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FINAL

U.S. Army Environmental Center

Site Inspection Health and Safety Plan

Bennett Army National Guard Facility
Bennett, Colorado

Prepared for:

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND 21010-5401

Prepared by:

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January 1995

SITE INSPECTION HEALTH AND SAFETY PLAN

BENNETT ARMY NATIONAL GUARD FACILITY
BENNETT, COLORADO

FINAL

USAEC CONTRACT NO. DAAAI5-14-D-0013

TASK ORDER 0001

Prepared for:

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland 21010-5401

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CKY Project No. 8802

January 26, 1995

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LIST OF ACRONYMS AND ABBREVIATIONS

ANG	Army National Guard
BANGF	Bennett Army National Guard Facility
bgs	Below Ground Surface
COR	Contracting Officer's Representative
CRZ	Contamination Reduction Zone
DOL	Department of Labor
EPIC	Environmental Photographic Interpretation Center
FID	Flame Ionization Detector
FS	Feasibility Study
HEPA	High-Efficiency Particulate Air
HSO	Health and Safety Officer
HSP	Health and Safety Plan
LEL	Lower Explosive Limit
LOX	Liquid Oxygen
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
PA	Preliminary Assessment
PCBs	Polychlorinated Byphenyls
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protection Equipment
ppm	Parts per Million
PVC	Polyvinyl Chloride
RI	Remedial Investigation
SCBA	Self Contained Breathing Apparatus
SHSO	Site Health and Safety Officer

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

SI	Site Inspection
SVOCs	Semivolatile Organic Compounds
USAEC	U.S. Army Environmental Center
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USDA	U.S. Department of Agriculture
UXO	Unexploded Ordnance
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

1.1 SCOPE AND PURPOSE

This Health and Safety Plan (HSP) is based on the Remedial Investigation/Feasibility Study (RI/FS) HSP originally developed by R.L. Stollar & Associates, Inc. in 1991 for use at the Bennett Army National Guard Facility (BANGF). Subsequent to the initial preparation of the plan, funding to perform the RI/FS at BANGF was not provided. The original RI/FS HSP has been modified to address the potential health and safety hazards associated with conducting a Site Inspection (SI) of this facility. The HSP meets the requirements of Title 29 of the Code of Federal Regulations, Section 1910.120 (29 CFR 1910.120) and 29 CFR 1910.134. Compliance with this HSP for BANGF is required of all field personnel including subcontractors conducting investigations and waste management identified in the BANGF SI Sampling and Analysis Plan.

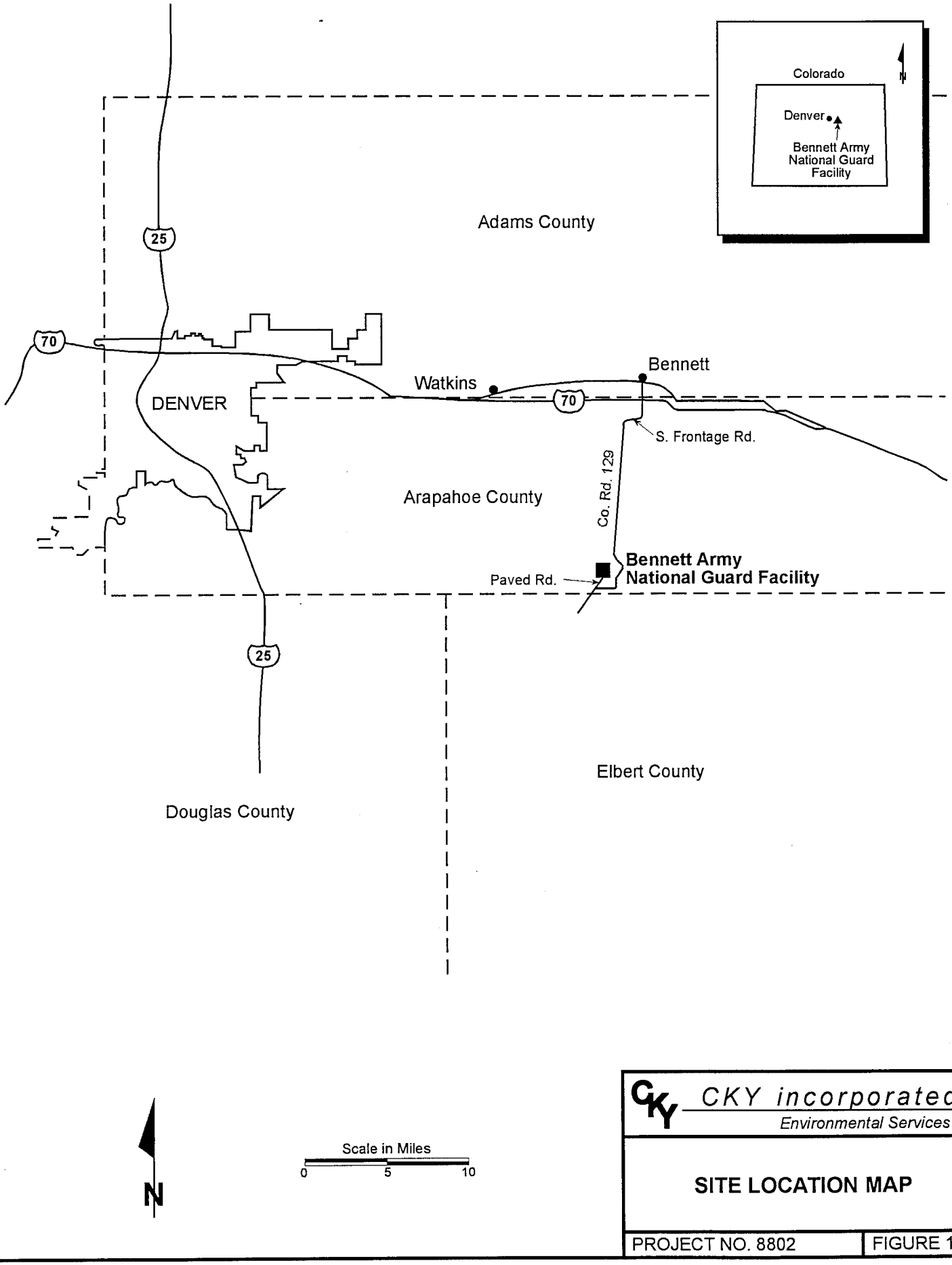
1.2 SITE LOCATION

BANGF is a federally owned property, located approximately 35 miles southeast of Denver, Colorado (Figure 1-1). The land encompassing the BANGF is currently leased by the Colorado Army National Guard (ANG) for training exercises. The facility is located on approximately 242 acres in the southeast corner of the old Lowry Bombing Range in Arapahoe County, Colorado.

1.3 SITE HISTORY

BANGF was built on land which was originally part of the Lowry Air Force Base bombing range. This land was obtained from the City and County of Denver and the State of Colorado by the Secretary of War in November 1940. The construction of a Titan I missile complex began at the site in April 1959 and was completed in August 1961. The missile complex was operational until January 1965, when it was closed due to technological changes in the nation's missile program.

Sections of the former bombing range were searched and cleared of unexploded ordnance (UXO) in 1959 and 1961 (Appendix A). Based on these ordnance clearing activities, the entire bombing range, except for the Titan I complexes, was officially cleared for unrestricted use. Ordnance clearance was accomplished by walking the surface of the area and removing any unexploded ordnance or fragments as found. The land has subsequently been sold to private interests and is being used for agricultural and ranchette uses. The construction history of the Titan complexes indicated that excavation was held up for a short time at Complex I-B in early 1959 when live ordnance was uncovered (USACE, 1961). Military explosive ordnance disposal units were called to the construction site and cleared the area. No mention was made of any ordnance related construction delays at the BANGF.



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SITE LOCATION MAP

PROJECT NO. 8802 | FIGURE 1-1

Final excessing actions and salvaging operations were conducted at the former missile complex in 1971. In October 1977, the site was transferred to the Department of the Army (DA) from the Air Force and subsequently the DA turned the site over to the Colorado ANG for training activities. The Colorado ANG used the surface of the site for tactical aviation training purposes and did not routinely access the underground complex.

In December 1988, the Defense Secretary's Commission on Base Realignment and Closure released a report which recommended BANGF for closure. In March 1989, the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), since renamed the U.S. Army Environmental Center (USAEC), was assigned the responsibility for centrally managing the Base Realignment and Closure Environmental Restoration Program.

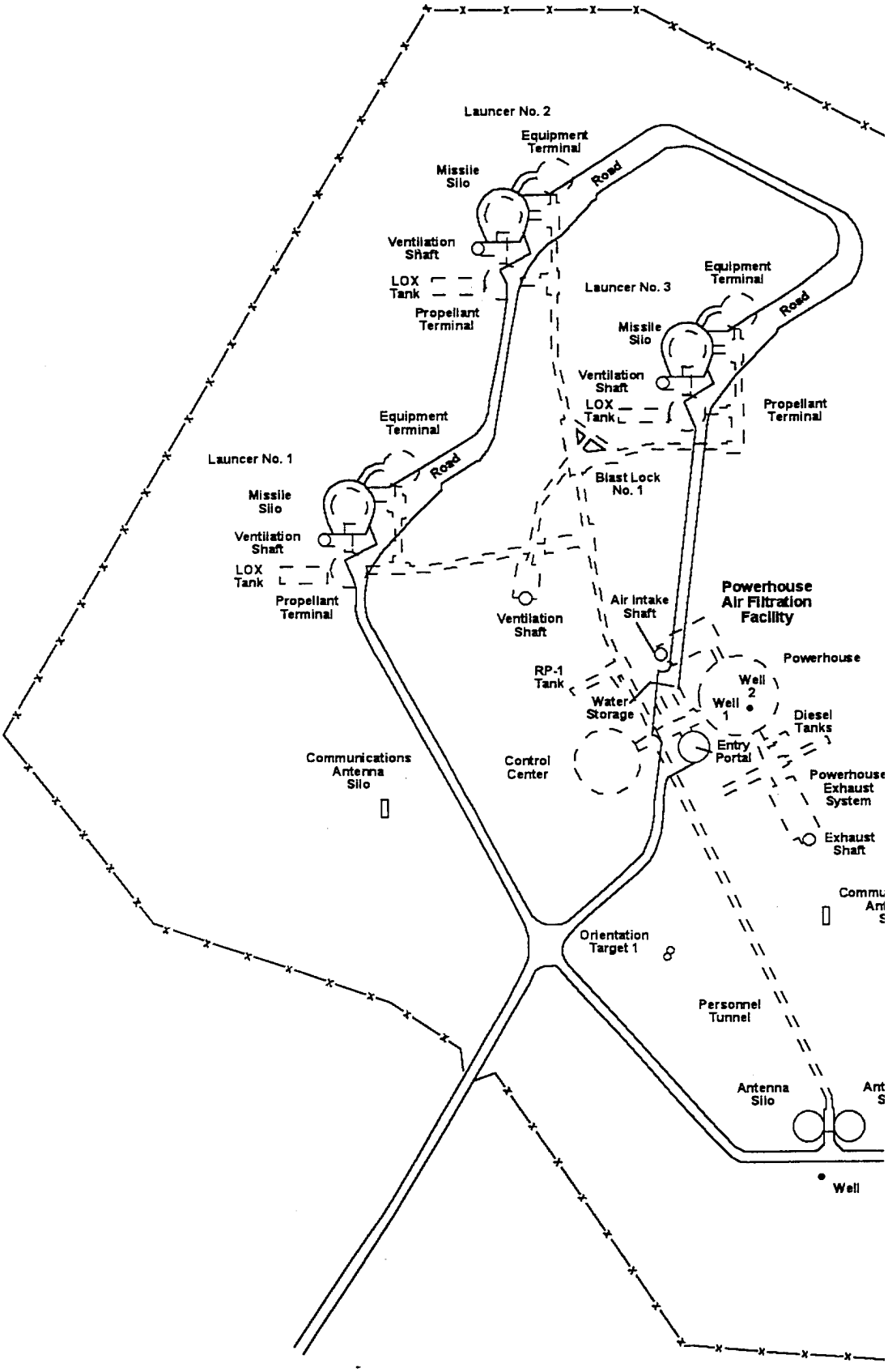
1.4 SITE DESCRIPTION

Information for this site description came from two investigations. The first source is the BANGF Enhanced Preliminary Assessment (PA) Report prepared by Roy F. Weston, Inc. in January 1990. This report describes the underground layout, the primary functions of each area when the facility was operational, potentially environmentally significant operations, and the major items removed during the salvage operation after the facility was closed. Additional information was collected during an inspection of the facility conducted by R. L. Stollar & Associates, Inc. on September 17 and 18, 1990. The inspection was conducted to document the condition of the complex, to determine whether hazardous wastes were present at the site, and assess health and safety hazards in the underground structure. Detailed descriptions of the condition of the facility can be found in Appendix A of the Sampling and Analysis Plan, Inspection Notes.

