEDIATE AND SEVERE IRRITATION, AND CORNEAL INJURY WITH COMPLETE RECOVERY IN 48 HOURS.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF BURNS, APPLY STERILE BANDAGES LOOSELY WITHOUT MEDICATION. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
VINYL CHLORIDE:
CARCINOGEN.

ACUTE EXPOSURE- ANIMAL STUDIES INDICATE THAT ORAL ADMINISTRATION ALTERED ELECTROENCEPHALOGRAM, AND EXHIBITED IMMUNOSUPPRESSIVE ACTIVITY.

CHRONIC EXPOSURE- ORAL ADMINISTRATION TO RATS, MICE, AND HAMSTERS RESULTED IN TUMOR PRODUCTION AT VARIOUS SITES, INCLUDING ANGIOSARCOMAS OF THE LIVER.

FIRST AID- TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY SECTION

REACTIVITY:
VINYL CHLORIDE:
SLIGHTLY REACTIVE UNDER NORMAL CONDITIONS. POLYMERIZES READILY UNDER THE INFLUENCE OF LIGHT, AIR, OR HEAT.

INCOMPATIBILITIES:
VINYL CHLORIDE:
  AIR: FORMS AN UNSTABLE POLYPEPTIDE THROUGH OXIDATION BY ATMOSPHERIC OXYGEN IN THE PRESENCE OF ANY OF A VARIETY OF CONTAMINANTS. STORAGE UNDER THESE CONDITIONS FOR A LONG PERIOD OF TIME INCREASES THE CONCENTRATION OF UNSTABLE POLYPEROXIDES TO HAZARDOUS LEVELS.
  OXIDIZING AGENTS: INCOMPATIBLE.
  COPPER: INCOMPATIBLE.

DECOMPOSITION:
THERMAL DECOMPOSITION MAY RELEASE TOXIC PHOSGENE, CORROSIVE HYDROGEN CHLORIDE, AND TOXIC CARBON MONOXIDE.

POLYMERIZATION:
EXPOSURE TO AIR, LIGHT, OR EXCESSIVE HEAT MAY INITIATE SELF-POLYMERIZATION.
EXPOSURE OF CONTAINERS TO FIRE OR HEAT MAY RESULT IN VIOLENT POLYMERIZATION.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE.

STORAGE

STORAGE: PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN A COOL, WELL-VENTILATED, NON-COMBUSTIBLE LOCATION, AWAY FROM ALL POSSIBLE SOURCES OF IGNITION. SEPARATE FROM OXIDIZING MATERIALS. (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

CONDITIONS TO AVOID

EXTREMELY FLAMMABLE. MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. VAPORS MAY TRAVEL TO A SOURCE OF IGNITION AND FLASH BACK. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION HAZARD INDOORS, OUTDOORS OR IN SEWERS.

SPILLS AND LEAKS

WATER-SPILL:
THE SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH CHEMICALS KNOWN TO CAUSE CANCER OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL-SPILL:
SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. ISOLATE AREA UNTIL GAS HAS DISPERSED. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD

AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:
THE FOLLOWING RESPIRATORS ARE THE MINIMUM LEGAL REQUIREMENTS AS SET FORTH BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION FOUND IN 29 CFR1910, SUBPART Z.

REQUIRED RESPIRATORS FOR VINYL CHLORIDE

ATMOSPHERIC CONCENTRATIONS OF VINYL CHLORIDE	REQUIRED APPARATUS
UNKNOWN OR ABOVE 3600 PPM	OPEN-CIRCUIT, SELF CONTAINED BREATHING APPARATUS, PRESSURE DEMAND TYPE, WITH FULL FACEPIECE
NOT OVER 3600 PPM	COMBINATION TYPE 'C' SUPPLIED AIR RESPIRATOR, PRESSURE DEMAND TYPE, WITH A FULL FACEPIECE AND AUXILIARY SELF-CONTAINED AIR SUPPLY; OR COMBINATION TYPE SUPPLIED AIR RESPIRATOR, CONTINUOUS FLOW TYPE, WITH A FULL OR HALF FACEPIECE, AND AUXILIARY SELF-CONTAINED AIR SUPPLY.
NOT OVER 1000 PPM	TYPE 'C' SUPPLIED AIR RESPIRATOR, CONTINUOUS FLOW TYPE, WITH A FULL OR HALF FACEPIECE, HELMET OR HOOD.
NOT OVER 100 PPM	COMBINATION TYPE 'C' SUPPLIED AIR RESPIRATOR, DEMAND TYPE, WITH A FULL FACEPIECE, AND AUXILIARY SELF-CONTAINED AIR SUPPLY; OR OPEN-CIRCUIT SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE, IN DEMAND MODE; OR TYPE 'C' SUPPLIED AIR RESPIRATOR, DEMAND TYPE, WITH FULL FACEPIECE.
NOT OVER 25 PPM	A POWERED AIR PURIFYING RESPIRATOR WITH HOOD, HELMET, FULL OR HALF FACEPIECE, AND A CANISTER WHICH PROVIDES A SERVICE LIFE OF AT LEAST 4 HOURS FOR CONCENTRATIONS OF VINYL CHRLORIDE

	UP TO 25 PPM; OR GAS MASK, FRONT- OR BACK-MOUNTED CANISTER WHICH PROVIDES A SERVICE LIFE OF AT LEAST 4 HOURS FOR CONCENTRATIONS OF VINYL CHORIDE UP TO 25 PPM.
NOT OVER 10 PPM	COMBINATION TYPE 'C' SUPPLIED AIR RESPIRATOR, WITH A HALF FACEPIECE AND AUXILIARY SELF-CONTAINED AIR SUPPLY; OR TYPE 'C' SUPPLIED-AIR RESPIRATOR, DEMAND TYPE, WITH A HALF FACEPIECE; OR ANY CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE WHICH PROVIDES A SERVICE LIFE OF AT LEAST 1 HOUR FOR CONCENTRATIONS OF VINYL CHLORIDE UP TO 10 PPM.

ENTRY INTO UNKNOWN CONCENTRATIONS OR CONCENTRATIONS GREATER THAN 36,000 PPM (LOWER EXPLOSION LIMIT) MAY BE MADE ONLY FOR THE PURPOSES OF LIFE RESCUE;

AND

ENTRY INTO CONCENTRATIONS OF LESS THAN 36,000 PPM, BUT GREATER THAN 3600 PPM MAY BE MADE ONLY FOR THE PURPOSES OF LIFE RESCUE, FIREFIGHTING OR SECURING EQUIPMENT SO AS TO PREVENT A GREATER HAZARD OF RELEASE OF VINYL CHLORIDE.

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.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

PROTECTIVE CLOTHING MUST COMPLY WITH OSHA REQUIREMENT FOR PROTECTIVE WORK CLOTHING AND EQUIPMENT (29CFR1910.1017(H)).

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

GLOVES MUST COMPLY WITH OSHA REQUIREMENTS FOR PROTECTIVE WORK CLOTHING AND EQUIPMENT. (29CFR1910.1017(H)).

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT

BE WORN.

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.

EYE PROTECTION MUST COMPLY WITH OSHA REQUIREMENT FOR PROTECTIVE WORK CLOTHING AND EQUIPMENT (29CFR1910.1017(H).

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 10/16/84 REVISION DATE: 06/27/88

****

MATERIAL SAFETY DATA SHEET   OHS26500

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS   (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 540-59-0
RTEC-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: UN 1150: OHS26500

CHEMICAL FAMILY:
HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C2-H2-CL2   MOLECULAR WEIGHT: 96.94

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

COMPONENTS AND CONTAMINANTS

COMPONENT: 1,2-DICHLOROETHYLENE   PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMIT:
1,2-DICHLOROETHYLENE (ALL ISOMERS):
200 PPM OSHA TWA
200 PPM (790 MG/M3) ACGIH TWA

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: COLORLESS LIQUID WITH ETHER-LIKE ODOR, SLIGHTLY ACRID

BOILING POINT: 119 F (48 C)   MELTING POINT: -113 F (-81)

SPECIFIC GRAVITY: 1.282   SOLUBILITY IN WATER: 0.35-0.63%

VAPOR DENSITY: 3.4   VAPOR PRESSURE: 400 MM HG @ 87 F

ODOR-THRESHOLD: 0.085 PPM

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
ALCOHOL, ETHER AND MOST OTHER ORGANIC SOLVENTS

FIRE AND EXPLOSION DATA

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.

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

UPPER EXPLOSION LIMIT: 12.8%

LOWER EXPLOSION LIMIT: 9.7%

AUTOIGNITION TEMP.: 860 F (460 C)

FLAMMIBILITY CLASS (OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK ENDS. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES, ELSE WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK DUE TO FIRE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, 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 FIRE PROTECTION GUIDE ON HAZARDOUS MATERIAL, EIGHTH EDITION).

TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.119
EXCEPTIONS: 49CFR173.118

TOXICITY

1,2-DICHLOROETHYLENE:
770 MG/KG ORAL-RAT LD50; 117 MG/M3/1 HOUR INHALATION-FROG LCLO; 2 GM/KG INTRAPERITONEAL-MOUSE LD50; MUTAGENIC DATA (MUREAV 46:214,1977); CARCINOGEN STATUS: NONE.

1,2 DICHLOROETHYLENE IS A CENTRAL NERVOUS SYSTEM DEPRESSANT AND AN EYE, MUCOUS MEMBRANE AND SKIN IRRITANT. STIMULANTS SUCH AS EPINEPHRINE AND EPHEDRINE MAY ENHANCE THE TOXICITY OF SOME HALOGENATED HYDROCARBONS. PERSONS WITH CHRONIC RESPIRATORY DISEASE MAY BE AT INCREASED RISK FROM EXPOSURE.

HEALTH EFFECTS AND FIRST AID

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.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY.

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.

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:
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 2000 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.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

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.

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, 11TH ED.) ADMINISTRATION OF GASTRIC LAVAGE OR OXYGEN SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY SECTION

REACTIVITY:
MAY FORM EXPLOSIVE PEROXIDES IN AIR.
UNLESS INHIBITED, GRADUAL DECOMPOSITION BY AIR, LIGHT, ULTAVIOLET LIGHT AND MOISTURE MAY RELEASE CORROSIVE HYDROGEN CHLORIDE.

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 VIA EPOXIDE INTERMEDIATES.
METAL (HOT): GRADUAL DECOMPOSITION WITH RELEASE OF CORROSIVE HYDROGEN

CHLORIDE.
NITROGEN TETROXIDE: EXPLOSIVE, ESPECIALLY WHEN SHOCKED.
OZONE: MAY FORM EXPLOSIVE PRODUCT.
PERCHLORYL FLUORIDE: EXPLOSIVE REACTION ON HEATING.
POTASSIUM HYDROXIDE (SOLID OR CONCENTRATED SOLUTION): MAY FORM EXPLOSIVE, SPONTANEOUSLY FLAMMABLE CHLOROACETYLENE.
PLASTICS, RUBBER, 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.
(2,2B,6,7,8,44,40,43,12,14,28,55)

DECOMPOSITION:
THERMAL DECOMPOSITION MAY RELEASE TOXIC GASES OF PHOSGENE AND CARBON MONOXIDE, AND CORROSIVE FUMES OF HYDROGEN CHLORIDE.

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.

STORAGE-DISPOSAL

STORAGE: PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN A STANDARD FLAMMABLE LIQUIDS STORAGE ROOM OR CABINET. SEPARATE FROM OXIDIZING MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION HAZARD INDOORS, OUTDOORS OR IN SEWERS. RUN-OFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

SPILLS AND LEAKS

OCCUPATIONAL-SPILL:
SHUT OFF IGNITION SOURCES. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. DO NOT GET WATER INSIDE CONTAINER. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT SECTION

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 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 AN ORGANIC VAPOR CANISTER AND A FULL FACEPIECE.

4000 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.
ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR 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.