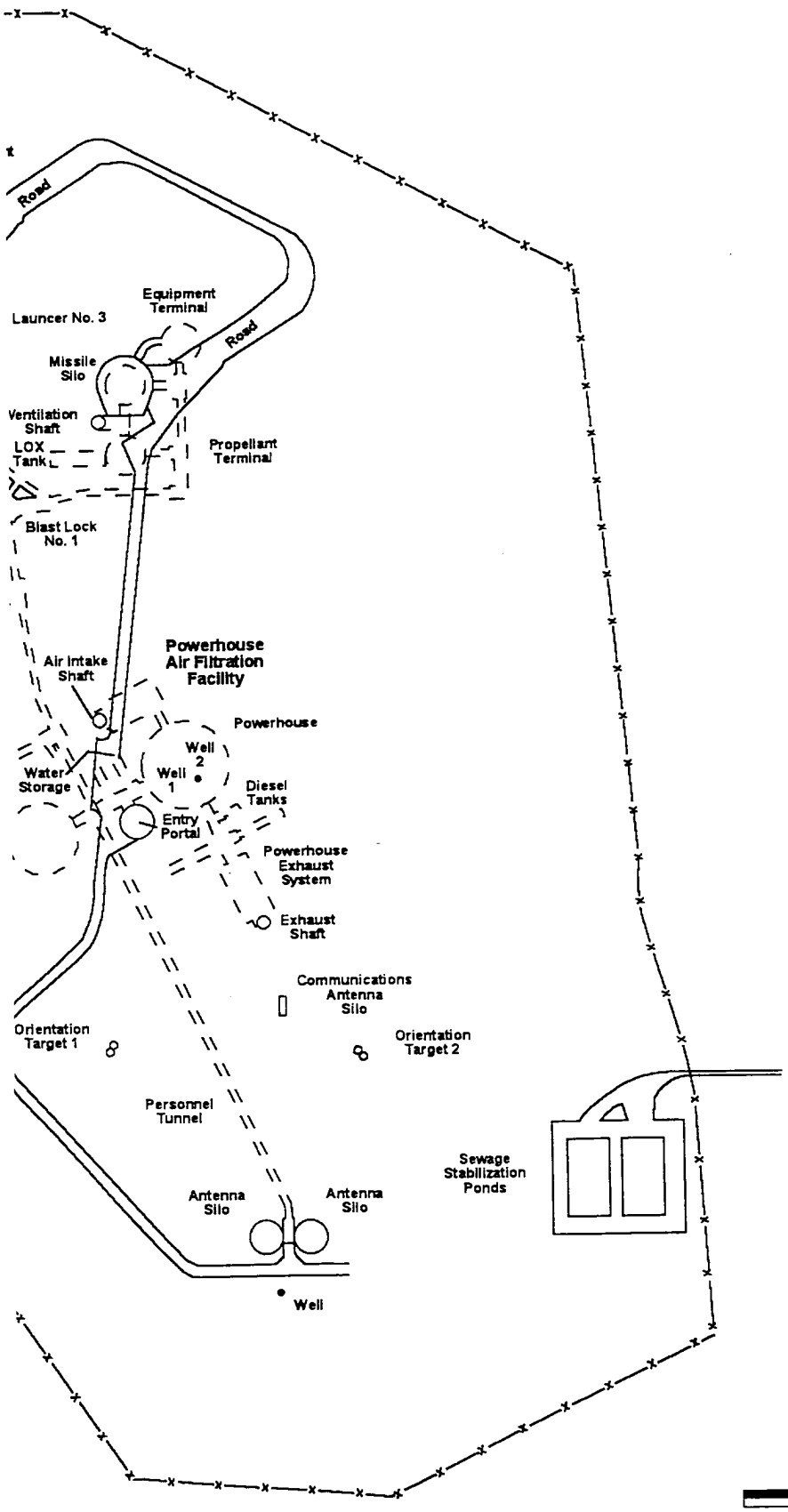
The BANGF contains an abandoned Titan I missile complex which includes an entry portal silo, powerhouse, control center, antenna terminal, two antenna silos, fuel terminal, powerhouse air filtration facility, three propellant terminals, three equipment terminals, and three missile silos (Figure 1-2). All of the structures are underground; they are constructed of reinforced concrete and are connected by steel tunnels.

1.4.1 Underground Facilities

The underground launch complex can be divided roughly into three operational subgroups; the powerhouse, the control center and the launch areas. These areas are connected by tunnels constructed of 9.5-ft-diameter corrugated metal. There are approximately 2,100 ft of tunnels which allowed personnel access and utility connections to all areas of the complex. During the inspection, the tunnels were observed to be generally damp, and insulating material, which appeared to consist mostly of fiberglass, was lying on the floor in many areas.



Source: Weston, 1990



Scale in Feet

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SITE DESCR

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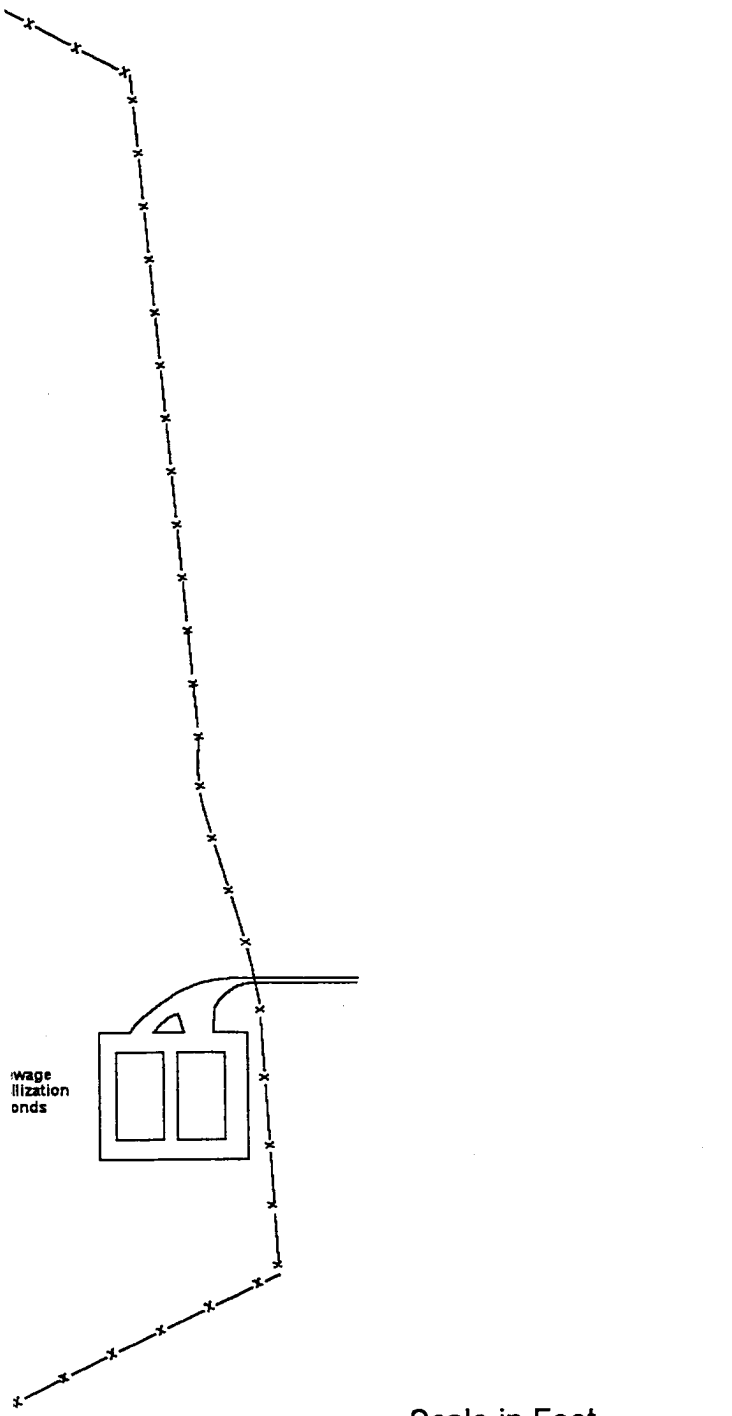

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SITE DESCRIPTION PLAN

PROJECT NO. 8802 | FIGURE 1-2

1.4.1.1 Entry Portal -- An entry hatch, which is approximately 5 ft in diameter, is located adjacent to the entry portal. The hatch is partially closed by a hydraulically operated trap door; the hydraulic arm has been disconnected. The hatch is approximately 20 ft deep and the entry way is blocked by two large concrete blocks which are stacked one on top of the other. The blocks measure 2 ft X 2 ft X 6 ft and weigh an estimated 3,600 lbs each. The top block has a rebar "handle" which may serve as a point of attachment for removal. There is no ladder in the hatch. The hatch leads to a stairway which accesses the main tunnel area. The stairway drops approximately 30 ft and wraps around the portal elevator. There is cable and debris within the portal.

1.4.1.2 Powerhouse -- The powerhouse provided electric power, heat, air conditioning, and water for the facility. This dome-shaped structure, with walls from 12 in to 30 in thick, is 120 ft in diameter at its base and 46 ft high. To strengthen the concrete structure, over 190 miles of pre-stressed wire was wrapped around its base.

Four large diesel generators, each capable of producing approximately 1,000 kilowatts of electric power, were located on the first level. The powerhouse had two large air conditioning units, each with a 250-ton capacity to provide the necessary air to cool the generators. Three supplemental ice banks were installed on the first floor as a backup for this equipment, with each bank holding 30,000 lbs of ice. The resulting cool air was used to reduce the temperature within the powerhouse and in the guidance equipment in the launch control center. Heat produced by the generators was used to provide hot water throughout the complex and to heat various facilities. Also included on this first level were the water filtration equipment, water and fuel pumps.

The water system facilities consisted of chlorinators, tanks, and pumps. Located beneath the powerhouse are two wells, each about 1,800 ft deep. These wells provided water for the entire complex.

Adjacent to the powerhouse were a number of storage tanks. These included two diesel fuel tanks, each with a capacity of 67,000 gal, for operating the generators, two water storage tanks with a total capacity of 60,000 gal, and one fuel tank holding 40,000 gal of RP-1 missile fuel. RP-1 is a kerosene-alcohol based propellant. There was also one 5,000 gal diesel fuel tank, called the "start tank," that provided the fuel to start the generators.

During salvage operations, both 67,000 gal diesel fuel tanks were removed. The other tanks are still in place, and the 5,000 gal diesel tank is open and contains a small amount of liquid. Product levels were not observed in the other tanks.

Three tanks associated with a water demineralization system were observed at the north end of the powerhouse during the site inspection. One of these tanks, which was approximately 300 gallons in capacity, was labeled "Sulfuric Acid". At the bottom of the tank there was a perforation with a crystalline substance, appearing to be sulfate. The other two tanks appeared to be in good condition. At the south end of the main level, generator and boiler parts lay strewn over the floor.

The tunnel leading to the powerhouse exhaust was on the south side of the mezzanine level. Exhaust pipes of many sizes from the generators and boilers pass through the tunnel. Most of the pipes were covered with friable white insulating materials. Chunks of insulation were lying on the floor and the entrance to the tunnel was covered with crushed insulation. Samples of this material were collected and analyzed during the RI/FS site visit. Laboratory results indicated that the insulation material contains 50 to 75 percent asbestos (see Appendix B).

A 5,000 gallon diesel fuel tank was located approximately 20 feet south of the powerhouse on the east side of the tunnel. There was an opening approximately 5 feet from the bottom of the tank. One to two inches of brownish liquid was visible in the bottom of the tank.

Further down the tunnel there was a large mound of soil at the former location of the 67,000 gallon fuel tanks. The tanks were removed and soil had come into the tunnel through the openings. South of the soil mound is the exhaust room. There was a loft in the room which contained several horizontally oriented pipes. Metal plate flooring was on the sides of the room and an uncovered pipe trench filled with pipe and water in the center of the room. There was a large fan in the wall at the end of the room.

1.4.1.3 Control Center -- The launch control center was the command center of the entire missile complex. It is a two level, dome-shaped structure, slightly smaller than the powerhouse. Its inside dimensions are 105 ft in diameter and 85 ft high. The lower level housed the living and working areas and was divided into ready rooms, dining hall and kitchen, and air conditioning and electrical equipment maintenance ready room. The top level contained various consoles, time display and status boards, and electronic and communications equipment. This equipment controlled and monitored the operations within the complex and was capable of giving an immediate visual status of the weapon system's state of readiness.

Associated with the control center, yet separated from the rest of the complex, are two antenna silos 27 ft in diameter and 71 ft high. The antenna silos are located approximately 500 ft south of the entry portal. The equipment in each silo was identical, with one used as backup for the other in the event one was destroyed or rendered inoperative.

During the site inspection, the floor of the tunnel leading from the portal elevator to the antenna silos was wet and contained yellow insulating material, which appeared to be fiberglass. Pipe elbows and bends appeared to contain asbestos. The antenna silos had about 3 inches of water above the grating floor and several feet of water under the grating.

1.4.1.4 Launch Areas -- The Titan installation was equipped with three identical launch areas. Each launch area contained a propellant terminal, equipment terminal, and missile silo.

The propellant terminal is a two-level, silo-type structure 47 ft high and 40 ft in diameter. Liquid nitrogen and helium were stored in this facility to provide the pressure to load the fuel and liquid oxygen (LOX) aboard the missiles. Also located within this terminal were the LOX and helium subcoolers and the LOX sump. The LOX subcooler was a large tank through which the liquid oxygen passed and was cooled by the colder liquid nitrogen prior to being loaded into the missiles. The subcooler cooled the helium prior to being pumped into the LOX tanks which pressurized the tanks to prevent the fuel from sloshing.

The first level of the propellant terminal contained the LOX sump pumps and a drainage facility for the liquid oxygen overflow. In addition, there were nine clusters of nitrogen and helium tanks that extended upwards into the second level and one 3,500gal tank that contained sulfuric acid. During the inspection the propellant terminals contained approximately 5 ft of water. The door to the Propellant Terminal in Complex 3 is locked, and the facility could not be inspected.

Adjacent to the propellant terminal was a 26,000 gal LOX storage tank. Reportedly, during the salvage operations, all LOX storage tanks and the other miscellaneous tanks found on the first floor of the three propellant terminals were removed.

Like the propellant terminal, the equipment terminal is a silo-shaped structure located next to the missile silo. This structure stored much of the equipment used to prepare and launch the missiles. It consists of four levels and is 62 ft high and 43 ft in diameter. The first level was called the powerpack room and contained the launcher logic racks, which provided automatic checkout of the launcher equipment, and the hydraulic equipment used to raise and lower the missile launch platform. The second level contained the air-conditioning unit which maintained proper temperature and humidity in the silo. The third level contained an electric power distribution system for the ground operating equipment, missile electrical system, ground hydraulic power unit, and the missile air-conditioning system. Also located on this third level were the fuel loading and unloading equipment. On the fourth level, the power produced by the four diesel generators in the powerhouse was stepped down from 2,400 volts to 480 volts. The electrical transformers were reportedly removed during the salvage operation.

The missile silo measures 163 ft from ground level to the base of the foundation and has an inside diameter of 40 ft. The foundation is 8 ft thick; the walls vary in thickness from 2 ft to 11 ft. On top of the missile silo are two 116-ton doors that were raised and lowered hydraulically.

The Fuel Terminal is located along the tunnel leading to the launch complexes, 75 feet north of the entrance tunnel. The room contained a 40,000gallon RP-1 fuel tank, and at the south end of the room, the tops of four high-pressure nitrogen tanks were visible. Only the end of each nitrogen tank and some connecting pipes were inside the room.

During the site visit for the preparation of the RI/FS work plans, it was noted that the launch complex structures contained varying amounts of water. The depth of water in the three silos ranges from 36 ft to 81 ft, and the lowest level in the equipment terminals in Complexes 2 and 3 was filled with water, while the lowest level in Complex 1 was empty.

The tunnel junction where the tunnel branches off to Launch Complex 1, had 1 to 2 feet of water on the floor. An escape hatch led to the surface from the room. At ground surface, the hatch was covered with dirt. There were pieces of metal, piping, hoses and other trash lying on the floor in the water. A metal beam, connected to the southern tunnel served as a bridge, but did not cross the room completely.

1.5 SI FIELD INVESTIGATION

The SI field investigation program includes the following:

- Drilling boreholes, soil sampling/analysis at two sewage treatment ponds, waste discharge locations, fuel tanks, and transformers
- Collection and analysis of shallow (upper 3 feet) soil samples in suspected areas
- Collection and analysis of standing water in the underground complex
- Collection and analysis of liquid samples (if any) from tanks in the underground complex
- Well installation and sampling/analysis of groundwater at the perimeter of the BANGF property
- Data evaluation and report preparation

Details of the SI field investigation are provided in the Sampling and Analysis Plan.

2.0 HEALTH AND SAFETY RESPONSIBILITIES

This section describes the health and safety designations and general responsibilities of task personnel who will implement this HSP during the SI at the BANGF. It is the responsibility of these individuals to ensure that all site personnel are aware of the hazards associated with the site and required tasks and that all project tasks are performed in a safe manner.

2.1 PROJECT MANAGER

The project manager (PM) for the SI task for the BANGF is responsible for the selection of qualified personnel, procurement of appropriate equipment and supplies, scheduling project activities, notifying USAEC Contracting Officer's Representative (COR) of project status, and disseminating information among all parties involved in the project. The PM has overall responsibility for the management of this project which includes ensuring that health and safety regulations and procedures are complied with by anyone working on or visiting the site.

2.2 HEALTH AND SAFETY OFFICER

The Health and Safety Officer (HSO) is responsible for managing and implementing the BANGF health and safety program. In addition, the HSO is responsible for ensuring that sufficient safety support and adequate review procedures are established so that site personnel work under reasonably safe conditions. Specific responsibilities of the HSO include the following:

- approving the individual chosen to serve as the Site Health and Safety Officer (SHSO) for this field operation;
- reviewing and approving the site-specific health and safety plan developed by the SHSO as well as any significant changes made to the site specific health and safety plan;
- overseeing the daily efforts of the SHSO and resolving site disputes involving health and safety issues; and
- overseeing the implementation of the site specific HSP by the SHSO.

2.3 SITE HEALTH AND SAFETY OFFICER

The SHSO is responsible for the development and implementation of this site health and safety plan, site specific training, air monitoring, site safety, inspection and use of health and safety equipment, decontamination, and emergency contingencies. The SHSO, in consultation with the HSO, is responsible for updating and modifying the HSP as site or

environmental conditions change. The SHSO is vested with the authority to stop site operations if he determines that an imminent health or safety hazard or other potentially dangerous situation exists. In addition, the SHSO, through the HSC, assures that all personnel entering the work areas are qualified for duty in accordance with 29 CFR 1910.120. The SHSO report all daily activities to the HSC and will inform the PM of all pertinent health and safety issues.

2.4 ON-SITE PERSONNEL

All personnel assigned on-site responsibilities shall be required to review this plan and acquire training as stipulated in Section 9.0 of this document. In addition, all onsite personnel must meet the medical fit-for-duty requirements stipulated in Section 8.0 of this plan.

3.0 HAZARD ASSESSMENT

Potential hazards that may be encountered during the BANGF SI field investigation will be of a chemical and physical nature. The hazards associated with entry into the BANGF were assessed during an inspection of the facility conducted on September 17 and 18, 1990, and from a review of available historical data by Stollar & Associates personnel (Stollar & Associates, et al., 1991). The air quality of the confined space was evaluated during the inspection.

The major potential chemical and safety hazards identified at this site that will be a concern during the SI include:

- inhalation of volatile organic compounds (VOCs) during soil boring, tank sampling, and while sampling standing water in the launch complex;
- eye and skin irritation from contact with residual acidic or caustic material;
- trips, slips, or falls during confined space work;
- dermal absorption or ingestion of polychlorinated biphenyls (PCBs) while soil sampling;
- inhalation of asbestos while sampling underground;
- encountering UXO during drilling activities;
- mechanical hazards associated with boring and drilling operations on the surface.

3.1 ATMOSPHERIC HAZARDS

During the BANGF SI, samples will be collected from various soil depths above the launch complex, from areas of standing water throughout the complex, and from tanks that still contain residual liquid. Atmospheric hazards will be unique for the two areas. Atmospheric hazards are a major concern in the underground complex due to the isolation of the environment. The facility has been partially sealed for several years, with minimal or no passive ventilation. Surface contaminants become a hazard when contaminated soil is disturbed and contaminants become airborne.

Because of the lack of ventilation and confined location of the complex, the oxygen concentration of the facility will be a concern. The oxygen concentration of the air in the facility was monitored continuously while personnel were underground during the previous inspection (Stollar & Associates, et al., 1991). The O_2 concentration was above 19.5 percent in all accessible areas of the complex which included the entire facility except Propellant Terminal No. 3. There was a door blocking entry into Propellant Terminal No. 3 which could not be opened by the entry team.

In addition to the potential for low oxygen concentrations, the possibility also exists for explosive gases or vapors to accumulate in confined areas. Sources of these vapors include the volatilization of fuels, accumulation of methane gas from organic decomposition (e.g., sewage, vegetation), and desorption of chemicals from the inner surface of tanks or cylinders. A combustible gas indicator was used during the previous inspection to identify the presence of flammable vapors; however, no combustible vapors were present in the facility. Again, all areas of the facility were evaluated except Propellant Terminal No. 3.

Toxic gases, vapors, and particulates are also potential hazards at this site due to the use of fuels, acids, asbestos, dielectric fluids, coolants, and water treatment chemicals while the facility was in operation. Specific materials identified in the PA included:

RP-I (Kerosene-Alcohol propellant)
Sodium Hypochlorite
Water Demineralizing Chemicals
Hydraulic Fluid
Ethylene Glycol
Compressed Oxygen
Compressed Helium
Sodium Hydroxide
Sulfuric Acid
Diesel Fuel
PCBs
Refrigerants
Asbestos
Compressed Nitrogen

Most of these chemicals have reportedly been removed.

Organic vapors were evaluated throughout the facility with a Foxboro organic vapor analyzer (OVA). This survey did not indicate the presence of organic vapors in the atmosphere. Exposed insulation was observed on piping throughout the facility. The straight runs of insulation appeared to be fiber glass while the elbows and bends appeared to be asbestos. Two bulk samples were collected, one from the powerhouse floor and the other from the tunnel leading to the powerhouse exhaust, and both showed 50 to 75 percent asbestos (see Appendix B). Further, area samples were collected to evaluate airborne asbestos concentrations in the entry portal, the powerhouse and the control center. The resulting fiber concentration in each of the areas is shown in Table 31.

Table 3-1 Airborne Asbestos Concentrations

Location	Air Volume (liters)	Air Concentration (fibers/cubic centimeter)
Portal Entry	751	0.0007
Powerhouse	723	0.0007
Control Center	472	0.01

The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for airborne asbestos is 0.2 fibers/cc as defined in 29 CFR 1910.1001. The preliminary assessment indicated that the PEL was not reached, however, none of the insulation was intentionally disturbed during the inspection resulting in negligible airborne concentrations. Disturbance of the insulation during the SI field investigation is expected to be minimal. Prior to entering the underground complex, field personnel will be briefed on the potential hazards within the structure including asbestos containing materials. Field personnel will be instructed to avoid contact with these materials whenever possible.

Another potential hazard is hydrogen sulfide. This hazardous gas can be generated by decaying organic matter which contains sulfur or by the reaction of sulfuric acid with iron. Monitoring was done to evaluate the hydrogen sulfide concentration in air throughout the facility and particularly around the out-of-service sulfuric acid tanks. This survey showed no indication of H_2S.

The launch facility was also surveyed for radiation during the initial site entry. Both a scintillometer and a Geiger-Mueller meter were used. Radiation levels did not exceed typical background levels.

Prior to entering the underground complex the atmospheric constituents will be evaluated using a combination oxygen, combustible gas, and hydrogen sulfide meter (trimeter) and an OVA, as described in Section 4.0. The trimeter and OVA will also be used continuously while personnel are in the underground structure to assure that proper levels of personal protective equipment (PPE) are being used.

At a minimum, full-face air-purifying respirators with combination HEPA, organic vapor, and acid gas cartridges will be worn by personnel entering the underground complex to protect them from potential atmospheric hazards. Respiratory protection and required chemical resistant clothing are discussed in Section 6.0.

3.2 ACTIVITY HAZARDS ANALYSIS

The SI field activities, identified in Section 1.5 and detailed in the Sampling and Analysis Plan, will include sampling of standing water and residual tank product within the underground complex, borehole drilling and soil sampling, and groundwater monitoring well installation and sampling. The potential hazards associated with each activity, and the control measures that will be used to minimize or eliminate them are discussed below.

3.2.1 Standing Water Sampling

Potential hazards involved with the collection of standing water samples within the underground complex include chemical toxicity hazards associated with skin contact with contaminated liquid, and safety hazards including unstable footing on unsecured grating, and slipping or falling on wet surfaces.

3.2.1.1 Toxicology and Explosive Hazards

Potential contaminants that may be present in the standing water include chlorinated solvents, asbestos, petroleum products, and metals. In addition, radioactive nuclides from rumoured disposal in the missile silos during the period in which the installation was abandoned may also be present. Low concentrations, if any, of these contaminants are expected to be encountered during the standing water sampling activities. Respiratory protection and appropriate chemical resistant clothing, as described in Section 6.0, will be used to reduce the risk of exposure.