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 AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

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.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 09/07/84 REVISION DATE: 06/29/88

****

MATERIAL SAFETY DATA SHEET OHS04770

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 67-66-3
RTEC-NUMBER FS9100000

SUBSTANCE: CHLOROFORM

TRADE NAMES/SYNONYMS:
TRICHLOROMETHANE: METHANE TRICHLORIDE: R20: FREON 20: METHENYL TRICHLORIDE: METHYL TRICHLORIDE: TRICHLOROFORM: FORMYL TRICHLORIDE: RCRA U044: STCC 4940310: UN 1888: C-294: C-295: C-298: C-574: C-605: C-603: C-607: C-606: OHS04770

CHEMICAL FAMILY:
HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C-H-CL3 MOL WT: 119.4

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

COMPONENTS AND CONTAMINANTS

COMPONENT: CHLOROFORM PERCENT: >99

OTHER CONTAMINANTS: <1% ETHANOL AS A STABILIZER

EXPOSURE LIMIT:
CHLOROFORM:
50 PPM OSHA CEILING
10 PPM (50 MG/M3) ACGIH TWA
ACGIH A2-SUSPECTED HUMAN CARCINOGEN.
2 PPM NIOSH RECOMMENDED 60 MINUTE CEILING

10,000 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY
5000 POUNDS SARA SECTION 304 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- (OCTOBER 1, 1987)

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS VOLATILE LIQUID WITH A SWEET PLEASANT ODOR AND SWEET TASTE

BOILING POINT: 142 F (61 C) MELTING POINT: -82 F (-63 C)

SPECIFIC GRAVITY: 1.5 EVAPORATION RATE: (BU ACETATE=1) 11.6

SOLUBILITY IN WATER: 0.8% VAPOR DENSITY: 4.1

VAPOR PRESSURE: 160 MM HG @ 20 C ODOR-THRESHOLD: 200-307 PPM

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
ALCOHOL, ETHER, BENZENE, SOLVENT NAPHTHA

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
SLIGHT FIRE HAZARD AND NEGLIGIBLE EXPLOSION HAZARD WHEN EXPOSED TO HIGH HEAT. WILL NOT SUPPORT COMBUSTION. NONFLAMMABLE, BUT WILL BURN ON PROLONGED EXPOSURE TO FLAME OR HIGH TEMPERATURE.

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. FIGHT FIRE FROM MAXIMUM DISTANCE. STAY AWAY FROM STORAGE TANK ENDS. DIKE FIRE CONTROL WATER FOR LATER DISPOSAL. DO NOT SCATTER MATERIAL (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 55).

EXTINGUISH USING AGENTS SUITABLE FOR TYPE OF FIRE. AVOID BREATHING VAPORS OR DUSTS, KEEP UPWIND.

FIRE FIGHTING PHASES: WHEN INVOLVED IN FIRE, CHLOROFORM EMITS HIGHLY TOXIC AND IRRITATING FUMES (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
ORM-A

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
NONE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.630
EXCEPTIONS: 49CFR173.505

TOXICITY

CHLOROFORM:
10 MG/24 HOURS OPEN SKIN-RABBIT MILD IRRITATION; 148 MG EYE-RABBIT IRRITATION; 500 MG/24 HOURS SKIN-RABBIT MILD IRRITATION; 20 MG/24 HOURS EYE-RABBIT MODERATE IRRITATION; 10 MG/M3/1 YEAR INHALATION-HUMAN TCLO; 140 MG/KG

ORAL-HUMAN LDLO; 25000 PPM/5 MINUTES INHALATION-HUMAN TCLO; 5000 MG/M3/7 MINUTES INHALATION-HUMAN TCLO; 546 MG/KG UNREPORTED ROUTE-MAN LDLO; 908 MG/KG ORAL-RAT LD50; 75 GM/M3/60 MINUTES INHALATION-RAT LCLO; 36 MG/KG ORAL-MOUSE LD50; 28 G/M3 INHALATION-MOUSE LCLO; 500 MG/KG ORAL-RABBIT LDLO; 59 G/M3 INHALATION-RABBIT LC50; 800 MG/KG SUBCUTANEOUS-RABBIT LDLO; 1000 MG/KG ORAL-DOG LDLO; 100 G/M3 INHALATION-DOG LCLO; 35000 MG/M3/4 HOURS INHALATION-CAT LCLO; 820 MG/KG ORAL-GUINEA PIG LD50; 20000 PPM/2 HOURS INHALATION-GUINEA PIG LCLO; 25000 PPM/5 MINUTES INHALATION-MAMMAL LCLO; 1000 MG/KG INTRAPERITONEAL-DOG LD50; 623 MG/KG INTRAPERITONEAL-MOUSE LD50; 704 MG/KG SUBCUTANEOUS-MOUSE LD50; 75 MG/KG INTRAVENOUS-DOG LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS); POSITIVE ANIMAL CARCINOGEN (IARC); INDEFINITE HUMAN CARCINOGEN (IARC); SUSPECT HUMAN CARCINOGEN (NTP); ORAL ADMINISTRATION CAUSED LIVER AND KIDNEY TUMORS IN MICE AND KIDNEY AND THYROID TUMORS IN RATS.

CHLOROFORM IS TOXIC EYE, SKIN AND MUCOUS MEMBRANE IRRITANT, CENTRAL NERVOUS SYSTEM DEPRESSANT, HEPATOTOXIN AND NEPHROTOXIN.

ALCOHOLICS MAY BE AT INCREASED RISK FROM EXPOSURE.

HEALTH EFFECTS AND FIRST AID

INHALATION:
CHLOROFORM:
NARCOTIC/HEPATOTOXIC/NEPHROTOXIC.
1000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- 1024 PPM CAUSED DIZZINESS, INTRACRANIAL PRESSURE AND NAUSEA AFTER 7 MINUTES, FOLLOWED BY PERSISTENT FATIGUE AND HEADACHE. VOMITING, SENSATION OF FAINTING AND SERIOUS DISORIENTATION OCCURRED AT 4100 PPM OR LESS. 10,000-15,000 PPM PRODUCED RAPID LOSS OF CONSCIOUSNESS OR ANESTHESIA. CHLOROFORM WAS WIDELY USED AS AN ANESTHETIC AGENT, BUT HAS BEEN LARGELY ABANDONED DUE TO THE FREQUENCY OF CARDIAC ARREST DURING SURGERY AND OF DELAYED DEATH DUE TO HEPATIC INJURY. EXPOSURE TO HIGH CONCENTRATIONS HAS RESULTED IN CARDIAC SENSITIZATION TO CATECHOLAMINES. AN INCREASED INCIDENCE OF CARDIAC ARRHYTHMIAS WAS DEMONSTRATED IN PATIENTS ANESTHETIZED WITH APPROXIMATELY 22,500 PPM CHLOROFORM AS COMPARED TO OTHER ANESTHETICS. RESPONSES ASSOCIATED WITH EXPOSURE TO CONCENTRATIONS BELOW ANESTHETIC OR PREANESTHETIC LEVEL TYPICALLY INCLUDE A FEELING OF WARMTH OF THE FACE AND BODY, THEN IRRITATION OF THE MUCOUS MEMBRANES AND SKIN, FOLLOWED BY LOSS OF REFLEXES, SENSATION AND CONSCIOUSNESS. OVERDOSAGE DURING ANESTHESIA MAY CAUSE SUDDEN DILATION OF THE PUPILS (TERMINALLY THE CORNEA BECOMES DULL AND CLOUDY), SUDDEN DISAPPEARANCE OF THE PULSE, COMPLETE RESPIRATORY FAILUTE AND RAPID DEATH FROM CIRCULATORY COLLAPSE AND VENTRICULAR FIBRILLATION. TRANSIENT NYSTAGMUS MAY OCCUR DURING RECOVERY FROM NARCOSIS. AFTER TRANSIENT RECOVERY FROM HEAVY EXPOSURE, LIVER AND KIDNEY FAILURE MAY CAUSE DEATH. ELDERLY, RUNDOWN OR CACHECTIC PERSONS ARE MORE SUSCEPTIBLE TO DELAYED TOXIC REACTIONS WHICH USUALLY DEVELOP 3-5 DAYS AFTER ANESTHESIA. SIGNS INCLUDE DROWSINESS AND SLEEPINESS, NAUSEA AND VOMITING, AND CHANGES IN THE SIZE OF THE LIVER, WHICH USUALLY BECOMES ENLARGED AND PAINFUL, BUT MAY BE CONTRACTED. SIGNS OF KIDNEY IRRITATION MAY BE PRESENT AND URINE MAY CONTAIN ACETONE AND BILE PIGMENTS. DELIRIUM AND COMA MAY DEVELOP. ALTHOUGH INJURY TO THE KIDNEY IS NOT AS COMMON AS THAT TO THE LIVER, IT MAY BE OBSERVED FROM EITHER ACUTE OR CHRONIC EXPOSURE. DILATION OF THE PUPILS OF THE EYES, REDUCED REACTION TO LIGHT AND REDUCED INTRAOCULAR PRESSURE HAVE BEEN DETECTED IN ANIMALS.

CHRONIC EXPOSURE- ALTHOUGH THE INCIDENCE OF HEPATIC NECROSIS FOLLOWING SINGLE ADMINISTRATION OF HALOMETHANE IS NOT SIGNIFICANTLY DIFFERENT FROM OTHER ANESTHETICS, AFTER MULTIPLE ADMINISTRATIONS, THE INCIDENCE INCREASES 7 TIMES. HEPATIC NECROSIS AFTER HALOMETHANE ADMINISTRATION IS AN ALLERGIC

OR AUTOIMMUNE RESPONSE. REPEATED ANESTHESIA INCREASES LIVER AND KIDNEY DAMAGE SOMETIMES FOLLOWED BY JAUNDICE AND CIRRHOSIS OF THE LIVER. THE ODOR THRESHOLD IS BY NO MEANS LOW ENOUGH TO BE CONSIDERED A WARNING FOR CHRONIC EXPOSURE. LIVER DAMAGE HAS BEEN REPORTED FROM REPEATED INDUSTRIAL EXPOSURE AT 10 PPM. OF 68 CHEMICAL WORKERS EXPOSED REGULARLY TO 2-205 PPM FOR 1-4 YEARS, 25% HAD HEPATOMEGALY; OF THESE 17, 4 HAD TOXIC HEPATITIS AND 14 HAD FATTY DEGENERATION OF THE LIVER. THE GROUP WAS MORE SUSCEPTIBLE TO VIRAL HEPATITIS THAN THE GENERAL POPULATION. IN ADDITION TO LIVER DAMAGE, DRUNKEN FEELING, SOMNOLENCE, IRRITABILITY, PSYCHOTIC UNBALANCE, LOSS OF APPETITE, AND DIGESTIVE DISTURBANCES, DRY MOUTH AND THIRST, FREQUENT AND PAINFUL URINATION, DEPRESSION, IRRITABILITY AND A FEELING OF BEING DAZED HAVE BEEN REPORTED FROM OCCUPATIONAL EXPOSURE. OTHERS HAVE REPORTED ANOREXIA, ANEMIA, WEAKNESS, BLURRING OF VISION, PARESTHESIA, MEMORY LOSS AND TREMORS. WORKERS IN A PHARMACEUTICAL PLANT EXPOSED TO CHLOROFORM AND OTHER SOLVENTS COMPLAINED OF HEADACHE, NAUSEA, ERUCTATION AND LOSS OF APPETITE. A HIGHER INCIDENCE OF ENLARGEMENT OF LIVER AND SPLEEN WERE DETECTED, BUT NO REMARKABLE CHANGE IN LIVER FUNCTION WERE DETECTED.
IN RATS EXPOSED TO 25, 50 OR 85 PPM CHLOROFROM IN AIR FOR 7 HOURS/DAY, 5 DAYS/WEEK FOR 6 MONTHS, HISTOPATHOLOGICAL ALTERATIONS, INCLUDING CLOUDY SWELLING OF KIDNEYS AND CENTRILOBULAR GRANULAR DEGENERATION AND NECROSIS OF THE LIVER, HIGHER MORTALITY AND CHANGES IN ORGAN WEIGHTS WERE OBSERVED. AFFECTS APPEARED REVERSIBLE AT 25 PPM AND NO EFFECTS WERE DETECTED IN RATS EXPOSED 4, 2 OR 1 HOUR/DAY. IN MICE, HEPATOTOXICITY WAS POTENTIATED BY PRIOR EXPOSURE TO ALIPHATIC ALCOHOLS. INHALATION STUDIES ON PREGNANT RATS AND MICE REPORTED EFFECTS ON THEIR FERTILITY, STUNTED FETUSES, FETAL DEATH, HOMEOSTASIS AND DEVELOPMENTAL ABNORMALITIES OF THE MUSCULOSKELETAL AND GASTROINTESTINAL SYSTEM OF THE OFFSPRING.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
CHLOROFORM:
IRRITANT.

ACUTE EXPOSURE- LOCAL EFFECTS FROM LIQUID EXPOSURE MAY RANGE FROM MILD IRRITATION TO SEVERE ERYTHEMA AND PURULENT BLEBS. SOME SKIN PENETRATION MAY OCCUR. ABSORPTION THROUGH INTACT SKIN OF RABBITS WAS INDICATED BY WEIGHT LOSS AND DEGENERATIVE CHANGES OF THE KIDNEY TUBULES, BUT DOSES AS HIGH AS 3980 MG/KG WERE SURVIVED.