The following is a brief description of the toxic effects of exposure to each material. Additional information is provided in Appendix C.

Chlorinated solvents are typically narcotics and mucous membrane irritants. They have been used as anesthetics. Symptoms of exposure include dizziness, drowsiness, light-headedness, nausea, vomiting, and headache. High concentrations can irritate the eyes and respiratory tract.

Inhalation and ingestion of asbestos fibers has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

Petroleum products and alcohols are mild narcotics and will irritate the eyes, nose, and throat. Symptoms of exposure include dizziness, drowsiness, headache, and nausea. Liquid petroleum is a defatting agent which causes drying and cracking of the skin after repeated or prolonged exposure. No chronic systemic effects have been reported from the widespread industrial use of these products, however, the presence of benzene substantially increases their toxicity. Benzene has a PEL of 10 ppm and is a suspected human carcinogen, therefore, exposures should be reduced to the lowest feasible limit. Acute exposure to benzene can cause dizziness, euphoria, giddiness, headache, weakness, and drowsiness. Repeated skin contact can cause redness, blistering, and dry, scaly dermatitis. Petroleum and alcohol products are also potentially explosive.

Acute toxic effects from metals results from the inhalation of air or the ingestion of liquids or solids containing very high concentrations of metals. Inhalation of high concentrations is irritating and may cause severe damage to the respiratory tract with bronchitis, chemical pneumonitis, and in sever cases, pulmonary edema. The symptoms associated with ingestion of excessive amounts of metals are those of food poisoning with nausea, vomiting, abdominal pains, and diarrhea.

Explosive hazards are not expected to be encountered during the standing water sampling activities.

3.2.1.2 Physical Hazards

The major physical hazards associated with the activities that will be performed in the underground complex include falls, poor footing, submersion under water, entrapment, and related structural concerns. Visual inspection of the facility identified numerous locations where equipment had been removed leaving an unprotected opening in the floor. Several of these areas are under water and are thus, not readily visible. The grating in the antenna area was submerged under approximately 3 inches of water, however, with adequate lighting, the holes are readily identifiable. The water level in the powerhouse was below the grating and thus, openings in this area were visible.

The area of greatest concern, in terms of a fall or slip hazard, is the sampling of water from the 3 silos. Varying levels of water remain in the silos. The depth to the water from the level of the access tunnels in Silos 1, 2, and 3 is 24, 63, and 36.5 ft, respectively, and the depth to the bottom of the silos from the sampling locations is 105, 99, and 104 ft, respectively. In addition, the areas from which samples will be obtained are not protected by railings nor secured in any way. Pipe racks, grating, and structural steel is available, however, in the area leading to the silos to which personnel will be secured while sampling.

The three equipment terminals associated with the missile silos have an opening located in the center of the floor on the three elevated floors (four floors total). These openings are approximately 2 ft by 2 ft and are not protected.

Insulation is scattered throughout the facility. Much of it is wet and thus unstable and could cause a fall.

Engineering controls will be established and enforced to minimize or eliminate the risk of personnel injuries resulting form slip trip and fall accidents. Fall protection and other engineering controls are discussed in Section 6.2.

Mechanical and electrical hazards are not a concern inside complex due to the lack of electrical and hydraulic power in the facility. Cable trays and wires are still present throughout the facility. These are especially evident in the tunnels. The trays are secured to the walls with adequate clearance between them and the opposing walls, therefore they do not represent a significant hazard.

3.2.2 Tank Sampling

Tanks which may contain residual liquid will be opened and sampled during the SI. These include two 30,000-gallon water tanks located between the powerhouse and control center, a 40,000-gallon RP-1 (kerosene-alcohol propellant) tank located at Tunnel Junction 12, a 5,000-gallon diesel tank located 20 ft south of the powerhouse on the east side of the tunnel leading to the powerhouse exhaust, a 500-gallon unlabeled tank located on the

upper level of the air filtration area, and three water demineralization tanks located in the north end of the powerhouse.

3.2.2.1 Toxicology and Explosive Hazards

Potential materials that may be encountered during the tank sampling activities include RP-1 propellant, diesel, sulfuric acid, and hydrogen sulfide. Level B PPE, including supplied air and appropriate chemical resistant clothing, will be required while opening and sampling tanks. The required PPE for this task is discussed in Section 6.0.

The following is a brief description of the toxic effects of exposure to each material. Additional information is provided in Appendix C.

Inhalation of RP-1 vapors may be narcotic or anesthetic. Ingestion of liquid will cause gastrointestinal distress, irritation, and possibly nausea. Liquid or vapors may be irritating to the skin and eyes. Chronic hazards include blood and possibly kidney effects. RP-1 contains naphthalene, which is a suspected carcinogen. Explosion hazards are reported to exist if RP-1 is stored in an area that may be subjected to fire.

The toxic effects of diesel are included in the discussion of petroleum products in Section 3.2.1.1. Under normal temperature and pressure, diesel is considered combustible, but not explosive.

Sulfuric acid is an eye, skin, and respiratory irritant. Splashes on or contact with the eye or skin will cause severe burns. Concentrated sulfuric acid destroys tissue due to its severe dehydrating action whereas dilute concentrations act as mild irritants. Extreme care will be taken while sampling in the area of the sulfuric acid tank. In addition to the hazards associated with the corrosivity of the compound, it may also generate hydrogen gas upon contact with metals. Hydrogen gas is explosive. The pH of standing liquid in the vicinity of the tank will be checked prior to sampling to further evaluate the concentration of the material. Sulfuric acid is incompatible with the sodium hydroxide used at the facility.

Hydrogen sulfide is a colorless gas with a strong odor of rotten eggs. Exposure to hydrogen sulfide typically deadens the sense of smell, therefore, odor should not be used as a warning property. Inhalation of low concentrations of H_2S may cause headache, dizziness, and upset stomach. High concentrations can cause loss of consciousness and death resulting from respiratory paralysis and asphyxia. Hydrogen sulfide is explosive between 4.3 percent and 46 percent by volume.

3.2.2.2 Physical Hazards

Physical hazards that will be encountered during the tank sampling activities will include the slip, trip, and fall hazards discussed in Section 3.2.1.2, as well as physical hazards associated with opening sealed tanks. The following sections describe the procedures that will be used for this task.

If possible, tank samples will be dispensed directly from the tank outlet. However, based on observations made during the RI/FS facility inspection (Stollar & Associates, et al., 1991), many of the tanks remaining in the complex will have to be sampled through inlet ports. If this is the case, the tanks will be accessed by carefully removing the bolts holding the inlet flanges to the tanks. Pressure valves will be used, if possible, as a precautionary measure to release pressure that may be present in the tank. The flanges will then be removed and samples collected.

The 5,000-gallon diesel fuel tank will be sampled through an opening located approximately 5 ft from the bottom of the tank, while the RP-1 propellant tank will be sampled through one of several 4-inch flanges that were observed during the facility inspection.

The two 30,000-gallon water tanks located between the powerhouse and control center are accessed by removing the 4-inch bolted flanges located on the top of each tank. The tanks appeared to be steel with a thin plastic coating and flanges approximately 7 ft off the floor. When sampling is conducted, a three-person team will be used to open, monitor, and sample these tanks. One person will collect samples, another will stabilize the ladder while the third person hands bottles and equipment to the designated sampler.

The tank in the air-filtration facility will be accessed by carefully disconnecting the line marked "UA" from the tank.

Two of the water demineralization tanks are vertical 500 gallon capacity tanks which appear to be intact. One was labeled "Acid" while the other was labeled "Danger". The third tank, which has a capacity of 300 gallons, was labeled "Sulfuric Acid" and appears to have leaked. Crystals (possibly crystalline sulfates) were visible below the tank. It was not determined whether any residual liquid was present in the sulfuric acid tank. These tanks will be accessed by carefully removing lines leading to the tanks and siphoning liquid from the inlet ports.

3.2.3 Borehole Drilling and Soil Sampling

In addition to the sampling to be performed at locations associated with known historic activities with a possible contaminating effect, the SI will include sampling at environmentally suspect areas identified and analyzed from aerial photographs taken between 1963 and 1975 by the Environmental Photographic Interpretation Center (EPIC). These areas include mounded material, pits, trenches, containers, tanks, and ground stains.

Potential hazards involved with the drilling and soil sampling activities include chemical toxicity hazards associated with skin contact and inhalation of contaminated soil; and physical hazards involving unexploded ordnance concerns, drill rig operations, and cold heat/cold stress.

3.2.3.1 Toxicology and Explosive Hazards

Potential contaminants that may be present in the soil include solvents, fuels, metals, and PCBs. Fuels used in the facility include RP-1, a kerosene-alcohol propellant, and diesel fuel. Low concentrations, if any, of these contaminants are expected to be encountered during the drilling and soil sampling activities. Field operations will be monitored for organic vapors, as stated in Section 4.0, to minimize exposure hazards. Initial personal protection will consist of Level D with chemical-resistant gloves to be used for soil sampling. If necessary, the level of protection will be upgraded to Level C, or the site will be evacuated, based on the results of field monitoring.

The toxic effects of exposure to diesel, chlorinated solvents, and metals were discussed in Section 3.2.1.1, while the toxic effects of exposure to RP-1 were discussed in Section 3.2.2.1. PCBs are suspected human carcinogens and have two distinct actions on the body: a skin effect and a toxic action on the liver. Symptoms of severe exposure include acne, nausea, vomiting, jaundice, edema, and abdominal pain.

3.2.3.2 Physical Hazards

Unexploded Ordnance

The area surrounding the former Titan Missile Site 1, Complex 2A located on the Bennett facility was cleared by a 1961 unexploded ordnance (UXO) survey (see Section 1.3, and Appendix A) conducted by military explosive ordnance disposal units. The portion of the BANGF excluded from this investigation included the fenced complex alone. The Titan Missile Complex 2A was not included in this survey presumably because it was not deemed necessary. The missile facility was fully operational at the time of the survey and it would be logical to assume that all UXO would have been cleared from the site during the construction of the facility considering the magnitude of the excavation for the underground complex. A map of the old Lowry Bombing Range shows that the closest target area at the BANGF was approximately 1 mile to the northwest, consequently the site was not in a high impact zone. Based on this information, additional ordnance clearing activities are not recommended for the area in the immediate vicinity of the underground complex. However, several borings will be drilled beyond the estimated limits of the former missile complex excavations during the SI fieldwork. Geophysical investigations will be conducted at these locations to reduce the risk of encountering UXO during drilling activities.

A visual surface clearance of a 15-foot wide lane to each boring location will be conducted to allow safe access for the drill rig. In addition, an area 50 feet in diameter will be cleared at each boring location to accommodate maneuvering of the drill rig. The cleared area will be marked using wooden stakes, engineering tape, and pin flags. All activities associated with drilling each boring will be conducted within the marked area.

Borings that will be drilled to depths greater than 3 feet bgs will be cleared to a depth of 2 feet using a Schonstedt magnetometer. The boring will be drilled to a depth of 2 feet, the augers will be removed from the hole, and the drill rig will be moved away to a distance of approximately 20 feet to avoid interference with the location equipment. The magnetometer will then be used to clear the location to a depth of 4 feet. The drill rig will be pulled back over the hole and will drill to a depth of 4 feet. Once the 4-foot level is reached, the process will be repeated every 4 feet using Schonstedt MG-220 down hole gradiometer to the desired drill depth or to a depth of 28 feet, whichever is less.

A surface check will be performed at the locations of borings that will be drilled to depths of 3 feet bgs. These locations will be cleared using a Schonstedt magnetometer.

The rationale for the 2-/4-foot magnetometer check is based on the type of ordnance reportedly fired/dropped in the area and the capabilities of the location equipment. Available records indicate that the former Lowry Bombing Range was used for air-to-ground gunnery and precision bombing practice. Aircraft rounds will normally not penetrate more than 2 feet, while bombs will normally not penetrate beyond 25 feet. The nearest target area (Target T5), located 1 mile distant from BANGF, was used from 1940 to 1945 for bombing practice with 100 to 500 pound bombs (Weston, 1990).

If a metallic object is encountered during drilling, the hole will be immediately abandoned. A new boring will be initiated a safe distance away from the first location.

Drill Rig Operations

The following safety provisions will be adhered to by the drill rig operator:

- Before raising the drill rig mast in the vicinity of electrical power lines, the operator must walk completely around the drill rig to determine the distance of the rig to the nearest power line when the mast is raised (this distance must be equal to or greater than 20 feet). Any questions regarding the appropriateness of a drilling location should be brought to the attention of the Site Safety Officer.

- Before drilling, the location must be adequately cleaned and leveled to accommodate the drill rig.

- Suitable storage for all tools, materials, and supplies will be provided. Pipe, drill rods, casings, augers, and similar drilling tools will be arranged to prevent rolling, spreading, or sliding by using chocks.

- Work areas and drilling platforms will be kept free of materials, obstructions, and substances that could cause the surface to become slick or otherwise hazardous.

- After stabilizing and leveling the drill rig, all unnecessary personnel will be cleared from the area immediately to the rear and the sides of the drill mast prior to its raising.

- When utilized, augers will be used in accordance with manufacturers recommended methods of securing the auger to the power coupling. Additionally, the operator and tool handler will be responsible for establishing safe procedures for drilling, auger connection and disconnection, and auger fork insertion and removal.

- Augers will only be cleaned by hand when the drill rig is in neutral and the auger has ceased to rotate.

- Unattended boreholes will be properly covered or otherwise protected.

Heat Stress

The stress of working in a hot environment can cause a variety of serious health conditions including heat exhaustion or heat stroke; the latter can be fatal. Personal protective equipment (EPA Level C protection) can significantly increase heat stress. To reduce or prevent heat stress, frequent rest periods and controlled beverage consumption to replace body fluids and salts may be required.

Additionally, quantitative physiological monitoring for heat stress may be conducted. Physiological monitoring for heat stress includes heart rate as a primary indicator and oral temperature as a secondary indicator. The frequency of monitoring depends on the ambient temperature and the level of protection used on-site. To determine the initial monitoring frequency, after a work period of moderate exertion, use the following information:

Adjusted Temperature*	**Level D**	**Level C**
90 F or above	after 45 minutes	after 15 minutes
87.5 to 90 F	after 60 minutes	after 30 minutes
82.5 to 87.5 F	after 90 minutes	after 60 minutes
77.5 to 82.5 F	after 120 minutes	after 90 minutes
72.5 to 77.5 F	after 150 minutes	after 120 minutes

* Adjusted air temperature (F) = observed temp + (13 x percent sunshine).

Air temperature is measured with a bulb shielded from radiant heat; percent sunshine is the time sun is not covered by clouds thick enough to produce a shadow (100 percent = no cloud cover and a sharp, distinct shadow; 0 percent = no shadows) (The Industrial Environment, its Evaluation and Control; U.S. Department of Health and Human Services, 1973).

The following procedures and action levels are to be used for the physiological monitoring of heat stress:

Heat rate: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle one-third and keep the rest period the same. If the heart rate exceeds the 110 beats per minute at the next rest period, shorten the following work cycle by another one-third and also monitor oral temperature.

Oral Temperature: Use a clinical thermometer (3 minutes under the tongue) to measure the oral temperature at the end of the work period (before drinking). If the oral temperature exceeds 99.6 F, shorten the next work cycle by one-third without changing the rest period. If the oral temperature exceeds 99.6 F at the beginning of the next rest period, shorten the following work cycle by one-third. DO NOT allow a field team member to wear EPA Level C protection when the oral temperature exceeds 100.6 F.

Personnel will be trained to recognize the symptoms of heat stress and the appropriate action to take upon recognition. Even though physiological monitoring is not always necessary, it is essential that personnel understand the significance of heat stress and its proper treatment.

Some of the symptoms that indicate heat exhaustion are:

- Clammy skin
- Lightheadedness
- Slurred speech
- Rapid pulse
- Weakness, fatigue
- Confusion
- Fainting
- Nausea (vomiting)

If these conditions are noted, the following steps should be performed:

- Remove the victim to a cool and uncontaminated area.
- Remove protective clothing.
- Give water to drink, if conscious.

Symptoms that indicate heat stroke include:

- Hot skin, temperature rise (yet may feel chilled)
- Incoherent, delirious
- Mental confusion

- Convulsions
- Unconsciousness

If heat stroke conditions are noted, immediately perform the following steps:

- Remove victim to a cool, uncontaminated area.
- Cool the victim, whole body, with water, compresses, and/or rapid fanning.
- Give water to drink, if conscious.
- Transport the victim to the designated medical facility for further cooling and monitoring of body functions. HEAT STROKE IS A MEDICAL EMERGENCY!

Cold Stress

Cold weather injuries may either be local or systemic. Local cold weather injuries include chilblains (chronic injury of the skin and peripheral capillary circulation) and frostbite. Frostbite occurs in three progressive stages: frostnip, superficial frostbite and deep frostbite.

Systemic cold injuries, due to hypothermia, are those that affect the entire body system. Hypothermia is caused by exposure to cold and is aggravated by moisture, cold winds, fatigue, hunger and inadequate clothing or shelter. Precautionary measures that will be taken at the project include:

Providing field shelters or wind screens;

- Monitoring temperature and wind speed to determine appropriate cold stress personal safety measures
- Adjusting work schedule based on weather conditions and temperature;
- Providing insulated clothing for field workers; and,
- Adhering strictly to the buddy system so that workers can assess cold stress symptoms in their co-workers.

3.2.4 Groundwater Monitoring Well Installation and Sampling

Groundwater monitoring well installation and sampling poses similar potential hazards and control problems as exist with borehole drilling and soil sampling (see Section 3.2.3). Additionally, there is a splash hazard while developing and sampling the wells.

3.5 HAZARD ASSESSMENT CONCLUSIONS

The primary hazards associated with the SI are safety concerns related to movement and accessibility within the underground complex. Fall protection is critical when working near the silos. Poor lighting and unstable footing are also important concerns. Safety belts will be worn at all times when working near the silos. Additional lighting will be used to increase visibility.

Based on preliminary monitoring, minimal chemical hazards are present underground; however, entering the underground complex will be conducted in accordance with the confined space entry procedures specified in Appendix D. The highest potential for exposure will be during the initial opening of sealed tanks. Level B will be worn while opening these tanks, and the breathing zone will be monitored using an OVA and trimeter.

4.0 AIR MONITORING

The objective of the air monitoring efforts is to assess potential chemical exposures of workers prior to and during underground entry, materials sampling, and drilling. A secondary benefit of air monitoring is the screening of soil and bulk materials for contamination which may warrant detailed laboratory analysis. The results of air monitoring shall serve to direct:

- changes in the selection and use of personal protective equipment;
- control of explosive atmospheres;
- requirements for decontamination; and
- requirements for emergency contingencies.

The SHSO shall be responsible for the calibration, maintenance, and use of air monitoring instrumentation; the HSO will interpret the data acquired.

4.1 INSTRUMENTATION

Instrumentation is recommended for the detection and quantification of oxygen, combustible gases, hydrogen sulfide, and total organic vapors.

A combination oxygen, combustible gas, and hydrogen sulfide meter (trimeter) with a pump and remote sampling line will be used for the monitoring of those atmospheric constituents. Sufficient lag time will be allowed for the purging of the sample line per the manufacturer's specifications (i.e., a 50 ft line will increase the response time on a given instrument to 30 seconds).

An OVA is required for real time general organic vapor monitoring. The type of meter may consist of a flame ionization detector (FID), a photoionization meter (PID), or an infrared spectrophotometer.

Other instruments which may be necessary for identification of suspected air contaminants are gas detection colormetric tubes and pumps, and radiation survey meters. NIOSH sampling techniques may be warranted if long term exposures to such contaminants as airborne asbestos fibers, acid gases, or specific organic vapors appear to be a possibility on the basis of field observations.

4.2 CALIBRATION OF INSTRUMENTS

Each instrument used on the project is to be calibration checked on a daily basis. The calibration gas recommended by the instrument manufacturer shall be used. A record of calibration shall be maintained by the health and safety officer.

4.3 INTERPRETATION OF DATA

The HSO is responsible for the interpretation of the data derived from the air monitoring program.

Table 4-1 lists the basic action levels associated with the air monitoring program. These actions are provided as baseline parameters which may be adjusted as additional information is obtained from sample analysis and/or field screening techniques.

4.4 INSTRUMENT MAINTENANCE

The air monitoring instruments are subject to impact and submersion during field use. Therefore, the cleaning, decontamination, and maintenance of these instruments is critical. The manufacturers' maintenance protocols shall be observed during the use of such instruments. All adjustments or repairs are to be documented by the SHSO. Only parts from the original manufacturer may be used for replacement of damaged components.

4.5 FREQUENCY AND TECHNIQUE OF MONITORING

Air monitoring with the trimeter shall be conducted remotely prior to the entry of lower level work areas of the missile complex. The end of the extension line shall be dropped to the bottom of the entry areas and retracted and read at each 6ft interval in order to monitor for gases with varying densities. It shall also be used continuously during all underground activities. The OVA shall be used during all drilling and sampling activities, at the source of potential emissions (i.e., bore holes, tanks, etc.). Breathing zone monitoring will be performed if readings above background occur at the potential emission sources. The OVA shall also be used to survey all of the accessible general areas underground. Personnel samples shall be collected using constant flow pumps and NIOSH recommended media at the discretion of the SHSO.

Table 4-1 Air Monitoring Action Levels (breathing zone)

Contaminant	Sampling Method	PEL[1)]	Level C Action Level	Level B Action Level	Other
Asbestos	NIOSH Methodology	0.2 Fibers/cc	0.1 Fibers/cc[2)]	20 Fibers/cc	1 Fiber is the 30 min. Excursion Limit
Chlorine	Colormetric Tube	0.5 ppm	0.5 ppm	5 ppm	------
Organic Vapors	OVA	Variable	5 Units[2)]	50 Units[2)]	------
H_2S	H_2S Meter	10 ppm	NA	10 ppm	------
Oxygen	Oxygen Meter	NA	NA	< 19.5%	------
Combustible Gas	Combustible Gas Meter	NA	NA	NA	Ventilate or withdraw if levels exceed 10% LEL[3)]
Beta/Gamma Radiation	GM Meter	NA	Above Background	NA	Withdraw if levels exceed 0.5 mr/hr[4)]

[1)] PEL - OSHA Permissible Exposure Levels.
[2)] Pending identification of product.
[3)] LEL - Lower Explosive Limit.
[4)] mr/hr - milliroentgens per hour.

5.0 SITE CONTROL

5.1 WORK ZONES

The BANGF shall be treated as a restricted zone during all SI operations. Members of the general public shall be denied access into the area. The underground complex shall be designated as an exclusion zone. Areas surrounding drill rigs and tank sampling operations shall also be designated as exclusion zones. Such areas will be delineated with barricade tape or cones. Only trained, medically approved personnel equipped with the required level of protective equipment shall be allowed into the entry portal or in the immediate area of sampling. A central decontamination site shall be established for surface sampling operations and a decontamination area shall be established outside the entry portal for those exiting the underground facility.

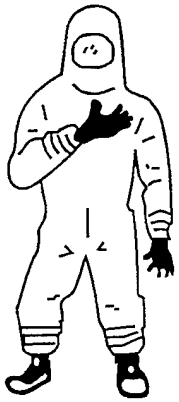
5.2 COMMUNICATIONS

Two-way radios shall be used by sample crews to maintain contact among the other crews and with the standby person(s). The system shall consist of line-of-sight use of Motorola radios by stationing individuals at major underground junctions. The locations of relay stations will be determined as the entry progresses. However, a minimum of two relay stations is anticipated. Non-verbal communication shall be established and used as necessary (Figure 5-1).

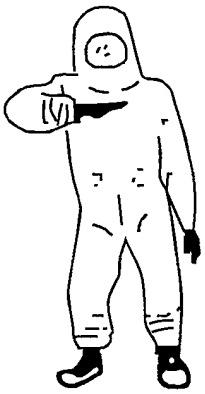
5.3 BUDDY SYSTEM

Worksite personnel must work in groups of two or more. Underground crew members must maintain visual contact with each other. The standby team will consist of two individuals equipped with level B equipment.

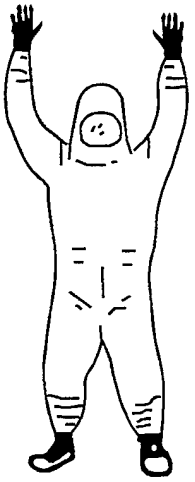
PERSONNEL PROBLEMS



LOW AIR

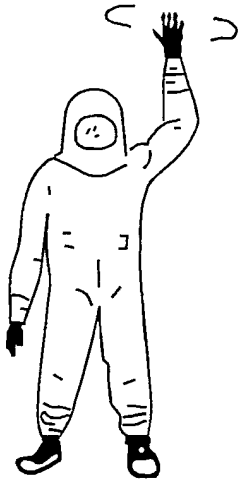


OUT OF AIR

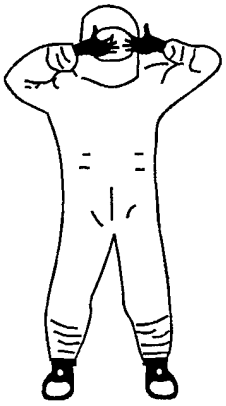


NEED ASSISTANCE

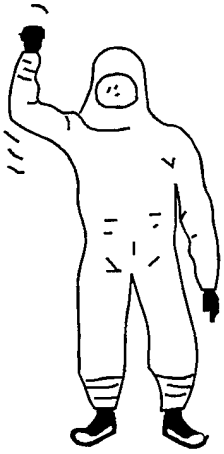
INCIDENT PROBLEMS



NEED HELP
FOR REPAIRS



CANNOT SEE



EVACUATE

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HAND SIGNALS

PROJECT NO. 8802 | FIGURE 5-1

6.0 ENGINEERING CONTROLS AND PPE

6.1 PERSONAL PROTECTIVE EQUIPMENT

The criteria used to determine appropriate levels of protective equipment include the work being performed, potential chemical and mechanical hazards at the site, availability of monitoring data, effectiveness of engineering controls, and applicable regulations.