CHRONIC EXPOSURE- THE LIQUID HAS A DEFATTING EFFECT ON SKIN AND MAY PRODUCE CHRONIC IRRITATION WITH DRYING AND CRACKING. ONE OR TWO 24-HOUR APPLICATIONS ON SKIN OF RABBITS RESULTED IN HYPEREMIA AND MODERATE NECROSIS. HEALING OF ABRADED SKIN APPEARED TO BE DELAYED BY APPLICATION OF A COTTON PAD SOAKED IN CHLOROFORM.

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:
CHLOROFORM:
IRRITANT.

ACUTE EXPOSURE- LIQUID SPLASHED IN THE EYES CAUSES IMMEDIATE BURNING PAIN, TEARING AND REDDENING OF THE CONJUNCTIVA. FREQUENTLY THE CORNEAL EPITHELIUM IS INJURED AND MAY BE PARTIALLY LOST; HOWEVER, REGENERATION IS PROMPT AND THE EYES RETURN TO NORMAL IN 1-3 DAYS. HIGH VAPOR CONCENTRATION MAY CAUSE MODERATE SENSATION OF STINGING AND IRRITATION WHICH USUALLY

AUTOMATICALLY INDUCES PROTECTIVE CLOSURE OF LIDS. CONJUNCTIVAL IRRITATION AND BLEPHAROSPASM HAVE ALSO BEEN REPORTED FROM VAPOR EXPOSURE.

CHRONIC EXPOSURE- PROLONGED EXPOSURE OF THE CORNEA DURING GENERAL ANESTHESIA HAS CAUSED PERSISTENT INJURY.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
CHLOROFORM:
NARCOTIC/HEPATOTOXIC/NEPHROTOXIC/CARCINOGENIC/TOXIC.

ACUTE EXPOSURE- THE MEAN LETHAL DOSE FOR HUMANS IS ESTIMATED AT ABOUT 1 FLUID OUNCE; HOWEVER, INGESTION OF 6 OUNCES HAS BEEN SURVIVED, BUT AS LITTLE AS 1 TEASPOON HAS CAUSED SERIOUS ILLNESS. SWALLOWING IS FOLLOWED IMMEDIATELY BY SEVERE BURNING SENSATION IN THE MOUTH, THROAT, ESOPHAGUS AND STOMACH, PAIN IN THE CHEST AND ABDOMEN WITH NAUSEA AND VOMITING. DEPENDING ON THE DOSE, COLD, CLAMMY SKIN; CYANOSIS OF THE EXTREMITIES AND FACE; GASPING, IRREGULAR RESPIRATION; EXTREME DILATION OF THE PUPILS; MUSCULAR CRAMPING, ESPECIALLY OF THE MASSETERS; AND LOSS OF CONSCIOUSNESS MAY FOLLOW. PROGRESSIVE HYPOTENSION FROM INCREASED CARDIAC WEAKNESS, PERIPHERAL VASODILATION AND RESPIRATORY FAILURE MAY OCCUR. LIVER DAMAGE MAY OCCUR AND, RARELY, THE HEARING IS AFFECTED. IN RATS, GROSS PATHOLOGICAL EXAMINATION SHOWED LIVER AND KIDNEY CHANGES AT DOSES AS LOW AS 250 MG/KG. IN RATS GIVEN LETHAL DOSES OF CHLOROFORM, CLINICAL SIGNS, INCLUDING DEPRESSION, PROFOUND SLEEP, DYSPNEA, ANOREXIA AND HEMATURIA, BEGAN WITHIN 20 MINUTES AFTER TREATMENT AND CONTINUED FOR SEVERAL DAYS. DEATH GENERALLY OCCURED IN 2-4 HOURS, BUT SOME WERE DELAYED AS LONG AS 2 WEEKS. THE ACUTE TOXICITY OF CHLOROFORM IS SPECIES-, STRAIN-, SEX- AND AGE-DEPENDENT; MALES OF MANY MOUSE STRAINS WERE SUSCEPTIBLE TO RENAL TUBULAR NECROSIS, BUT FEMALES WERE NOT AFFECTED.

CHRONIC EXPOSURE- CHLOROFORM WAS BANNED BY THE U. S. FOOD AND DRUG ADMINISTRATION FROM USE IN FOOD, DRUGS AND COSMETICS ON JUNE 29, 1976. PRIOR TO BEING BANNED, CHLOROFROM HAD BEEN APPROVED FOR USE IN COUGH PREPARATIONS, LINAMENTS, TOOTHPASTES, COSMETICS AND TOOTHACHE DROPS. IT IS STILL USED IN A PESTICIDE USED IN THE U. S. FOR FUMIGATION OF RAW, STORED, BULK GRAIN INCLUDING BARLEY, CORN, MILO, OATS, RICE, RYE, SORGHUM AND WHEAT, BUT DIETARY EXPOSURE IS BELIEVED TO BE NEGLIGIBLE FROM THE SOURCE. SMALL AMOUNTS OF CHLOROFROM HAVE BEEN FOUND IN TOMATOES, MUSCAT GRAPES, MILK, CREAM AND FRESH CODFISH. ALTHOUGH RESULTANT LEVELS ARE LOW, FEW PPB, CHLOROFORM CAN BE PRODUCED IN THE PROCESS OF CHLORINATING DRINKING WATER. CORRELATIONS WERE FOUND BETWEEN TRIHALOMETHANE LEVELS IN DRINKING-WATER SUPPLIES AND VARIOUS SITE-SPECIFIC CANCER MORTALITY RATES, ESPECIALLY BLADDER CANCER, BUT ALSO LYMPHOMA AND CANCERS OF RECTUM-INTESTINE, BRAIN AND KIDNEYS, BUT NO CAUSAL INFERENCE CAN BE MADE FROM THE DATA. RESULTS OF PREGNANT MICE AND RAT FEEDING STUDIES INCLUDE FETOTOXICITY, REDUCED WEIGHT GAIN OF THE NEWBORNS AND DEVELOPMENTAL ABNORMALITIES OF THE MUSCULOSKELETAL SYSTEM IN THE FETUSES. CHLOROFORM IS CARCINOGENIC FOLLOWING ORAL ADMINISTRATION, PRODUCING BENIGN AND MALIGNANT LIVER NEOPLASMS IN MICE AND KIDNEY AND THYROID NEOPLASMS IN RATS. NODULAR HYPERPLASIA OF THE LIVER AND CIRRHOSIS ALSO OCCURRED IN MICE THAT HAD NOT DEVELOPED CARCINOMAS.

FIRST AID- START GASTRIC LAVAGE IMMEDIATELY. BEGIN OXYGEN ADMINISTRATION AND VENTILATION AT ONCE. SUPPORT THE CARDIOVASCULAR SYSTEM. EPINEPHRINE IS CONTRAINDICATED; IT MAY CAUSE VENTRICULAR FIBRILLATION. (CAIN, FLINT'S EMERGENCY TREATMENT AND MANAGEMENT, 7TH EDITION, 1985) GET MEDICAL ATTENTION IMMEDIATELY. TREATMENT SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY SECTION

REACTIVITY:
CHLOROFORM:
UNLESS STABILIZED WITH ETHANOL OR OTHER STABILIZER, DECOMPOSES SLOWLY ON PROLONGED EXPOSURE TO SUNLIGHT IN THE PRESENCE OR ABSENCE OF AIR AND IN THE DARK WHEN AIR IS PRESENT. DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC PHOSGENE AND OXIDES OF CARBON AND CORROSIVE HYDROGEN CHLORIDE. THE REACTION MAY BE ACCELERATED BY IRON AND WATER AT HIGH TEMPERATURES. CAN BE EXPLOSIVE WHEN CONFINED WITH WATER. POSES AN EXPLOSION HAZARD IF PRESENT IN BOILER FEED OR COOLING WATER.

INCOMPATIBILITIES:
CHLOROFORM:
ADDITION OF SODIUM TO INADEQUATELY COOLED CHLOROFORM-METHANOL MIXTURE DURING ATTEMPTED PREPARATION OF TRIMETHYLORTHOFORMATE: VIOLENT EXPLOSION.
A SOLUTION OF PERCHLORIC ACID IN CHLOROFORM POURED ON PHOSPHORUS PENTOXIDE: VIOLENT EXPLOSION.
MIXED WITH ACETONE IN A RESIDUE BOTTLE POSSIBLY CONTAINING BASE: EXPLOSION.
STRONG BASES AND ALCOHOLS: EXPLOSION HAZARD.
METHANOL AND SODIUM HYDROXIDE OR POTASSIUM HYDROXIDE: EXPLOSIVE REACTION.
DINITROGEN TETROXIDE: EXPLOSION ON IMPACT.
POTASSIUM-SODIUM ALLOY: IMPACT SENSITIVE, PRODUCING A VIOLENT EXPLOSION.
POTASSIUM: IMPACT SENSITIVE, PRODUCING A STRONG EXPLOSION.
SODIUM: IMPACT SENSITIVE,PRODUCING A FAIRLY STRONG EXPLOSION.
LITHIUM: IMPACT SENSITIVE, PRODUCING A WEAK EXPLOSION.
ALUMINUM POWDER: POSSIBLE EXPLOSION.
MAGNESIUM POWDER: POSSIBLE EXPLOSION.
VARIOUS COMBINATIONS OF ALKALI OR ALKALINE-EARTH METALS WITH HALOCARBONS:
HIGHLY HEAT OR IMPACT SENSITIVE.
NITROMETHANE WITH HALOFORMS: DETONABLE MIXTURE.
ACETONE OR OTHER KETONES IN PRESENCE OF POTASSIUM HYDROXIDE, CALCIUM HYDROXIDE OR OTHER STRONG ALKALI: VIGOROUS, EXOTHERMIC REACTION WITH FORMATION OF EXPLOSIVE PRODUCT.
IN PREPARATION OF METHYLORTHOFORMATE, SOLID SODIUM METHOXIDE, METHANOL AND CHLOROFORM WERE MIXED TOGETHER: VIOLENT EXOTHERMIC REACTION FOLLOWED BY EXPLOSION.
RAPID ADDITION OF SODIUM METHYLATE TO MIXTURE OF CHLOROFORM AND METHANOL: UNCONTROLLED EXOTHERMIC REACTION TERMINATED IN VIOLENT EXPLOSION.
1:1 SOLUTION WITH BIS(DIMETHYLAMINO)DIMETHYLSTANNANE: MILD EXPLOSION ON HEATING.
CONTACT OF 1.5 GM SOLID POTASSIUM-TERT-BUTOXIDE WITH DROPS OF LIQUID CHLOROFORM: IMMEDIATE IGNITION.
EXPOSURE OF 1.5 GM SOLID POTASSIUM-TERT-BUTOXIDE TO VAPORS OF CHLOROFORM: IGNITION AFTER 2 MINUTES.
DISILANE: INCANDESCENT
FLUORINE: VIOLENT OR POSSIBLE EXPLOSIVE REACTION.
TRIISOPROPYLPHOSPHINE: INTENSE OR VIGOROUS REACTION.
OXIDIZED BY STRONG OXIDIZING AGENTS SUCH AS CHROMIC ACID WITH FORMATION OF PHOSGENE AND CHLORINE GAS: HIGHLY TOXIC PRODUCT.
IN CONTACT WITH WATER WILL CORRODE IRON AND CERTAIN METALS: CORROSIVE PRODUCT.
REACTS READILY WITH HALOGENS OR HALOGENATING AGENTS: VIGOROUS REACTION.
SOME FORMS OF PLASTIC, RUBBER AND COATINGS: ATTACKED BY LIQUID CHLOROFORM.

LIGHT METALS: EXOTHERMIC REACTION.

DECOMPOSITION:
CHLOROFORM:
THERMAL DECOMPOSITION MAY RELEASE TOXIC OR CORROSIVE VAPORS, INCLUDING OXIDES OF CHLORINE AND CARBON, PHOSGENE, CHLORINE GAS AND HYDROGEN CHLORIDE.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE.

STORAGE

THRESHOLD PLANNING QUANTITY (TPQ):
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 302 REQUIRES THAT EACH FACILITY WHERE ANY EXTREMELY HAZARDOUS SUBSTANCE IS PRESENT IN A QUANTITY EQUAL TO OR GREATER THAN THE TPQ ESTABLISHED FOR THAT SUBSTANCE NOTIFY THE STATE EMERGENCY RESPONSE COMMISSION FOR THE STATE IN WHICH IT IS LOCATED. SECTION 303 OF SARA REQUIRES THESE FACILITIES TO PARTICIPATE IN LOCAL EMERGENCY RESPONSE PLANNING (40 CFR 355.30).

STORE IN A COOL, DRY, WELL-VENTILATED LOCATION. SEPARATE FROM STRONG ALKALIS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. CONTAINERS MAY EXPLODE IN HEAT OF FIRE.

SPILLS AND LEAKS

SOIL-RELEASE:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.

USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID MASS.

IMMOBILIZE SPILL WITH UNIVERSAL GELLING AGENT.

AIR-RELEASE:
COMBUSTION PRODUCTS INCLUDE CORROSIVE OR TOXIC VAPORS.

MAY EMIT TOXIC PHOSGENE UNDER FIRE CONDITIONS.

WATER-SPILL:
TRAP SPILLED MATERIAL AT BOTTOM IN DEEP WATER POCKETS, EXCAVATED HOLDING AREAS OR WITHIN SAND BAG BARRIERS.

USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

IF DISSOLVED, AT A CONCENTRATION OF 10 PPM OR GREATER, APPLY ACTIVATED CARBON AT TEN TIMES THE AMOUNT THAT HAS BEEN SPILLED.

USE MECHANICAL DREDGES OR LIFTS TO EXTRACT IMMOBILIZED MASSES OF POLLUTION AND PRECIPITATES.

OCCUPATIONAL-SPILL:
DO NOT TOUCH SPILLED MATERIAL. 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 SMALL DRY SPILLS, WITH A CLEAN SHOVEL PLACE MATERIAL INTO CLEAN, DRY CONTAINERS 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. VENTILATE CLOSED SPACES BEFORE ENTERING.

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

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.

FOR CHLOROFORM:
GREATER THAN ANY DETECTABLE CONCENTRATION:
- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
- 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 OR 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.

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. CONTACT LENSES SHOULD NOT BE WORN.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 10/01/84 REVISION DATE: 07/08/88

****

MATERIAL SAFETY DATA SHEET OHS09390

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 107-06-2
RTEC-NUMBER KI0525000

SUBSTANCE: ETHYLENE DICHLORIDE

TRADE NAMES/SYNONYMS:
ETHANE, 1,2-DICHLORO-: 1,2-BICHLOROETHANE: BROCIDE: 1,2-DICHLOROETHANE: DICHLOR-MULSION: SYM-DICHLOROETHANE: ALPHA, BETA-DICHLOROETHANE: 1,2-DICHLORETHANE: DUTCH LIQUID: EDC: ETHYLENE CHLORIDE: GLYCOL DICHLORIDE: RCRA U077: STCC 4909166: UN 1184: E-175: OHS09390

CHEMICAL FAMILY:
HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C2-H4-CL2 MOLECULAR WEIGHT: 98.96

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

COMPONENTS AND CONTAMINANTS

COMPONENT: ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) PERCENT: 100

EXPOSURE LIMIT:
ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE):
50 PPM (200 MG/M3) OSHA TWA; 100 PPM OSHA CEILING;
200 PPM/5 MINUTES OSHA PEAK IN ANY 3 HOURS
10 PPM (40 MG/M3) ACGIH TWA
1 PPM NIOSH RECOMMENDED 10 HOUR TWA; 2 PPM NIOSH RECOMMENDED 15 MINUTE CEILING

5000 POUNDS 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- (JANUARY 1, 1987)

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS, OILY LIQUID WITH A PLEASANT CHLOROFORM-LIKEODOR AND SWEET TASTE.

BOILING POINT: 183 F (84 C) MELTING POINT: -32 F (-35 C)

SPECIFIC GRAVITY: 1.256 EVAPORATION RATE: (CARBON TETRACHLORIDE = 1) 1.3

VISCOSITY: 1.45 CP

SOLUBILITY IN WATER: 0.8%

VAPOR DENSITY: 3.35

VAPOR PRESSURE: 87 MMHG @ 25 C

ODOR-THRESHOLD: 6 PPM

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
SOLUBLE IN ALCOHOL, ETHER, ACETONE, BENZENE, FATS, RESINS, RUBBERS, VINYL CHLORIDE, CARBON TETRACHLORIDE

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT, FLAME, OR OXIDIZERS.

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.

FLASH POINT: 56 F (13 C) (CC)

UPPER EXPLOSION LIMIT: 16%

LOWER EXPLOSION LIMIT: 6.2%

AUTOIGNITION TEMP.: 775 F (413 C)

FLAMMIBILITY CLASS (OSHA): IB

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK ENDS. FOR MASSIVE FIRE IN STORAGE AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES, ELSE WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK DUE TO FIRE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, 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 FIRE PROTECTION GUIDE ON HAZARDOUS MATERIAL, EIGHTH EDITION).

TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.119
EXCEPTIONS: 49CFR173.118

TOXICITY

ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE):
625 MG/OPEN SKIN-RABBIT MILD IRRITATION; 63 MG/EYE-RABBIT SEVERE IRRITATION; 4000 PPM/1 HOUR INHALATION-MAN TCLO; 286 MG/KG ORAL-HUMAN LDLO; 428 MG/KG ORAL-HUMAN TDLO; 892 MG/KG ORAL-MAN TDLO; 714 MG/KG ORAL-MAN LDLO; 670 MG/KG ORAL-RAT LD50; 1000 PPM/7 HOURS INHALATION-RAT LC50; 99 MG/KG SUBCUTANEOUS-RAT LDLO; 489 MG/KG ORAL-MOUSE LD50; 5000 MG/M3/2 HOURS INHALATION-MOUSE LCLO; 380 MG/KG SUBCUTANEOUS-MOUSE LDLO; 1500 PPM/7 HOURS INHALATION-GUINEA PIG LCLO; 3000 PPM/7 HOURS INHALATION-RABBIT LCLO; 3890 MG/KG SKIN-RABBIT LD50; 860 MG/KG ORAL-RABBIT LD50; 3000 PPM/7 HOURS INHALATION-PIG LCLO; 2000 MG/KG ORAL-DOG LDLO; 600 MG/KG INTRAPERITONEAL-GUINEA PIG LDLO; 175 MG/KG INTRAVENOUS-DOG LDLO; 1200 MG/KG SUBCUTANEOUS-RABBIT LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS); CARCINOGEN STATUS: ANIMAL SUFFICIENT EVIDENCE (IARC); ANTICIPATED HUMAN CARCINOGEN (NTP). ORAL ADMINISTRATION OF ETHYLENE DICHLORIDE TO MICE AND RATS RESULTED IN A SIGNIFICANT INCREASE IN TUMORS AT VARIOUS SITES IN BOTH SPECIES. IN THE ABSENCE OF ADEQUATE DATA IN HUMANS, IARC SUGGESTS THAT IT IS REASONABLE FOR PRACTICAL PURPOSES, TO REGARD ETHYLENE DICHLORIDE AS IF IT PRESENTED A CARCINOGENIC RISK TO HUMANS.

ETHYLENE DICHLORIDE IS AN EYE, SKIN, AND MUCOUS MEMBRANE IRRITANT AND A CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY AFFECT THE LIVER, KIDNEYS, HEART, AND ADRENAL GLANDS. THE USE OF ALCOHOLIC BEVERAGES MAY ENHANCE THE TOXIC EFFECTS.

HEALTH EFFECTS AND FIRST AID

INHALATION:
ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE):
IRRITANT/NARCOTIC/HEPATOTOXIN/NEPHROTOXIN.
1000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- INHALATION OF HIGH VAPOR CONCENTRATIONS MAY CAUSE IRRITATION OF THE EYES AND UPPER RESPIRATORY TRACT, FOLLOWED BY HEADACHE, NAUSEA, VOMITING, DIARRHEA, EPIGASTRIC PAIN, ANESTHETIC EFFECTS, NARCOSIS, WEAK, RAPID PULSE, CYANOSIS, ANEMIA, PULMONARY EDEMA, DIFFICULTY IN BREATHING, AND EFFECTS OF CENTRAL NERVOUS SYSTEM DEPRESSION SUCH AS DIZZINESS, DULLNESS, WEAKNESS, TREMBLING, AND MENTAL CONFUSION. THIS MAY BE FOLLOWED IN SEVERE CASES BY COLLAPSE, COMA, AND DEATH FROM RESPIRATORY AND CIRCULATORY, HEPATIC, OR RENAL FAILURE.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY RESULT IN LACRIMATION, IRRITATION OF THE MUCOUS MEMBRANES, LOSS OF APPETITE, NAUSEA, VOMITING, CONSTIPATION, INSOMNIA, EPIGASTRIC DISTRESS, NYSTAGMUS, NEUROLOGICAL CHANGES, LIVER AND KIDNEY DAMAGE, ACUTE BRONCHIAL INFLAMMATION, ANXIETY, RESTLESSNESS, AND CARDIAC PAIN. DEATH MAY RESULT FROM RESPIRATORY AND CIRCULATORY, HEPATIC, OR RENAL FAILURE. ANIMAL STUDIES INDICATE AN INCREASED MORTALITY, PRECEDED BY LOSS IN WEIGHT, PULMONARY CONGESTION, AND LIVER CHANGES, IN 5 SPECIES OF ANIMALS WHEN EXPOSED TO VAPOR

CONCENTRATIONS OF 200 PPM FOR UP TO 7 HOURS A DAY FOR SEVERAL WEEKS. EFFECTS ON FERTILITY HAVE BEEN REPORTED FROM CHRONIC INHALATION IN RATS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE):
IRRITANT/HEPATOTOXIN/NEPHROTOXIN.

ACUTE EXPOSURE- DIRECT CONTACT WITH THE LIQUID MAY CAUSE IRRITATION. SYSTEMIC TOXICITY, INCLUDING CYANOSIS, HYPOTENSION, NAUSEA, VOMITING, DIARRHEA, CARDIOVASCULAR COLLAPSE, DIZZINESS, DULLNESS, COMA, INTERNAL BLEEDING, JAUNDICE, ALBUMINURIA, GLYCOSURIA, OLIGURIA, ANURIA, LIVER AND KIDNEY DAMAGE, AND ANEMIA, IS POSSIBLE IF LARGE AMOUNTS ARE ABSORBED THROUGH THE SKIN. IF CONTACT IS SEVERE, PULMONARY EDEMA MAY DEVELOP. DEATH IS POSSIBLE FROM RESPIRATORY, HEPATIC, OR RENAL FAILURE.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT TO THE LIQUID CAN PRODUCE A DRY, SCALY, FISSURED DERMATITIS DUE TO THE DEFATTING ACTION ON THE SKIN. PROLONGED CONTACT MAY RESULT IN SEVERE IRRITATION, MODERATE EDEMA, AND NECROSIS. SYSTEMIC EFFECTS, AS IN ACUTE EXPOSURE, MAY ENSUE. AS EVALUATED BY RTECS, ADMINISTRATION TO MICE BY CHRONIC INGESTION RESULTED IN A STATISTICALLY SIGNIFICANT INCREASE IN THE INCIDENCE OF NEOPLASTIC TUMORS.

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:
ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE):
IRRITANT.

ACUTE EXPOSURE- EXPOSURE TO HIGH VAPOR CONCENTRATIONS OR TO THE LIQUID MAY CAUSE IMMEDIATE DISCOMFORT, HYPEREMIA OF THE CONJUNCTIVA, AND CORNEAL INJURY, WHICH RETURN TO NORMAL WITHIN A DAY OR TWO. DIRECT CONTACT WITH THE LIQUID HAS RESULTED IN PAIN, LACRIMATION, AND CORNEAL BURNS THAT HAVE HEALED QUICKLY. EXPOSURE TO 63 MG CAUSED SEVERE IRRITATION IN RABBIT EYES. APPLICATION OF A DROP OF THE LIQUID TO RABBIT EYES GRADED 3 ON A SCALE OF 10 AFTER 24 HOURS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE):
HEPATOTOXIC/NEPHROTOXIC/CARCINOGEN/TOXIC.

ACUTE EXPOSURE- INGESTION OF THE LIQUID MAY RESULT IN HYPOTENSION, CYANOSIS, NAUSEA, VOMITING, DIARRHEA, HEADACHE, EPIGASTRIC PAIN, PULMONARY EDEMA, CARDIOVASCULAR COLLAPSE, LETHARGY, DYSPNEA, SOMNOLENCE, INTERNAL BLEEDING, AND EFFECTS OF CENTRAL NERVOUS SYSTEM DEPRESSION SUCH AS DIZZINESS, DULLNESS, WEAKNESS, TREMBLING, AND MENTAL CONFUSION. THIS MAY BE FOLLOWED IN SEVERE CASES BY COLLAPSE, COMA, AND DEATH FROM RESPIRATORY AND CIRCULATORY, HEPATIC, OR RENAL FAILURE. THE FATAL HUMAN ADULT DOSE IS APPROXIMATELY 5 MILLILITERS. IF THE PATIENT SURVIVES, JAUNDICE, OLIGURIA, ANEMIA, HYPOGLYCEMIA, AND HYPERCALCEMIA MAY OCCUR.