6.1.1 Underground

All sampling underground will involve the collection of liquid samples. Saranex will be utilized by all underground personnel because of its liquid resistant properties. Latex inner gloves will be worn under outer protective gloves when sampling and will be securely taped to the Saranex coveralls with duct tape. Butyl rubber gloves will be used for sampling the water demineralization tanks because of the unknown sulfuric acid concentrations of the residual liquid and nitrile rubber gloves which are more resistant to petroleum products, alcohols, caustics, and refrigerants will be used for all of the other underground sampling tasks. Leather gloves can be worn over the chemical resistant gloves to aid in climbing, moving equipment, etc.; however, they will be removed while sampling. Disposable outer boots will be worn over steel-toed rubber inner boots and will be securely taped to the Saranex coveralls with duct tape. To further ensure the safety of all personnel, hard hats, MSHA approved cap lights, and miners belts with safety D rings will be worn by anyone entering the launch complex.

If monitoring indicates that hazardous conditions do not exist (see Section 4.0), respiratory protection can be down-graded to Level C, full-face air-purifying respirators with combination HEPA, organic vapor, and acid gas cartridges. Cartridges will be changed daily and will be changed more frequently if odor is detected inside the cartridge or breathing becomes difficult as a result of particulate accumulation on the filters. Self-contained breathing apparatus (SCBA) will be worn when any sealed tank or container is initially opened.

6.1.2 Above Ground Sampling

Above ground sampling will include both liquid and soil samples. Tyvek will be worn for all above ground soil sampling and Saranex will be worn for water or liquid sampling. Latex inner gloves will be worn under nitrile outer gloves which will be used in all areas except the PCB contaminated area.

For potential contact with PCBs, butyl rubber gloves will be used. All site personnel will also wear steel-toed rubber boots.

Table 6-1 PPE Requirements for Site Tasks

Activity	Personal Protection Level
Opening sealed tanks	B (nitrile gloves)
Opening and sampling water demineralization tanks	B (butyl rubber gloves)
Sampling standing liquid	C (nitrile gloves)
PCB sampling	C (butyl rubber gloves)
All other above ground sampling	D (nitrile gloves)

6.2 ENGINEERING CONTROLS

Engineering controls will be used to ensure that site personnel are adequately protected. Necessary equipment that will be utilized on this site include:

- a crane or backhoe:
- a 20-ft ladder;
- a retractable lifeline and fall protector;
- safety lines; and
- battery operated, explosion-proof portable cap lamps.

An angle iron will be welded to the portal door prior to the initiation of any work inside the launch complex. It will have a hole drilled through it that is large enough to feed a chain through. A backhoe or crane will be utilized to open the portal door and will remain on site to secure the door in the open position. The silo will not be entered until the door has been secured. The concrete blocks obstructing the silo entrance will be removed with a crane. The blocks will be put back into the portal following the completion of underground sampling. The portal door will be closed at the end of each day.

A retractable lifeline and fall protector will be utilized when the health and safety officer enters the portal. The lifeline will remain in the lowered position while anyone is underground. The retrieval system will be monitored by surface personnel at all times in the event that a rescue is required. The ladder will also remain in the portal until all personnel have exited the facility at the end of each day.

Personnel sampling the silos will be attached to a safety line that is only long enough for them to get within one foot of the silo. Samples will be obtained from that location. A safety line will be attached to mine belts with safety rings and to a secure structural feature of the facility (e.g., a pipe rack, pipe, tank, etc.).

Some manways underground are missing sections of decking or catwalks as a result of the salvage operation. A suspended safety line will be erected across the missing sections of decking and catwalks to provide a hand support for personnel requiring to pass over these areas.

Battery operated portable cap lamps will be used to provide lighting for the crews underground. These lamps, designed for use in mines, are explosion-proof and provide a backup light source.

7.0 DECONTAMINATION

All personnel and/or equipment exiting exclusion zones will be subject to decontamination. Personnel decontamination will take place as close to the entry portal as safely feasible. Individuals shall observe standard EPA protocol for the sequential removal of PPE as reflected in Figure 7-1. All disposable PPE will be monitored for visible contamination and organic residue with a FID or PID instrument. Non-contaminated PPE will be bagged and disposed of as nonhazardous trash. Contaminated PPE will be bagged, drummed and disposed of in a permitted facility. PPE that comes into contact with the standing water in the underground complex will be considered contaminated with asbestos and will be disposed in accordance with all applicable state and federal requirements.

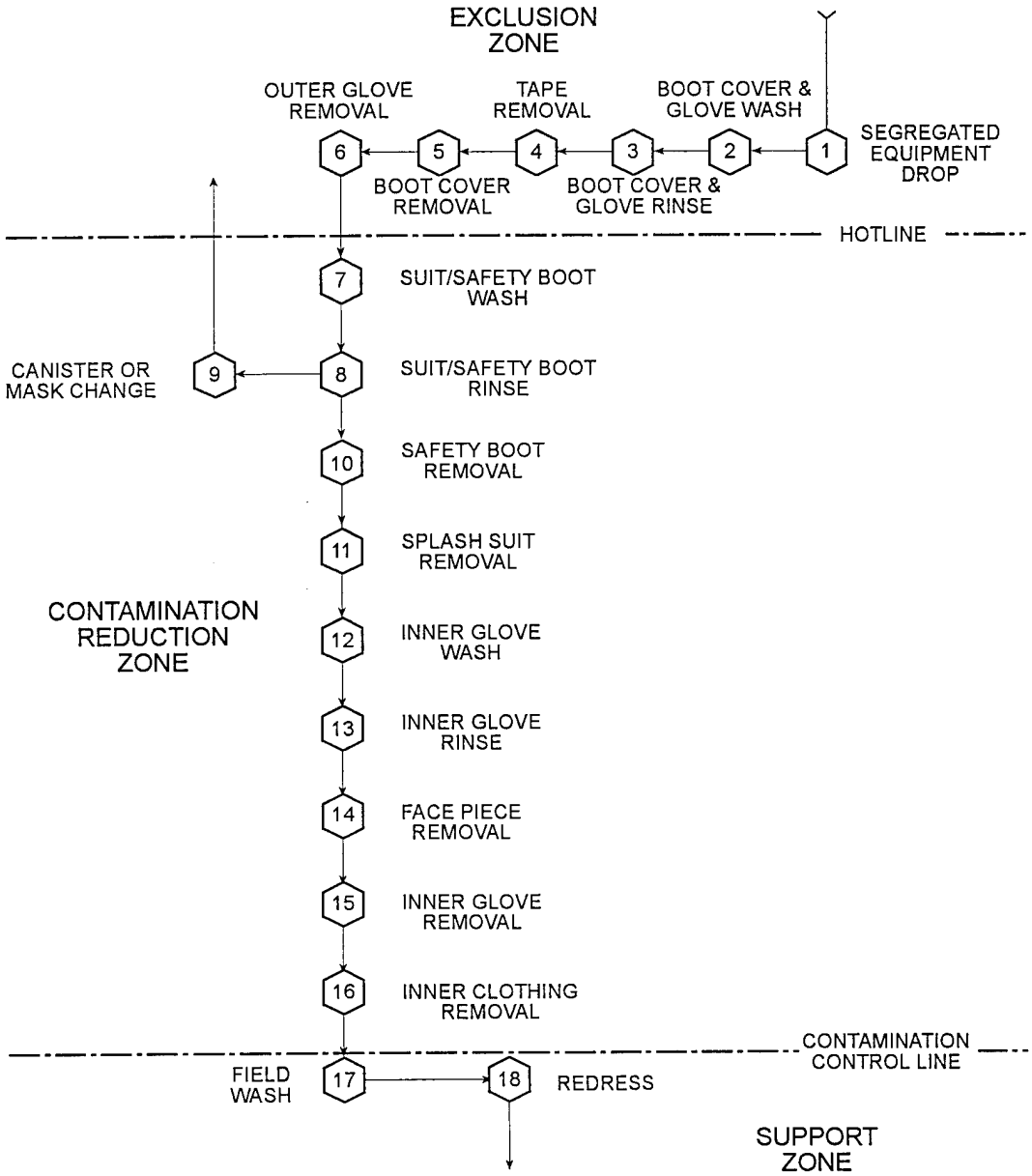
7.1 SMALL EQUIPMENT DECONTAMINATION

Small equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit.

Contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe. The units can then be wiped off with damp disposable wipes and dried. The units will be checked, standardized, and recharged as necessary for the next day's operation. They will then be prepared with new protective coverings.

7.2 HEAVY EQUIPMENT DECONTAMINATION

Downhole equipment of the drilling rigs will be cleaned at the work area or central staging area with high-pressure steam. Loose material will be removed by brush. The person performing this activity will be at least at the level of protection utilized during the personnel and monitoring equipment decontamination.



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DECONTAMINATION LAYOUT, LEVEL C PROTECTION

PROJECT NO. 8802 | FIGURE 7-1

8.0 MEDICAL SURVEILLANCE

The medical surveillance requirements of OSHA 29 CFR 1910.120 (f) provide the framework for a medical monitoring program for workers involved in hazardous waste operations. The standard includes provisions for baseline, periodic, and termination medical examinations to monitor for potential exposures to hazardous materials. All personnel entering potentially contaminated areas of this site (underground and surface sampling activities) must be medically qualified for the site assignment through a medical surveillance program. All site personnel performing tasks which require the use of respirators must provide written authorization from a qualified physician that they are medically fit-for-duty and are qualified to wear a respirator. Personnel who do not have a current (within the last year) medical clearance will not be permitted to work in the investigation areas.

9.0 TRAINING

All personnel working in investigation areas must complete the training required by 29 CFR 1910.120. This training includes 40 hours of initial hazardous waste operations training, three days of on-the job training, an 8 hour annual refresher training course, and, if acting in an on-site supervisory capacity, 8 hours of supervisory health and safety training. Personnel without documentation of the required training will not be permitted to enter the work areas. Certificates of training will be provided to the SHSO for each person working in the investigation areas. Of the support personnel on the surface, one shall serve as a safety technician with responsibility for the safety support equipment and shall be certified in first aid and CPR.

Each individual involved in on-site work is responsible for knowing the contents of this plan and conducting themselves in accordance with the procedures described. All field personnel shall participate in site orientation dealing with the contents of this plan, the selected PPE, non-verbal communications, decontamination techniques and requirements, and emergency contingencies. The training shall be conducted by the SHSO.

10.0 EMERGENCY CONTINGENCIES

The standby personnel are responsible for assisting in the extrication of injured personnel, the application of first aid, and for requesting assistance should the need arise. The Arapahoe County Sheriffs office shall be informed of the scheduled activities prior to commencement of the entry. In the event of an incident the sheriffs office shall be contacted for coordination of rescue support and/or medical transportation. Should an injury occur necessitating immediate transport of a worker to a medical facility, the injured party shall be taken to the AMI Aurora Presbyterian Hospital located at Sixth Avenue & I-225.

To reach Aurora Presbyterian Hospital from BANGF, take County Road 129 north 10 miles and curve east for one mile, paralleling I-70 east, then cross I-70 and enter I-70 going west to Denver. Proceed 23 miles to Exit 282 and take I-225 south. Proceed south on I-225 to 6th Avenue and go west on 6th Avenue to Potomac. Turn right onto Potomac and the emergency room to Aurora Presbyterian Hospital will be posted nearby (Figure 10-1).