CHRONIC EXPOSURE- ANIMAL STUDIES INDICATE THAT CHRONIC INGESTION MAY RESULT

IN DEGENERATIVE CHANGES IN THE LIVER AND TUBULAR DAMAGE AND NECROSIS OF THE KIDNEYS. AS INDICATED BY RTECS, ADMINISTRATION TO MICE AND RATS BY CHRONIC INGESTION RESULTED IN A STATISTICALLY SIGNIFICANT INCREASE IN THE INCIDENCE OF CARCINOGENIC TUMORS. IN MICE, IT PRODUCED BENIGN AND MALIGNANT TUMORS OF THE LUNG AND MALIGNANT LYMPHOMAS IN ANIMALS OF BOTH SEXES; HEPATOCELLULAR CARCINOMAS IN MALES AND MAMMARY AND UTERINE ADENOCARCINOMAS IN FEMALES. IN RATS, IT PRODUCED CARCINOMAS OF THE FORESTOMACH IN MALES, BENIGN AND MALIGNANT MAMMARY TUMORS IN FEMALES, AND HEMANGIOSARCOMAS IN ANIMALS OF BOTH SEXES. TOTAL DOSES RANGED FROM 18 TO 72 GM/KG INTERMITTENTLY FOR 78 WEEKS.

FIRST AID- TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY SECTION

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
ETHYLENE DICHLORIDE: (1,2-DICHLOROETHANE):
  ALUMINUM: FORMATION OF A SHOCK-SENSITIVE COMPOUND.
  AMMONIA (LIQUID): POSSIBLE VIOLENT EXPLOSION.
  CAUSTICS (STRONG): REACTS.
  DIMETHYLAMINOPROPYLAMINE: POSSIBLE VIOLENT EXPLOSION.
  DINITROGEN TETROXIDE: FORMATION OF A SHOCK-SENSITIVE COMPOUND.
  NITRIC ACID: MIXTURES ARE EASILY DETONATED BY HEAT, IMPACT, OR FRICTION.
  OXIDIZERS (STRONG): VIGOROUS REACTION.
  POTASSIUM: FORMATION OF A SHOCK-SENSITIVE COMPOUND.

DECOMPOSITION:
THERMAL DECOMPOSITION MAY RELEASE TOXIC GASES OF PHOSGENE AND CARBON MONOXIDE, AND CORROSIVE FUMES OF HYDROGEN CHLORIDE.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE.

STORAGE

PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN A STANDARD FLAMMABLE LIQUIDS STORAGE ROOM OR CABINET. SEPARATE FROM OXIDIZING MATERIALS.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION HAZARD INDOORS, OUTDOORS OR IN SEWERS. RUN-OFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

SPILLS AND LEAKS

SOIL-RELEASE:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.

USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID MASS.

IMMOBILIZE SPILL WITH UNIVERSAL GELLING AGENT.

REDUCE VAPOR AND FIRE HAZARD WITH FLUOROCARBON WATER FOAM.

AIR-RELEASE:
KNOCK DOWN VAPORS WITH WATER SPRAY. KEEP UPWIND.

COMBUSTION PRODUCTS INCLUDE CORROSIVE OR TOXIC VAPORS.

WATER-SPILL:
TRAP SPILLED MATERIAL AT BOTTOM IN DEEP WATER POCKETS, EXCAVATED HOLDING AREAS OR WITHIN SAND BAG BARRIERS.

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 SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH CHEMICALS KNOWN TO CAUSE CANCER OR REPRODUCTIVE TOXICITY.

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, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE 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 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.

ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE):

AT ANY DETECTABLE CONCENTRATION:

ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
ANY SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPRATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH CHIN-STYLE OR 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.

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. CONTACT LENSES SHOULD NOT BE WORN.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 11/09/84 REVISION DATE: 06/27/88

****

MATERIAL SAFETY DATA SHEET OHS23850

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 79-01-6
RTEC-NUMBER KX4550000

SUBSTANCE: TRICHLOROETHYLENE

TRADE NAMES/SYNONYMS:
ACETYLENE TRICHLORIDE: ETHYLENE TRICHLORIDE: ALGYLEN: 1-CHLORO-2,2-DICHLOROETHYLENE: 1,1-DICHLORO-2-CHLOROETHYLENE: TCE: ANAMENTH: ETHINYL TRICHLORIDE: TRICHLOROETHENE: 1,1,2-TRICHLOROETHYLENE: TRI: CHLORYLEN: 1,1,2-TRICHLOROETHENE: DENSINFLUAT: CHLORILEN: TRILEN: UN 1710: U228: STCC 4941171: T-340; T-341; T-403: OHS23850

CHEMICAL FAMILY:
HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C2-H-CL3 MOL WT: 131.40

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

COMPONENTS AND CONTAMINANTS

COMPONENT: TRICHLOROETHYLENE PERCENT: >99

OTHER CONTAMINANTS: MAY CONTAIN ANTIOXIDANTS SUCH AS AMINES OR EPOXIDES AND ESTERS TO STABILIZE

EXPOSURE LIMIT:
TRICHLOROETHYLENE:
100 PPM OSHA TWA; 200 PPM OSHA CEILING; 300 PPM/5 MINUTE OSHA PEAK IN ANY 2 HOURS
50 PPM ACGIH TWA; 200 PPM ACGIH STEL
25 PPM NIOSH RECOMMENDED 10 HOUR TWA

1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: COLORLESS, HEAVY, MOBILE LIQUID WITH A MILD CHLOROFORM-LIKE ODOR

BOILING POINT: 188 F (87 C) MELTING POINT: -99 F (-73 C)

SPECIFIC GRAVITY: 1.5 EVAPORATION RATE: (CCL4=1) 0.69

SOLUBILITY IN WATER: 0.1% VAPOR DENSITY: 4.5

VAPOR PRESSURE: 58 MMHG @ 20 C ODOR-THRESHOLD: 20 PPM

OTHER SOLVENTS (SOLVENT - SOLUBILITY):
ALCOHOL, ETHER, ACETONE, CHLOROFORM, BENZENE

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

UPPER EXPLOSION LIMIT: 10.5 @ 25 C LOWER EXPLOSION LIMIT: 8.0 @ 25 C

AUTOIGNITION TEMP.: 770 F (410 C) FLAMMIBILITY CLASS (OSHA): IC

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE OR HALON
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
STAY AWAY FROM STORAGE TANK ENDS. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 74).

USE AGENT SUITABLE FOR TYPE OF FIRE. AVOID BREATHING TOXIC VAPORS, KEEP UPWIND.

TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
ORM-A

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
NONE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.605
EXCEPTIONS: 49CFR173.505

TOXICITY

TRICHLOROETHYLENE:
20 MG/24 HOURS EYE-RABBIT MODERATE IRRITATION; 500 MG/24 HOURS SKIN-RABBIT SEVERE IRRITATION; 7 GM/KG ORAL-HUMAN LDLO; 2143 MG/KG ORAL-MAN TDLO; 160 PPM/83 MINUTES INHALATION-HUMAN TCLO; 6900 MG/M3/10 MINUTES INHALATION-HUMAN TCLO; 812 MG/KG INHALATION-HUMAN TCLO; 110 PPM/8 HOURS INHALATION-MAN TCLO; 2900 PPM INHALATION-MAN LCLO; 3670 MG/KG ORAL-RAT LD50; 32500 MG/KG INHALATION-CAT LCLO; 8000 PPM/4 HOURS INHALATION-RAT LC50; 8450 PPM/4 HOURS INHALATION-MOUSE LCLO; 5864 MG/KG ORAL-CAT LDLO; 2402 MG/KG

ORAL-MOUSE LD50; 7330 MG/KG ORAL-RABBIT LDLO; 37200 PPM/40 MINUTES INHALATION-GUINEA PIG LCLO; 1900 MG/KG INTRAPERITONEAL-DOG LD50; 1831 MG/KG INTRAPERITONEAL-MOUSE LD50; 150 MG/KG INTRAVENOUS-DOG LDLO; 34 MG/KG INTRAVENOUS-MOUSE LD50; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS); SUSPECT ANIMAL CARCINOGEN (IARC); INDEFINITE HUMAN CARCINOGEN (IARC). TRICHLOROETHYLENE PRODUCED LIVER AND LUNG NEOPLASMS IN MICE AFTER ORAL ADMINISTRATION. ADMINISTRATION BY INHALATION WAS ASSOCIATED WITH AN INCREASED INCIDENCE OF LYMPHOMAS IN FEMALE MICE, BUT NOT IN RATS OR HAMSTERS.

TRICHLOROETHYLENE IS AN EYE, MUCOUS MEMBRANE AND SKIN IRRITANT AND A CENTRAL NERVOUS SYSTEM DEPRESSANT. POISONING MAY AFFECT THE LIVER, KIDNEYS, AND HEART. THE PRESENCE OF TETRACHLOROETHANE AS AN IMPURITY, OR THE COMSUMPTION OF ALCOHOLIC BEVERAGES, MAY ENHANCE THE SYSTEMIC TOXICITY.

EPINEPHRINE OR OTHER STIMULANTS MAY INDUCE VENTRICULLAR ARRHYTHMIAS.

HEALTH EFFECTS AND FIRST AID

INHALATION:
TRICHLOROETHYLENE:
IRRITANT/NARCOTIC. 1000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- LEVELS OF 90-130 PPM FOR 8 HOURS HAVE RESULTED IN DECREASED PERFORMANCE IN TESTS OF PERCEPTION, MEMORY, COMPLEX REACTION TIME AND MANUAL DEXTERITY. ADDICTION HAS OCCURRED FROM DELIBERATE INHALATION OF MODERATE AMOUNTS WHICH CAUSE EUPHORIA, DISORIENTATION, VISUAL HALLUCINATIONS, DELUSIONS, AND OTHER PSYCHOTIC SYMPTOMS. MILD RESPIRATORY IRRITATION, DROWSINESS, DIZZINESS, HEADACHE, EXCITATION, VOMITING, ABDOMINAL CRAMPS, AND FLUSHED SKIN MAY OCCUR. ABOVE 1000 PPM, PULMONARY EDEMA, NARCOSIS, ANESTHESIA, AND COMA ARE POSSIBLE. IF CONSCIOUSNESS IS REGAINED, NAUSEA AND VOMITING MAY FOLLOW FOR SEVERAL HOURS. ANEMIA AND DAMAGE TO THE LIVER, KIDNEYS, AND LUNGS HAVE OCCURRED. ANIMAL STUDIES HAVE SHOWN SPLEEN DAMAGE ALSO. DEATH MAY OCCUR FROM RESPIRATORY ARREST OR VENTRICULLAR FIBRILLATION AND PRIMARY CARDIAC FAILURE.

CHRONIC EXPOSURE- REPEATED EXPOSURE TO LEVELS BELOW 300 PPM HAVE CAUSED NAUSEA, VOMITING, ABDOMINAL CRAMPS, SLEEPINESS, DRUNKENNESS, FLUSHING, ANOREXIA, SWELLING OF THE EYES, FACE, AND HANDS, AND MILD CARDIAC ARRYTHMIA. OTHER POSSIBLE SYMPTOMS ARE WHEEZING, FACIAL NERVE PARALYSIS, LOSS OF COORDINATION AND SENSE OF SMELL AND TASTE, IMPAIRMENT OF TACTILE AND AUDITORY SENSES, DOUBLE VISION, CHANGES IN COLOR PERCEPTION, BLINDNESS AND JOINT AND MUSCLE PAIN. INTOLERANCE TO ALCOHOL, TREMOR, GIDDINESS, BRADYCARDIA, AND ANXIETY HAVE BEEN FOUND IN WORKERS CHRONICALLY EXPOSED TO 5-630 PPM. LIVER, KIDNEY, AND BRAIN DAMAGE MAY ALSO OCCUR. PREGNANT RATS CHRONICALLY EXPOSED EXHIBITED POST-IMPLANTATION MORTALITIES, FETOTOXICITY, AND MUSCULOSKELETAL AND UROGENITAL SYSTEM ABNORMALITIES OF THE FETUSES. ADMINISTRATION BY INHALATION WAS ASSOCIATED WITH AN INCREASED INCIDENCE OF LYMPHOMAS IN FEMALE MICE, BUT NOT IN RATS OR HAMSTERS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
TRICHLOROETHYLENE:
IRRITANT.

ACUTE EXPOSURE- CONTACT MAY CAUSE IRRITATION. IT MAY BE ABSORBED, HOWEVER,

DERMAL ABSORPTION IS NOT LIKELY TO BE OF TOXICOLOGICAL SIGNIFICANCE UNDER NORMAL USE.

CHRONIC EXPOSURE- MAY CAUSE A DEFATTING TYPE OF DERMATITIS AND VESICULATION. REPEATED CONTACT HAS RESULTED IN PARALYSIS OF THE FINGERS. CHRONIC ABSORPTION MAY PRODUCE WEIGHT LOSS, NAUSEA, ANOREXIA, FATIGUE, VISUAL IMPAIRMENT, JOINT PAIN, WHEEZING, AND DERMATITIS. JAUNDICE IS RARE.

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:
TRICHLOROETHYLENE:
IRRITANT.

ACUTE EXPOSURE- INCIDENCES FROM ACUTE EXPOSURE HAVE BEEN REPORTED AND RESULTED IN LOSS OF SENSATION IN THE DISTRIBUTION OF THE TRIGEMINAL NERVE ON ONE OR BOTH SIDES. THESE CASES WERE OCCASIONALLY COMPLICATED BY CORNEAL EPITHELEAL ULCERATION, WHICH DID NOT CAUSE DISCOMFORT BECAUSE OF THE CORNEAL ANESTHESIA DUE TO PARALYSIS OF THE SENSORY NERVE. OCULOMOTOR PARALYSIS ACCOMPANIED THE TRIGEMINAL PALSIES IN A FEW OF THESE CASES. DIRECT EXTERNAL CONTACT WITH THE VAPOR OR LIQUID WITH THE EYE HAS CAUSED CHEMICAL BURNS OF THE LIDS, CONJUNCTIVA, AND CORNEA IN SEVERAL INSTANCES. A SPLASH IN THE EYE CAUSED SMARTING PAIN, AND INJURED CORNEAL EPITHELIUM IN A MANNER SIMILAR TO CHLOROFORM. COMPLETE SPONTANEOUS RECOVERY IS USUAL. EPITHELIUM MAY BE LOST, BUT RAPIDLY REGENERATES.

CHRONIC EXPOSURE- REPEATED OR PROLONGED VAPOR CONTACT MAY PRODUCE CONJUNCTIVITIS. CHRONIC INTOXICATION MAY CAUSE OPTIC NEURITIS, DOUBLE VISION, NYSTAGMUS, CHANGES IN COLOR PERCEPTION AND BLINDNESS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
TRICHLOROETHYLENE:
NARCOTIC/CARCINOGEN.

ACUTE EXPOSURE- LARGE AMOUNTS MAY CAUSE DIARRHEA, INEBRIATION, CONFUSION, TACHYCARDIA, AND CENTRAL NERVOUS SYSTEM DEPRESSION WITH DIZZINESS, NAUSEA, VOMITING, HEADACHE, COLLAPSE, CONVULSIONS AND RARELY COMA FOLLOWEDBY DEATH FROM RESPIRATORY FAILURE, CARDIAC ARREST, OR HEPATORENAL FAILURE. IN NON-LETHAL EXPOSURE, TRANSIENT NEUROLOGICAL SEQUELAE MAY INCLUDE HEADACHE, AMNESIA, NUMBNESS, WEAKNESS OF THE EXTREMITIES, HEMIPARESIS, AND PSYCHOSIS. ASPIRATION MAY CAUSE CHEMICAL PNEUMONIA.

CHRONIC EXPOSURE- STUDIES ON PREGNANT RATS RESULTED IN EFFECTS ON NEWBORN BEHAVIOR AND THE NUMBER OF NEONATES ALIVE AT WEANING AS COMPARED TO THE NUMBER OF NEONATES ALIVE AT DAY 4. TRICHLOROETHYLENE PRODUCED LIVER AND LUNG NEOPLASMS IN MICE AFTER REPEATED ORAL ADMINISTRATION.

FIRST AID- IF CONSCIOUS, REMOVE CHEMICAL BY GASTRIC LAVAGE OR EMESIS, PROTECTING AGAINST ASPIRATION. MAINTAIN BLOOD PRESSURE AND AIRWAY. GIVE ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED. GIVE OXYGEN IF RESPIRATION IS DEPRESSED. DO NOT GIVE EPINEPHRINE OR OTHER STIMULANTS THAT MAY CAUSE VENTRICULLAR ARRHYTHMIAS. GET MEDICAL ATTENTION. LAVAGE AND OXYGEN MUST BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL. (DREISBACH, HANDBOOK OF POISONING, 11TH ED.)

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. DO NOT GIVE STIMULANTS. (DREISBACH, HANDBOOK OF POISONING, 11TH ED.)

REACTIVITY SECTION

REACTIVITY:
TRICHLOROETHYLENE:
SLOWLY DECOMPOSES BY LIGHT (UV) WHEN MOIST WITH THE FORMATION OF HYDROGEN CHLORIDE.

INCOMPATIBILITIES:
TRICHLOROETHYLENE:
PRESSURIZED OXYGEN GAS: EXPLOSIVE REACTION.
LIQUID OXYGEN WHEN IGNITED: EXPLOSIVE REACTION.
BORON + POTASSIUM NITRATE + LAMINAC: EXPLOSIVE REACTION.
PERCHLORIC ACID: VIOLENT REACTION.
ALUMINUM: INTENSE EXOTHERMIC POLYMERIZATION.
DILUTE HYDROCHLORIC ACID: INTENSE EXOTHERMIC POLYMERIZATION.
SODIUM OR POTASSIUM HYDROXIDE: MAY FORM SPONTANEOUSLY FLAMMABLE AND HIGHLY TOXIC DICHLOROACETYLENE.
ALUMINUM: VIOLENT REACTION.
BARIUM: VIOLENT REACTION.
LITHIUM: VIOLENT REACTION.
NITROGEN TETROXIDE: VIOLENT REACTION.
SODIUM: VIOLENT REACTION.
POWDERED BERYLLIUM: FLASHES OR SPARKS ON IMPACT.
MAGNESIUM: FLASHES OR SPARKS ON IMPACT.
TITANIUM: FLASHES OR SPARKS ON IMPACT.

DECOMPOSITION:
TRICHLOROETHYLENE:
UPON CONTACT WITH CERTAIN METALS, HIGH TEMPERATURES, OPEN FLAME, OR ULTRAVIOLET LIGHT, DECOMPOSES INSTANTLY TO HIGHLY TOXIC AND CORROSIVE FUMES OF PHOSGENE AND/OR HYDROGEN CHLORIDE, CHLORINE, AND DICHLOROACETYL CHLORIDE. ABOVE 700 C VAPORS DECOMPOSE TO A MIXTURE OF DICHLORETHYLENE, TETRACHLORETHYLENE, CARBON TETRACHLORIDE, CHLOROFORM, AND METHYLCHLORIDE.

POLYMERIZATION:
TRICHLOROETHYLENE:
MAY POLYMERIZE WHEN CATALYZED BY ALUMINUM CHLORIDE IN A SELF-SUSTANING REACTION WHICH MAY DEVELOP TEMPERATURES UP TO 1350 C. A STABILIZER IS REQUIRED TO PREVENT POLYMERIZATION WHEN HEATED OR EXPOSED TO SUNLIGHT.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE.

STORAGE

STORAGE: STORE IN A COOL, DRY, WELL-VENTILATED LOCATION, AWAY FROM ANY AREA WHERE THE FIRE HAZARD MAY BE ACUTE (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY.
CONTAINER MAY EXPLODE IN HEAT OF FIRE.
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3)

STORE IN A COOL, DRY, WELL-VENTILATED LOCATION, AWAY FROM ANY AREA WHERE THE FIRE HAZARD MAY BE ACUTE. (NFPA, FIRE PROTECTION GUIDE ON HAZARDOUS MATERIALS, 8TH ED.)

SPILLS AND LEAKS

SOIL-RELEASE:
DIG A HOLDING AREA SUCH AS A PIT, POND OR LAGOON TO CONTAIN SPILL AND DIKE SURFACE FLOW USING BARRIER OF SOIL, SANDBAGS, FOAMED POLYURETHANE OR FOAMED CONCRETE. ABSORB LIQUID MASS WITH FLY ASH OR CEMENT POWDER.

AIR-RELEASE:
APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT.

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.

OCCUPATIONAL-SPILL:
SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL LIQUID SPILLS, TAKE UP WITH SAND, EARTH OR OTHER ABSORBENT MATERIAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY.

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

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.

FOR TRICHLOROETHYLENE:

500 PPM- CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE.
SUPPLIED-AIR RESPIRATOR.
SELF-CONTAINED BREATHING APPARATUS.

1000 PPM- CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE WITH A FULL FACEPIECE.
GAS MASK WITH AN ORGANIC VAPOR CANISTER (CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER).
SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.
SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

ESCAPE- GAS MASK WITH AN ORGANIC VAPOR CANISTER (CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER).
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.

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. CONTACT LENSES SHOULD NOT BE WORN.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 10/24/84 REVISION DATE: 06/28/88

****

MATERIAL SAFETY DATA SHEET OHS11210

OCCUPATIONAL HEALTH SERVICES, INC.
450 SEVENTH AVENUE, SUITE 2407
NEW YORK, NEW YORK 10123
(800) 445-MSDS (212) 967-1100

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615) 292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 7783-06-4
RTEC-NUMBER MX1225000

SUBSTANCE: HYDROGEN SULFIDE

TRADE NAMES/SYNONYMS:
HYDROSULFURIC ACID: SULFUR HYDRIDE: SULFURETED HYDROGEN: HEPATIC GAS: STINK DAMP: U135: STCC 4905410: UN 1053: OHS11210

CHEMICAL FAMILY:
INORGANIC GAS

MOLECULAR FORMULA: H2-S MOLECULAR WEIGHT: 34.08

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

COMPONENTS AND CONTAMINANTS

COMPONENT: HYDROGEN SULFIDE PERCENT: >99.0

OTHER CONTAMINANTS: METHYL MERCAPTAN; CARBON DISULFIDE; OXIDES OF CARBON AND SULFUR

EXPOSURE LIMIT:
HYDROGEN SULFIDE:
20 PPM OSHA ACCEPTABLE CEILING CONCENTRATION; 50 PPM/10 MINUTES OSHA PEAK
10 PPM ACGIH TWA; 15 PPM ACGIH STEL
10 PPM NIOSH RECOMMENDED 10 MINUTE CEILING

500 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY
100 POUNDS SARA SECTION 304 REPORTABLE QUANTITY

PHYSICAL DATA

DESCRIPTION: COLORLESS GAS AT ATMOSPHERIC TEMPERATURE AND PRESSURE, WITH ANODOR OF ROTTEN EGGS

BOILING POINT: -76 F (-60 C) MELTING POINT: -121 F (-85 C)

SPECIFIC GRAVITY: 1.192 SOLUBILITY IN WATER: SOLUBLE

VAPOR DENSITY: 1.2 VAPOR PRESSURE: 17 ATM @ 68 F (20 C)

ODOR-THRESHOLD: 0.05 PPM

OTHER SOLVENTS (SOLVENT - SOLUBILITY):

SOLUBLE IN CARBON DISULFIDE, WEAK ACIDS, ETHANOL, GASOLINE, KEROSENE, CRUDE OIL

OTHER PHYSICAL DATA
WATER SOLUBILITY DECREASES WITH TEMPERATURE INCREASE.

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
HIGHLY FLAMMABLE GAS WHEN EXPOSED TO HEAT, FLAME OR OXIDIZERS. MODERATE EXPLOSION HAZARD. GAS-AIR MIXTURES ARE EXPLOSIVE. VAPORS ARE HEAVIER THAN AIR, AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

UPPER EXPLOSION LIMIT: 46%   LOWER EXPLOSION LIMIT: 4.3%

AUTOIGNITION TEMP.: 500 F (260 C)

FIREFIGHTING MEDIA:
LET BURN UNLESS LEAK CAN BE STOPPED IMMEDIATELY
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. STAY AWAY FROM STORAGE TANK ENDS. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK FROM FIRE. COOL CONTAINERS WITH WATER USING UNMANNED DEVICE UNTIL WELL AFTER FIRE IS OUT. ISOLATE AREA UNTIL GAS HAS DISPERSED (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 13).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR AS A DISTANCE AS POSSIBLE. AVOID BREATHING POISONOUS VAPORS, KEEP UPWIND. EVACUATE TO A RADIUS OF 2500 FEET FOR UNCONTROLLABLE FIRES. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

FIRE FIGHTING PHASES: STOP FLOW OF GAS. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL AND TO PROTECT PERSONNEL EFFECTING THE SHUT OFF.
(NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
FLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
FLAMMABLE GAS AND POISON

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.304 AND 49CFR173.314
EXCEPTIONS: NONE

TOXICITY

HYDROGEN SULFIDE:
600 PPM/30 MINUTES INHALATION-HUMAN LCLO; 5700 UG/KG INHALATION-MAN LDLO; 800 PPM/5 MINUTES INHALATION-HUMAN LCLO; 444 PPM INHALATION-RAT LC50; 673 PPM/1 HOUR INHALATION-MOUSE LC50; 800 PPM/5 MINUTES INHALATION-MAMMAL LCLO; CARCINOGEN STATUS: NONE.

HYDRODEN SULFIDE IS TOXIC AND A SEVERE SKIN, EYE, AND MUCOUS MEMBRANE IRRITANT AND NEUROTOXIN.