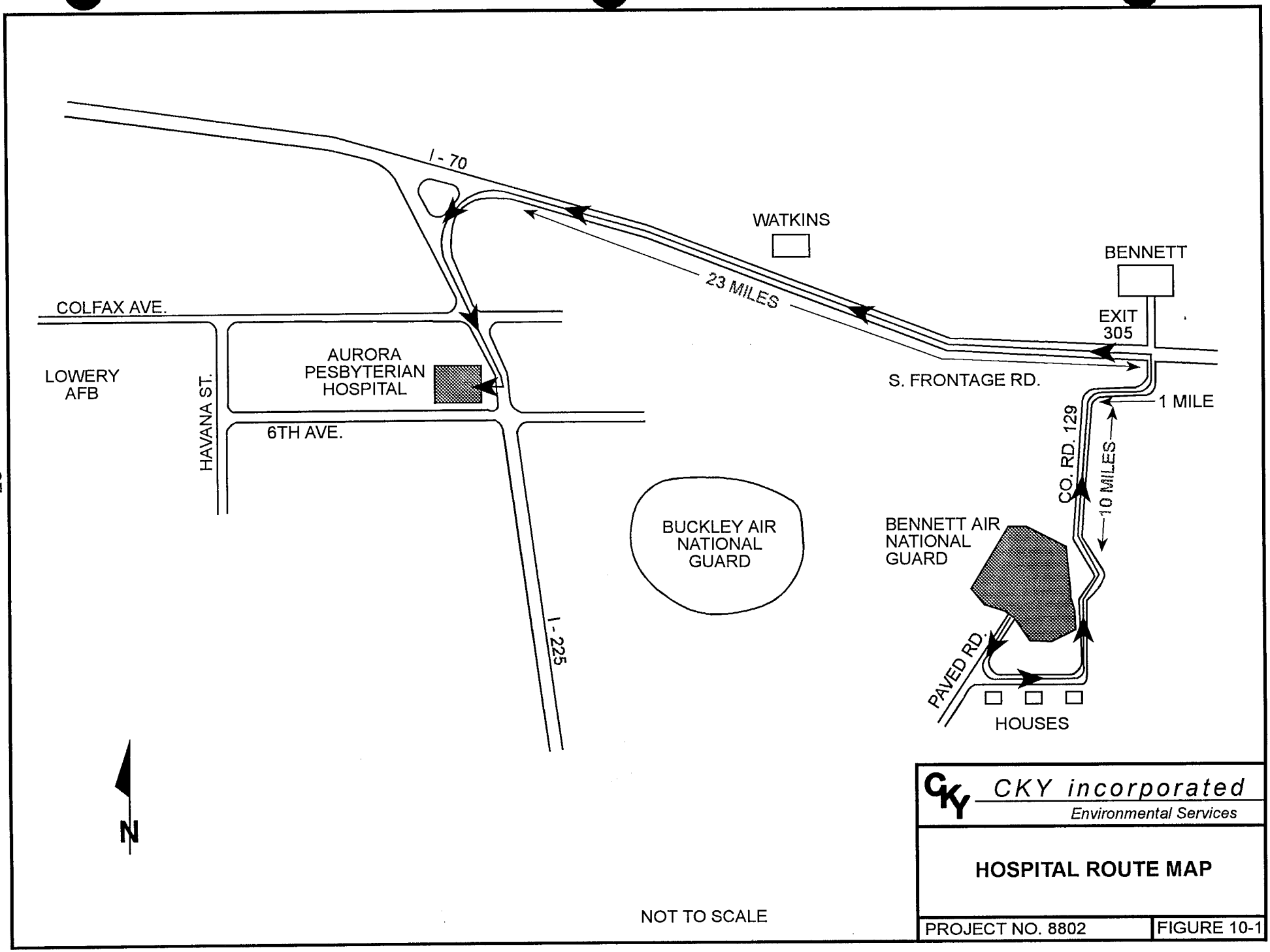
A portable telephone shall be on-site to contact emergency personnel. Several farmhouses within one mile of BANGF may serve as a source for emergency phone use, should the portable phone system fail.

A retractable lifeline and fall protection system shall be on-site for fall protection and rescue efforts. When applicable this system shall be secured to an acceptable anchor for support. The workers shall be attached to this system by a harness whenever a work task shows a potential risk of a fall.

Emergency Phone Numbers:

Emergency	911
Arapahoe County Sheriff	795-4711
Aurora Fire Department	366-1556
Bennett Fire Department	644-3555
Colorado Army National Guard	397-3239
USAEC Project Manager	(410) 671-1614/3261
CKY Project Manager	(310) 792-3728

Accidents resulting in a fatality, lost-time injury or illness, hospitalization of three or more personnel, or property damage to government or contractor property equal to or exceeding $2,000 will be reported by telephone to the CKY Project Manager, (310) 792-3728 and to USAEC, (410) 671-1614, as soon as possible, but not later than 2 hours after occurrence. The accident will be reported in writing within 5 days of occurrence on DA Form 285 (Appendix E). In addition, the Department of Labor (DOL) will be notified of any such accident within 8 hours of occurrence, as required by OSHA (59 FR 15594). All other accidents/incidents will be reported by telephone to CKY and USAEC, within 8 hours of occurrence, sooner if conditions permit.



CKY incorporated
Environmental Services

HOSPITAL ROUTE MAP

PROJECT NO. 8802 | FIGURE 10-1

11.0 REFERENCES

Stollar, R.L., & Associates, Inc. et al., 1991. Draft-Final Health and Safety Plan for Bennett Army National Guard Facility Remedial Investigation and Feasibility Study. Contract No. DAAA-15-90-D-0018, Task Order 0001.

Weston, Roy F., 1990. Enhanced Preliminary Assessment Bennett Army National Guard Facility, Denver, Colorado.

APPENDIX A

CERTIFICATES OF CLEARANCE
LOWRY BOMBING RANGE

CERTIFICATE OF CLEARANCE

All lands within the Lowry Bombing Range, located approximately 21 miles southeast of Lowry Air Force Base, Colorado, described as follows; All of sections 12, 13 and 24, T.5S, R.65W; 6th principan (sic) meridian. All of the above land located in Arapahoe County, Colorado; Department of Interior land, 1920 acres. Above land description was obtained from and prepared by Air Installation Engineers, Real Estate Division, Lowry Air Force Base, Colorado.

All of the above described land has been given a careful visual search and has been cleared of all dangerous and/or explosive materials reasonably possible to detect. There are no restrictions on the future use of all land in section 24. It is recommended that all land in sections 12 and 13 be restricted to surface use only. It is possible that subsurface ordnance remains undetected in sections 12 and 13 due to prior usage as impact area and heavy growth of vegetation. All present and/or future owners and/or inhabitants of these lands are hereby advised that if at any time an item identified or suspicious of being military ordnance is located, the nearest government or civil authorities should be notified immediately.

Date of this clearance was 21 October 1959.

/s/ Gayle K. Braesicke
GAYLE K. BRAESICKE
1st Lt. USAF

COPY

May 1963" (Decontaminated - Oct. 1959) and (Decontaminated - May 1963) filed in Vol. 2, Lowry AFB, AF Facility S-7, C2-3-9551

SECTION I

CERTIFICATE OF CLEARANCE

UNRESTRICTED FOR ANY FUTURE USE

6 June 1963

All lands (approximately 54,466.16 acres more or less) within Lowry Missile Site Nr. 1, located approximately 14 miles Southeast of Lowry Air Force Base, Colorado, Townships 4 and 5 South, Ranges 63, 64 and 65 West of the 6th Principal Meridian and described as follows have been thoroughly searched and are cleared of all explosive ordnance and ordnance residue reasonably possible to detect:

"A tract of land lying within the military reservation of Lowry AFB Bombing Range (currently known as Lowry Missile Site Nr. 1), being all of Sections 31, 32, 33, 34, 35 and 36 of Township 4 South, Range 65 West; all of Sections 1, 2, 3, 4, and Section 5 less Complex 1-A, Section 6, Section 8 less Ammunition Storage Area, Sections 9, 10, 11, 12, 13, 14, 15, 16, and Section 17 less Demolition Area, East ½ of Section 20, Sections 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35 and 36 of Township 5 South, Range 65 West; all of Sections 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 and Sections 25 and 36 less Complex 1-C of Township 4 South, Range 64 West; all of Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36 and Section 20 less Complex 1-B of Township 5 South, Range 64 West; all of Section 31 of Township 4 South, Range 63 West; all of Sections 6, 7, 17, 18, 19, 20, 30, 31, West half of Sections 5 and 8, and Section 29 less Complex 2-A of Township 5 South, Range 63 West of the 6th Principal Meridian, Arapahoe County, Colorado. As official plot by the Bureau of Land Management and filed and recorded at the Arapahoe County Seat, Littleton, Colorado." (Description was obtained from Real Property Officer, Civil Engineering Division, Lowry AFB, Colorado.)

Attached map (LF 7-21) reflects the areas decontaminated.

There are no restrictions on the future use of all the above described lands.

Because of surface distortion caused by previous use of the lands, all present and/or future users, owners and/or inhabitants of these lands are hereby advised that if, at any time, an item identified or suspected of being military ordnance is located, the nearest government or civil authority should be contacted.

Date of clearance was 24 May 1963.

Durward G. Price

DURWARD G. PRICE
Captain, USAF
Range Clearance Project Officer

1 Atch
Map a/s

SECTION II

REPORT OF CLEARANCE

6 June 1963

1. References and Authority:

a. Ltr, 2701st EOD Sq, 25 Sep 62, Range Survey Report- Lowry Missile Site Nr. 1, w/4 indorsements thereto.

b. Ltr, ATC (ATEOM-OR), 20 Feb 63, Notice of Contamination - Declaration of Excess Lowry Missile Site Nr. 1, w/1st Ind, AFLC (MCEFR-1), thereto.

2. Range Description: A tract of land located within the Lowry Missile Site Nr. 1 (formerly known as Lowry AFB Bombing Range) approximately 14 miles Southeast of Lowry Air Force Base, Colorado. Controlling installation is Lowry Air Force Base, Colorado.

3. Range Area: Approximately 54,466.16 acres.

4. Date Project Started: 1 May 1963 Completed: 24 May 1963

5. Number of Personnel Utilized: 2 Officers and 18 Enlisted Men.

6. Manhours Utilized:

a. In Decontamination:	2,265
b. In Travel Time to and from Range:	311
c. In Travel Time to and from Home Station:	690
Total:	3,266

7. Total Cost of Clearance:

a. POL Costs:

(1) Gasoline- 2,531.5 gals @ $ .14 gal -	$354.40
(2) Motor Oil- 25 gals @ $1.92 gal -	28.00
(3) Fuel Oil- 704 gals @ $ .10 gal -	70.40
Total:	$452.80

b. Demolition Material Costs:

(1) Comp C- 1 case @ $29.00 case -	$29.00
(2) Safety Fuze- 100 ft @ $ .01 ft -	1.00

(3) Blasting Caps- 20 ea @ $ .04 ea - .80

(4) Fuse Lighters- 25 ea @ $ .34 ea - 8.50

Total: $39.30

c. Vehicle Maintenance: $109.45

d. Transportation and Per Diem Costs:

(1) Transportation- $ 673.75

(2) Per Diem- 1528.29

Total: $2202.04

e. H-21 Helicopter provided by Lowry AFB for 4 hours @ $250.00 per hour - $1000.00

Total Costs: $3603.59

f. Cost Per Acre: $ .07

8. Hazardous Material Recovered and Disposition:

a. Powder, Paraflare -	5 lbs	-	Burned
b. Motor, Rocket 2.75" -	28 ea	-	Burned
c. Head, HE Rocket 2.75" -	11 ea	-	Detonated
d. Cartridge, Photoflash -	110 ea	-	Detonated
e. Grenade, Smoke -	1 ea	-	Burned
f. Igniter, WP -	2 ea	-	Detonated
g. Head, HE Rocket 5" -	1 ea	-	Detonated
h. Fuze, Rocket, Mk 149 -	1 ea	-	Detonated
i. Charge, Spotting, M1A1 -	14 ea	-	Detonated
j. Igniter, WP M23 -	2 ea	-	Detonated
k. Fuze, Mech Time, M152 -	2 ea	-	Detonated
l. Fuze, Mech Time, T 73 -	8 ea	-	Detonated
m. Bomb, Practice, Mk 23 w/spot. Charge	17 ea	-	Detonated

n. JATO 15KS1000 - 1 ea - Burned

o. Bomb, Incendiary, M69 - 1 ea - Burned

p. Bomb, Incendiary, M74 - 2 ea - Burned

q. Projectile, 20 MM, HE - 350 ea - Detonated

9. Inert Material Recovered and Disposition: Light Ferrous Metal, 30,000 lbs, turned in to Marketing and Redistribution Activity, Lowry AFB, Colorado.

10. Vehicles and Equipment Used and Adequacy:

a. Truck, Cargo, 6 x 6, $2\frac{1}{2}$ ton - 3 ea

b. Truck, Cargo, 4-dr, 4 x 4 - 2 ea

c. Truck, Dump, 5 ton - 2 ea

d. Truck, P/U, $\frac{1}{2}$ ton - 1 ea

e. Tractor Bulldozer D-6 - 1 ea

f. Disc 12' w/24" Blades - 1 ea

Vehicles and equipment were considered adequate.

11. Difficulties Encountered:

a. Manpower Losses: 95 m/hrs were lost because of sick call and minor injuries.

b. Vehicle Maintenance: Vehicles were deadlined for maintenance for a total of 101 hours.