HEALTH EFFECTS AND FIRST AID

INHALATION:
HYDROGEN SULFIDE:
CORROSIVE/NEUROTOXIN/TOXIC. 300 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- LOW CONCENTRATIONS MAY PRODUCE NASAL AND RESPIRATORY TRACT IRRITATION. AT 50 PPM, ANOSMIA, ANOXIA, HEADACHE, NAUSEA, DIZZINESS, VOMITING, CONFUSION, WEAKNESS, ATAXIA, IRRITABILITY, AND INSOMINIA MAY OCCUR. RHINITIS, PHARYNGITIS, COUGHING, BRONCHITIS, AND PNEUMONITIS ARE ALSO POSSIBLE. AT 500-1000 PPM, COMA, CONVULSIONS, AND DEATH MAY OCCUR WITHIN 30 MINUTES. AT EXTREMELY HIGH CONCENTRATIONS, RESPIRATORY PARALYSIS AND DEATH FROM ASPHYXIA MAY BE IMMEDIATE. NON-FATAL EXPOSURES MAY RESULT IN SEQUALAE INCLUDING RESIDUAL COUGH, CARDIAC DILATION, SLOW PULSE, PERIPHERAL NEURITIS, ALBUMINURIA, AMNESIA, PSYCHIC DISTURBANCES, AND PERMANENT BRAIN DAMAGE.

CHRONIC EXPOSURE- PROLONGED OR REPEATED EXPOSURE TO LOW CONCENTRATIONS MAY CAUSE HYPOTENSION, NAUSEA, ANOREXIA, WEIGHT LOSS, INCOORDINATION, AND CHRONIC COUGH. PROLONGED EXPOSURE TO 250 PPM HAS LED TO PULMONARY EDEMA.

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. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
HYDROGEN SULFIDE:
CORROSIVE.

ACUTE EXPOSURE- HIGH VAPOR CONCENTRATIONS MAY CAUSE SEVERE IRRITATION TO THE SKIN. DIRECT CONTACT WITH THE LIQUIFIED GAS MAY CAUSE ERYTHEMA, PAIN, AND POSSIBLE FROSTBITE.

CHRONIC EXPOSURE- A HIGH INCIDENCE OF FURUNCULOSIS HAS BEEN REPORTED IN INDUSTRIAL HYDROGEN SULFIDE WORKERS.

FIRST AID- IN CASE OF FROSTBITE, WARM AFFECTED SKIN IN WARM WATER AT A TEMPERATURE OF 107 F. IF WARM WATER IS NOT AVAILABLE OR IMPRACTICAL TO USE, GENTLY WRAP AFFECTED PART IN BLANKETS. ENCOURAGE VICTIM TO EXERCISE AFFECTED PART WHILE IT IS BEING WARMED. ALLOW CIRCULATION TO RETURN NATURALLY. (MATHESON GAS, 6TH EDITION) GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

HYDROGEN SULFIDE:
CORROSIVE.

ACUTE EXPOSURE- 50 PPM FOR ONE HOUR HAS CAUSED CONJUNCTIVITIS, PAIN, LACRIMATION, PHOTOPHOBIA, AND APPEARANCE OF HALOES AROUND LIGHTS. WITHIN A FEW HOURS OR DAYS, SYMPTOMS MAY PROGRESS TO KERATOCONJUNCTIVITIS AND VESICULATION OF THE CORNEAL EPITHELIUM. HIGHER CONCENTRATIONS MAY CAUSE SEVERE IRRITATION, LACRIMATION, AND INTENSE PAIN. DIRECT CONTACT WITH THE LIQUIFIED GAS MAY CAUSE FROSTBITE.

CHRONIC EXPOSURE- PROLONGED OR REPEATED EXPOSURE MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF BURNS, APPLY STERILE BANDAGES LOOSELY WITHOUT MEDICATION. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
HYDROGEN SULFIDE:

ACUTE EXPOSURE- INGESTION OF A GAS IS UNLIKELY.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.

ANTIDOTE:
THE FOLLOWING ANTIDOTE(S) HAVE BEEN RECOMMENDED. HOWEVER, THE DECISION AS TO WHETHER THE SEVERITY OF POISONING REQUIRES ADMINISTRATION OF ANY ANTIDOTE AND ACTUAL DOSE REQUIRED SHOULD BE DETERMINED BY QUALIFIED MEDICAL PERSONNEL.

AMYL NITRITE OR SODIUM NITRITE CAN BE USED TO AID IN THE FORMATION OF SULFMETHEMOGLOBIN, THUS REMOVING SULFIDE FROM COMBINATION IN TISSUES. PYRIDOXINE 25 MG/KG INTRAVENOUSLY, OR 10% UREA, 1 G/KG INTRAVENOUSLY, HAS BEEN SUGGESTED AS A SULFIDE ACCEPTOR. ADMINISTRATION OF ANTIDOTES SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL. THE NITRITE ANTIDOTE IS TOXIC; THERAPY IS DANGEROUS. (DREISBACH, HANDBOOK OF POISONING, 11TH EDITION)

REACTIVITY SECTION

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
HYDROGEN SULFIDE:

ACETALDEHYDE: VIOLENT REACTION.
BARIUM OXIDE, MERCUROUS OXIDE AND AIR: INCANDESCENT REACTION OR EXPLOSION.
BARIUM OXIDE, NICKEL OXIDE AND AIR: INCANDESCENT REACTION OR EXPLOSION.
BARIUM PEROXIDE: INGITION REACTION.
BROMINE PENTAFLUORIDE: FIRE AND EXPLOSION HAZARD.
CHLORINE MONOXIDE: IGNITION REACTION ON CONTACT.
CHLORINE TRIFLUORIDE: EXPLOSIVE REACTION.
CHROMIC ANHYDRIDE: INCANDESCENT REACTION ON HEATING.
COPPER: INTENSE EXOTHERMIC REACTION.
COPPER POWDER: INTENSE REACTION.
DIIRON TRIOXIDE HYDRATE: FORMATION OF COMBUSTIBLE SUBSTANCE.
FLUORINE: IGNITION REACTION.
METALS: ATTACKS MOST METALS, ESPECIALLY IN THE PRESENCE OF WATER.
METAL OXIDES: COMBUSTION, INCANDESCENT REACTION OR EXPLOSION.

LEAD DIOXIDE: COMBUSTION REACTION.
NITRIC ACID: INCANDESCENT REACTION.
NITRIC ACID (FUMING OR CONCENTRATED): VIOLENT REACTION.
NITROGEN TRICHLORIDE: EXPLOSIVE REACTION.
NITROGEN TRIFLUORIDE: FORMATION OF EXPLOSIVE MIXTURE.
NITROGEN TRIIODIDE AND AMMONIA: EXPLOSIVE REACTION.
OXIDANTS: VIOLENT REACTION.
OXYGEN DIFLUORIDE: EXPLOSIVE REACTION ON MIXING.
PERCHLORYL FLUORIDE: IGNITION OR EXPLOSION AT 100-300 C.
PHENYL DIAZONIUM CHLORIDE: FORMATION OF EXPLOSIVE SUBSTANCE.
RUST: HYDROGEN SULFIDE MAY IGNITE IF PASSED THROUGH RUSTY IRON PIPES.
SILVER FULMINATE: VIOLENT REACTION AT AMBIENT TEMPERATURES.
SODA LIME AND AIR: INCANDESCENT REACTION.
SODIUM: RAPID REACTION ON CONTACT WITH MOIST GAS.
SODIUM PEROXIDE: VIOLENT REACTION OR IGNITION, EVEN IN THE ABSENCE OF AIR.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC AND HAZARDOUS HYDROGEN, SULFUR, AND OXIDES OF SULFUR.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE-DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE.

STORAGE

PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERRED, INSIDE STORAGE SHOULD BE IN A COOL, WELL-VENTILATED, NONCOMBUSTIBLE LOCATION, AWAY FROM ALL POSSIBLE SOURCES OF IGNITION. STORE AWAY FROM NITRIC ACID, STRONG OXIDIZING MATERIALS, CORROSIVE LIQUIDS OR GASES, CYLINDERS OR OTHER CONTAINERS UNDER HIGH PRESSURE, AND POSSIBLE SOURCES OF IGNITION. PROTECT AGAINST STATIC ELECTRICITY, DIRECT SUNLIGHT AND EXCESSIVE HEAT (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

THRESHOLD PLANNING QUANTITY (TPQ):
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 302 REQUIRES THAT EACH FACILITY WHERE ANY EXTREMELY HAZARDOUS SUBSTANCE IS PRESENT IN A QUANTITY EQUAL TO OR GREATER THAN THE TPQ ESTABLISHED FOR THAT SUBSTANCE NOTIFY THE STATE EMERGENCY RESPONSE COMMISSION FOR THE STATE IN WHICH IT IS LOCATED. SECTION 303 OF SARA REQUIRES THESE FACILITIES TO PARTICIPATE IN LOCAL EMERGENCY RESPONSE PLANNING (40 CFR 355.30).

CONDITIONS TO AVOID

STORE IN A COOL PLACE AWAY FROM IGNITION SOURCES, HEAT, AND SUNLIGHT.

SPILLS AND LEAKS

SOIL-RELEASE:
DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.

USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID MASS.

NEUTRALIZE SPILL WITH SLAKED LIME, SODIUM BICARBONATE OR CRUSHED LIMESTONE.

AIR-RELEASE:
APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT.

WATER-SPILL:
ADD SUITABLE AGENT TO NEUTRALIZE SPILLED MATERIAL TO PH-7.

OCCUPATIONAL-SPILL:
SHUT OFF IGNITION SOURCES. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. ISOLATE AREA UNTIL GAS HAS DISPERSED. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING. EVACUATE AREA ENDANGERED BY GAS.

PROTECTIVE EQUIPMENT SECTION

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE 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 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.

HYDROGEN SULFIDE:
100 PPM- SUPPLIED-AIR RESPIRATOR.
SELF-CONTAINED BREATHING APPARATUS.

250 PPM- SUPPLIED-AIR RESPIRATOR OPERATED IN CONTINUOUS FLOW MODE.
SELF-CONTAINED BREATHING APPARATUS.

300 PPM- SELF-CONTAINED BREATHING APPARATUS.
SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE.

ESCAPE- AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER.
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.

CLOTHING:
WEAR PROTECTIVE CLOTHING. PREVENT ANY POSSIBILITY OF CONTACT WITH LIQUID AND REPEATED OR PROLONGED VAPOR CONTACT WITH SKIN.

GLOVES:
WEAR FULL PROTECTIVE, COLD INSULATING GLOVES.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

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.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 10/29/84 REVISION DATE: 07/08/88

****

Attachment 3

Operations Procedure for Building Entry

1. Using level B ensemble, upon gaining access to structure, immediately monitor with HNU/OVA and combustible gas/hydrogen sulfide/oxygen deficiency meter to determine presence/absence of any airborne contaminants.

2. Open all roll up and other doors. Allow to structure to ventilate naturally for a minimum of 30 minutes.

3. Continue to monitor. In the absence of any detectable airborne contaminants, the initial investigation may proceed in level D.

3a. If airborne contaminants are still detectable after natural ventilation, all further investigations will be conducted in level B/C depending upon the presence/absence of vinyl chloride and concentrations of contaminant.

- o Military police or other base representative should be present.
- o Entry shall be made in teams of two. For each entry team, there shall be one backup team.
- o Entry ensemble shall be a minimum of: steel toed/shank boots, boot covers, Saranex tyvek, hard hat, safety glasses or goggles, neoprene or butyl gloves (outer), surgical gloves (inner).
- o Entry into confined spaces (e.g., wet/dry wells) is strongly discouraged. Sampling should be performed remotely (e.g., long handled samplers). If necessary, entry into confined spaces (e.g., wet/dry wells) will require the minimum entry ensemble, described above, self contained breathing apparatus, full body harness, and lifeline(s). A fully equipped backup team will be present for all confined space entry.
- o Presence of airborne contaminants at any concentration shall be deemed sufficient cause for reevaluation of sampling/investigation strategy.
- o Line of sight will be maintained. Use of radios (Army provided?) is a permissible substitute.
- o Sufficient lighting to visualize hazards shall be provided by natural or other means. All entry team members will carry an explosion proof flashlight.

ICF TECHNOLOGY SITE HEALTH AND SAFETY PLAN
SHORT FORM

Attachment 4

Well Opening Procedures

1. All monitoring well openings shall be done with respiratory protection (i.e., a minimum requirement of an air purifying respirator). Gloves shall be used where there is a possibility of contacting contaminated solutions/soil.

   Situations involving (or anticipated to involve) highly toxic materials, high airborne concentrations of contaminants, explosive atmospheres, or where respirators are not sufficiently protective (e.g., with HCN), Level B protective ensemble shall be used.

2. Well openings shall be done from the upwind side, whenever possible.

3. Immediately upon removing the well cap, sample with appropriate direct reading instruments to determine the presence/absence of airborne contaminants. A grab sample may be taken, if desired, using an air sampling pump and tedlar bag.

3a. If no airborne contaminants are detected, rapidly raise and lower a bailer or similar instrument down the well opening. Resample to determine if any airborne contaminants are generated.

3b. If airborne contaminants are detected, allow the well to "air" out undisturbed for a minimum of 15-30 minutes. Resample at the end of this time period.

4. If airborne contaminants are still present, note this. Depending upon the contaminants of concern and monitored levels, all subsequent sampling activities may require Level B/C protective ensembles.

APPENDIX D

RESUMES OF KEY PERSONNEL

Park G. Gilmore joined ICF Technology in August 1987 as a Geologist. He received B.A. degrees in both Geology and Economics from Denison University, and is a candidate for a M.S. in Hydrogeology from George Washington University. At ICF Technology, Mr. Gilmore has conducted route-of-movement risk assessments for several different toxic rocket propellants, and is currently developing a computerized model for performing of transportation risk assessments. He has provided support to the EPA's National Pesticide Survey (NPS) conducting field sampling of domestic water wells to determine the extent of pesticide contamination of ground-water. Additionally, he has been involved in the preparation of an Environmental Impact Statement for the Federal Energy Regulatory Commission (FERC) which analyzed the impacts of proposed regulations. He has participated in the preparation of competitive prices for a hazardous waste treatment facility for a private client, and has assisted in development of a model to aid generators and State officials with the analysis of hazardous waste reduction, reuse, and treatment alternatives. In addition, he has assisted in the preparation of preliminary hazard analyses for the storage and transport of hazardous materials. Mr. Gilmore has conducted a market survey on quantities and disposal costs of specific wastes, and prepared cost estimates for the excavation and cleanup of a hazardous and toxic waste site. Other projects include research assistance to a major aerospace firm for the conceptual design of the Advanced Launch System for the Department of Defense; conducting a fire risk assessment of proposed automotive refueling vapor recovery systems; and conducting a Spill Prevention, Control, and Countermeasure (SPCC) Plan for Vandenberg AFB.

Kim R. Green joined ICF Technology as a Lead Geochemist in 1986. She holds a Master of Science degree in Geochemistry from the Colorado School of Mines and a B.S. in Chemistry/Geology from Southern Oregon State College. She also has additional training in ground-water and unsaturated zone monitoring and sampling. Ms. Green has extensive experience managing and performing site investigations, and over the past seven years has accrued a very broad range of professional experience. This experience extends to technical and policy issues in the areas of hazardous and solid waste management, surface and ground water quality, contaminant fate and transport, and environmental risk analysis. Her project experience at ICF Technology has included managing and performing evaluations of the adequacy of ground-water monitoring systems at hazardous and solid waste sites to detect and prevent ground-water contamination, developing EPA guidance documents, developing a space launch program support feasibility study for Vandenberg Air Force Base, California, review of EPA delisting petitions, assessing environmental effects associated with the disposal of coal-fired utility plant wastes, and review of Site Characterization Plans for high-level radioactive waste respositories. Ms. Green has a wide variety of field and laboratory experience and has extensive experience in managing, formulating, and performing geochemical field studies including the collection and analysis of rock, soil, water, and gas samples. She has conducted such investigations in many parts of the world. Previous experience also includes the development and presentation of a training course on the geochemical behavior of hazardous and toxic substances in the hydrogeologic environment.

Catherine M. Madore joined ICF Technology as a Senior Associate in January of 1988. She received a B.S. in geology and an M.R.P. in environmental planning from the University of Massachusetts, Amherst, and is currently pursuing a J.D. degree from George Mason University School of Law. At ICF Technology, Ms. Madore is preparing a comprehensive hazardous waste management guide for the U.S. Air Force and is involved in the development of a hazard response system for releases of hypergolic propellants at Cape Canaveral Air Force Station (CCAFS).

Before joining ICF Technology, Ms. Madore worked as environmental planner for the Maryland-National Capital Park and Planning Commission (M-NCPPC), where she reviewed land use proposals to assess environmental impacts, served on Maryland's Coastal Resources Advisory Committee's Wetlands Task Force, and authored an environmental information guide for the residents of Prince George's County. Ms. Madore also worked for the National Park Service Cooperative Research Unit, where she measured dune migration rates within Cape Cod National Seashore, analyzed Park Service policies, assessed the socio-economic and environmental impacts of dune movement, and prepared a stabilization and management plan for the Province Lands Dunes Area. Ms. Madore's other environmental planning experience includes the development of a community energy plan for the Town of Amherst, Massachusetts, and an analysis of the recreation opportunities associated with wastewater treatment facilities in the City of Holyoke, Massachusetts, which she performed for the Dept. of Environmental Quality and Engineering (DEQE).

In addition, Ms. Madore possesses an extensive background in technical communications; having written, edited, and produced user documentation and training materials for computer systems developed by the data communications and process control industries, as well as the Department of Defense. These positions involved extensive interviews with engineers, marketing managers, military personnel, and equipment users who had little or no technical background, requiring an ability to communicate effectively in a wide variety of situations and, above all else, the skill to present complex ideas in a clear, concise manner.

Dr. Gary McKown is a Vice-President at ICF Technology. He holds B.S. and Ph.D. degrees in chemistry and performed extensive research and post doctoral work in chemical physics. Dr. McKown has more than 15 years of experience in hazardous waste characterization and remediation technology, process systems safety engineering, hazard/risk analysis, and hazardous materials research, development, test and evaluation. At ICF Technology, Dr. McKown has been involved in performing RI/FS, RFA and RFI work for the U.S. Army, determining benefits of RCRA listing programs, in developing hazard assessment data bases for acutely toxic chemicals under TSCA, developing laboratory support services for EPA, performing hazardous materials research, and supporting DOE and DOD hazardous waste site characterization programs. Prior to joining ICF Technology, Dr. McKown was project manager for DOD and EPA investigations at more than a dozen sites throughout the country. These programs included evaluation of process wastes and disposal methods; extensive chemical and geohydrologic site characterization activities; development of feasible remedial measures; establishment of mathematical models for prediction of remedial action benefits; analysis of resultant health and environmental endangerments and residual risks; specification and preliminary design of remedial processes; and analysis of the reliability of remedial designs based on uncertainties in the data collected during remedial investigations and feasibility studies.

For seven years, Dr. McKown led a team of engineers and technicians in evaluating the hazards associated with manufacturing, storage, supply and use of highly reactive materials, and in developing process equipment designed to minimize risks. He also has several years of experience in academic instruction and chemical physics research.

Georgeann N. Morekas is a Senior Environmental Engineer with ICF Technology, and holds a M.S. degree in Environmental Engineering from Duke University and a B.A. degree in Chemistry from Western Maryland College. Ms. Morekas also has additional training in health and safety and remedial response at Superfund sites, ground-water and unsaturated zone monitoring and sampling, and in developing corrective actions for containing and controlling ground-water contamination. Her project experience at ICF includes management of current Part B permit application modifications for a private client, preparation of Contingency Plans for the Vulcanus I and II ocean incineration vessels, environmental compliance audits of industrial facilities, and the development of several EPA guidance documents, including the RCRA Exposure Information Assessment Guidance Manual. She has also developed and presented a 2-day training course on hazardous waste cleanup technologies and their application at Superfund sites. Ms. Morekas is also developing a CERCLA guidance on compliance with other environmental statutes, including RCRA and the Clean Water Act, is participating in the analysis of remedial alternatives for a U.S. Army chemical agent/explosives disposal site, and is developing a hypergolic propellant hazard response guidance document for the Air Force.

Wayne R. Saunders joined ICF Technology in 1987 as a Project Manager. He received his B.S. in Geology from Florida Atlantic University in 1975 and has completed Masters related courses from the University of Wisconsin-Extension in Madison. At ICF Technology, Mr. Saunders is currently coordinating the development of geophysical work within the firm and will be marketing geophysical activities to a variety of governmental and private clients. Mr. Saunders is regarded as a pioneer in the development of investigating subsurface organic contamination which are low conductors by electromagnetic induction. He has provided his services to Federal and State governments, major oil companies, Department of Defense, Department of Energy, and major industries. He is a chairman of an ASTM subcommittee which is developing geophysical implementation guidelines for the investigation of ground water. Before joining ICF Technology, Mr. Saunders worked for the major consulting firms of Camp Dresser and McKee and Woodward-Clyde Consultants and the Department of Environmental Protection for the State of New Jersey. Mr. Saunders has investigated hundred's of hazardous waste sites throughout the United States. In addition he has conducted numerous geotechnical and make resource investigations throughout the Caribbean and the United States utilizing geophysical methods.

Spence S. Smith joined ICF Technology as an Associate in 1986. He has completed all requirements except the thesis for a Master of Science degree in Geoscience from the University of Arizona. He holds a Bachelor of Arts degree with majors in Biology, Environmental Science, and Earth Science from Wesleyan University. Mr. Smith has substantial field experience as a geoscientist. This experience includes the subdisciplines of hydrology, geohydrology, and flood modeling; tectonic geomorphology and soil genesis; alluvial stratigraphy; dendrochronology; and process geomorphology. Recent research has utilized innovative approaches to flood frequency analysis and determination of the probable maximum flood (PMF) for arid/semiarid river systems. In addition, Mr. Smith has worked as a geological interpreter for river expeditions in Grand Canyon, Arizona and as a science teacher.

Frederick H. Swahn, Jr., Lead Hydrogeologist. Mr. Swahn has over five years experience in the planning and management of hazardous waste and groundwater contamination projects such as initial site assessments, monitoring program designs, field investigations, remedial action alternatives studies, and closure analyses. He has been responsible for on-site field operations, data gathering, and site characterization for numerous Superfund and RCRA facility site investigations across the United States, including several at military installations. He also conducts environmental site risk assessments and regulatory compliance audits for various industrial operations. Mr. Swahn earned a B.S. in Geology from the University of Maryland and is currently working toward a M.S. in Environmental Science from the Virginia Polytechnic Institute and State University.

Andrew P. Szilagyi joined ICF Technology, in 1988 as a Project Manager. He received a B.A. in Biology from York College and a Masters of Environmental Science from C.W. Post College. Mr. Szilagyi is a Certified Hazardous Waste Specialist, and a member of the American Industrial Hygiene Association Hazardous Waste Committee. He specializes in the managerial, technical and health and safety aspects of hazardous waste investigations, and has extensive experience at more than 180 Superfund sites nationwide. At ICF Technology, Mr. Szilagyi is presently responsible for the development and implementation of an in-depth and comprehensive Health and Safety Program in compliance with the requirements of the Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response; Interim Final Rule (29 CFR 1910.120). Prior to joining ICF Technology, Mr. Szilagyi worked at Camp Dresser McKee Federal Programs Corporation where he functioned in a multidisciplinary role. His responsibilities included serving as the Technical Coordinator for the EPA REM II Program, as Corporate Deputy Health and Safety Officer and as Project Manager for numerous EPA and DOD assignments.

Mr. Szilagyi is a marine biologist with recognized expertise in coral reef ecology and extensive national and international experience in marine, wetland and aquatic ecology, marine fisheries assessment, water quality management, and impact/mitigation assessment of various industrial, commercial and military activities in and around the marine environment. He has designed, directed and executed numerous investigations including the determination of the composition, structure and distribution of key marine ecosystems; delineation of water quality conditions and oceanographic parameters. He has conducted assessments of potential impacts and determined mitigative actions for activities such as hazardous and industrial waste water discharge, cooling water intake and disposal, dredging and large scale facility sitting, military operations, and industrial facility construction and operations. Mr. Szilagyi's clients have included the chemical industry, power plants, LNG/NGL facilities, refineries, and military and governmental organizations in such diverse locations as the United States, Indonesia, Saudi Arabia, South America, and throughout the Caribbean.

Davida Parker Trumbo joined ICF Technology in March 1988 as an Associate. She received a B.S. in Chemistry from the University of New Orleans, New Orleans, Louisiana. At ICF Technology, Ms. Trumbo is currently coordinating the QA program for the National Pesticide Survey well sampling, and data collection processing tasks. She will be providing support to internal QA/QC protocols. Before joining ICF Technology, Ms. Trumbo worked at Camp Dresser and McKee Federal Programs Corporation where she monitored the REM II QA programs in the ten EPA established regions. She worked for Martin Marietta at their Michoud division which was responsible for manufacturing the external fuel tank for NASA's space shuttle program. In addition to her environmental analysis experience, she has been involved in clean room analyses, inspection monitoring, process chemical evaluation, and soil analyses of underground storage.