12. Remarks: The support rendered by the personnel of Lowry AFB was exceptionally good in every respect.

13. Participating Personnel: The following personnel, detachments indicated, participated in this project:

Major William Stouppe - Detachment 3

Capt Durward G. Price - Detachment 7

SMSgt Joseph L. Wyatt - Detachment 3

MSgt Daniel G. Bertron - Detachment 2

TSgt	Michael R. Armour	-	Detachment 1
TSgt	Raymond Crandall	-	Detachment 3
TSgt	David R. Evans	-	Field Ops
TSgt	Billie L. Owens	-	Field Ops
TSgt	Marvin L. Seaman	-	Detachment 2
SSgt	Joseph Aranda	-	Detachment 3
SSgt	Stuart K. Carr, Jr.	-	Field Ops
SSgt	Richard C. Doerr	-	Detachment 2
SSgt	Johnnie B. Goodwin	-	Detachment 2
SSgt	Melvin Pilson	-	Detachment 2
SSgt	Kenneth D. Stehlik	-	Detachment 3
A1C	James E. Farris	-	Detachment 3
A1C	Henry L. Griffitts	-	Detachment 3
A1C	George E. Isaacs	-	Field Ops
A1C	Jerome E. Mulvihill	-	Detachment 3
A1C	David A. Parks	-	Detachment 3

Durward G. Price

DURWARD G. PRICE
Captain, USAF
Clearance Officer

APPENDIX B

ASBESTOS SAMPLING RESULTS

HAGER
LABORATORIES, INC.

Box 4012
Golden, Colorado 80401
(303) 278-3400 (800) 878-3434
FAX # (303) 278-2121

REPORT ON SERVICE NUMBER 50264AH
September 20, 1990

Customer Project Code:

To: Mr. David Farler
Urie Environmental Health
11407 W. I-70 Frontage Rd., N.
Wheat Ridge, CO 80033

Analysis: The following samples were submitted for analysis:
Two bulk samples for asbestos identification and content determination.
Three membrane filter samples and two blanks for fiber count.

Method: ASBESTOS (identification)
Each sample was analyzed following EPA method 600/M4-82-020. Portions of each bulk material were immersed in oil of known refractive index on a microscope slide and observed at 100-125 power using a McCrone Dispersion Staining Objective with polarized light. Characteristics of the fibers under polarized light and dispersion staining conditions were compared to similarly prepared samples of known asbestos types. Optical estimates of the asbestos fiber content were made by comparing the quantity of non-asbestos material to asbestos fibers.

FIBER (count)
The fiber concentration of each filter sample was determined following NIOSH Method 7400 (A Rules). Wedges from each filter were examined at 400 power using phase contrast microscopy. All fibers longer than five (5) microns with a length-to-width ratio of 3:1 or more were counted.

Results: The results are found on Tables 1 - 2.

Discussion: The present OSHA permissible exposure limit (PEL) for asbestos is 0.2 fibers/cc.

Detection limit for bulk samples is <1% asbestos fibers.

LT( ) indicates "less than" with the lower limit of quantification shown in parentheses.

All filter samples have been corrected for the blank unless otherwise noted.

The Laboratory has been EPA approved for asbestos analysis since 1979, and is accredited under NIST/NVLAP for asbestos fiber analysis.

Hager Laboratories, Inc., has been accredited by the American Industrial Hygiene Association (AIHA) since 1977 and is enrolled in the AIHA Proficiency Analytical Testing (PAT) Program for phase contrast microscopy. Microscopists have completed the NIOSH 582 course "Sampling and Evaluating Airborne Asbestos Dust".

Discussion: (Cont.) Laboratory data are filed and available upon request. A portion of each sample is retained for subsequent review and future analysis.

If you have any questions, please contact our Technical Services Department, at (303)278-3400 or toll free at (800)878-3434.

Filter Samples Analyzed by: Patricia G. Manning for
Daniel Fillipi

Date Analyzed: 9-20-90

Bulk Samples Analyzed by: Sandra L. McCarty
Sandra L. McCarty

Date Analyzed: 9-20-90

Submitted by: Patricia G. Manning
Patricia G. Manning
Microscopy Supervisor

PGM/slt

09/20/90

TABLE 1

Service Order # 50264

Sample ID	Homogeneous (Y/N)	Sample Color	No. of Layers	Asbestos Present (Y/N)	Chrysotile (%)	Amosite (%)	Crocidolite (%)	Anthophyllite (%)	Tremolite/ Actinolite (%)	Total Asbestos (%)	Fibrous Glass (%)	Cellulose Fibers (%)	Other Fibers (Type/%)	Non-Fibrous Material (Type/%)	Sample Description
Powerhouse Floor	Y	grey	1	Y	5-15	30-50				50-75		trace		30-50	
Tunnel to Powerhouse Exhaust	Y	grey	1	Y	15-30	15-30				50-75		trace		30-50	

Note: trace = less than or equal to 1%.

SN 50264AH
September 20, 1990

TABLE 2

Sample Number	Counted (fibers)	Counted (fields)	Total (fibers)	Air Volume (liters)	Air Concentration (fibers/cc)
B.9.18.90.1	2.	100.	LT(4900.)	723.	LT(0.007)
B.9.18.90.3	3.	100.	LT(4900.)	751.	LT(0.007)
B.9.18.90.10	3.	100.	LT(4900.)	472.	LT(0.01)
Blank #1	0.	100.	LT(4900.)	-	-
Blank #2	0.	100.	LT(4900.)	-	-

APPENDIX C

CHRIS DATA SHEETS AND MATERIAL SAFETY DATA SHEETS

RP-1

MATERIAL SAFETY DATA SHEET
RP-1

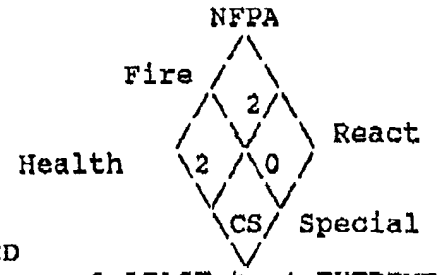
TION I
****

PRODUCT; RP-1

COMMON NAME; Petroleum distillates

CAS NUMBER; Blend

SUPPLIER; HOWELL HYDROCARBONS, INCORPORATED
7811 S. PRESA
SAN ANTONIO, TEXAS 78223
Telephone (512) 533-2542
24 Hr. CHEMTREC 1-800-424-9300



HMIS PPI:

Prepared 9/90 by Scientific Information Services, C.A.R.E.,Corp.

SECTION II, HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS-(CAS Number) OSHA PEL ACGIH TLV OTHER

Solvent Refined Heavy Naphtha (64741-92-0)--NO DATA AVAILABLE
Hydrotreated kerosene (64742-47 8)---NO DATA AVAILABLE

*Naphthalene (91-20-3)----------NO DATA AVAILABLE
*Anthracene (120-12-7)----------NO DATA AVAILABLE
*May contain Polynuclear Aromatics combined % of 5%.

TION III, PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING POINT, 365-412 F. MELTING POINT, ND
SPECIFIC GRAVITY (H2O=1), Approx. 0.77
VAPOR PRESSURE, Approx. 4mmHg @ 25 C. VAPOR DENSITY (Air=1), Approx. 6.3
EVAPORATION RATE (BuAc=1), 0.08
SOLUBILITY IN WATER, Negligible
APPEARANCE AND ODOR, Clear & bright liquid with red dye typical hydrocarbon odor.

SECTION IV, FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method), 138 F. (TCC)
FLAMMABLE LIMITS; Lower, 1.1 Upper, 6

Extinguishing media, water fog or spray, foam, dry powder, carbon dioxide (CO2).

SPECIAL FIRE FIGHTING PROCEDURES, Approach fire from upwind side. Avoid breathing smoke, fumes, mist, or vapors on the downwind side.

UNUSUAL FIRE AND EXPLOSION HAZARDS, If stored in drums: Containers may rupture from internal pressure if confined to fire area. Cool with water. Get non-emergency personnel out of the area.

MATERIAL SAFETY DATA SHEET
RP-1

SECTION V, REACTIVITY INFORMATION

STABILITY: PRODUCT IS Stable

INCOMPATIBILITY: Materials to avoid: Heat, and oxidizers or oxidizing materials.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS, From Fire: Smoke, carbon dioxide, carbon monoxide.

HAZARDOUS POLYMERIZATION, Will not occur.

SECTION VI, HEALTH HAZARD DATA
THRESHOLD LIMIT VALUE, 10 ppm (Based on Naphthalene)

ROUTES OF ENTRY

INHALATION? Possible (Irritant, narcotic)
SKIN/EYES? Possible (Irritant)
SKIN ABSORPTION? Possible (Irritant, toxic, narcotic)
INGESTION? Unlikely

HEALTH HAZARDS

ACUTE, Inhalation of vapors may be narcotic or anesthetic. Ingestion of liquid will cause gastrointestinal distress, irritation, and possibly nausea. Liquid or vapors may be irritating to skin and eyes.

CHRONIC, Blood effects, possibly kidney effects. Cancer suspect agent, contains hydrotreated kerosene. ld50 for naphthalene is 490mg/Kg - ORAL RAT.

CARCINOGENICITY

LISTED IN NTP? No IARC MONOGRAPHS? Yes OSHA REGULATED? No

SIGNS AND SYMPTOMS OF EXPOSURE, Signs of inhalation overexposure, in order: Irritation of respiratory tract, nervous system depression, headaches, dizziness, staggering gait, confusion, unconsciousness, coma.

Skin irritation develops slowly after contact, eye irritation develops immediately upon contact.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE, Dermatitis.

****

EMERGENCY AND FIRST AID PROCEDURES,

EYE CONTACT, Flush eyes with water. Get medical attention if symptoms develop and persist.

SKIN CONTACT, Wash skin with water. Get medical attention if symptoms develop and persist.

INGESTION, Do NOT induce vomiting, Get immediate medical attention. Aspiration into lungs may cause chemical pneumonia.

INHALATION, Remove victim to fresh air and, if needed, immediately begin artificial respiration. Give oxygen if breathing is labored. Get emergency medical help. Contact physician immediately.

MATERIAL SAFETY DATA SHEET
RP-1

SECTION VII, PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED, Small spills, pick up with absorbent media. Store as Hazardous waste.

Large spills, contain with dikes, pick up with vacuum truck. Handle as Hazardous waste. Notify proper local, state, and federal agencies.

WASTE DISPOSAL METHOD, EPA approved Hazardous waste disposal site. Follow applicable local, state, and federal regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE, Store away from oxidizers or materials bearing a yellow "D.O.T." label. Store in a cool, ventilated area, away from ignition sources.

OTHER PRECAUTIONS, Clean up leaks immediately to prevent soil or water contamination.

SECTION VIII, CONTROL MEASURES

RESPIRATORY PROTECTION, (If concentration reaches or exceeds TLV), NIOSH approved organic vapor mask required.

VENTILATION; LOCAL EXHAUST, Recommended SPECIAL, ---
MECHANICAL, Recommended OTHER, ---

PROTECTIVE GLOVES, Chemical resistant gauntlet type gloves.

PROTECTION, Chemical goggles or full face shield.

OTHER PROTECTIVE EQUIPMENT, Boots, aprons, drench showers, eye wash as needed for protection against spills and/or splashes.

WORK HYGIENIC PRACTICES, Avoid contact with skin, eyes, and clothing. After handling this product, wash hands before eating, drinking, or smoking. If contact occurs, remove contaminated clothing. If needed, take first aid action shown in section VI.

Launder contaminated clothing before reuse.

SECTION IX, TRANSPORTATION INFORMATION

DOT Proper Shipping Name, Hazard Class., UN/NA Number, RQ (Contains)
If <110 gallons in a single container:
PETROLEUM NAPHTHA, NOT REGULATED

If >110 gallons in a single container:
PETROLEUM NAPHTHA, COMBUSTIBLE LIQUID, UN1255 (CONTAINS NAPHTHALENE)

If >622 gallons in a single container:
PETROLEUM NAPHTHA, COMBUSTIBLE LIQUID, UN1255, RQ (CONTAINS NAPHTHALENE)

MATERIAL SAFETY DATA SHEET
RP-1

SECTION X, OTHER DATA
HAZARDS, Acute Yes Chronic Yes Flammability Yes
Sudden Release of Pressure No Reactive No

CERCLA RQ 4,000 lbs. or 622 gallons
HAZARDOUS WASTE NUMBER D001 Ignitable
SARA Title III
Threshold Planning Quantity, None
Reportable Quantity, None
Section 313, Toxic Materials: YES

Chemical Name	CAS Number	Weight %
Naphthalene	91-20-3	--Together these two
Anthracene	120-12-7	ingred. add up to 5%.

CLEAN AIR ACT Not listed
CLEAN WATER ACT Yes, Sect. 304, 307, 311
TOXIC SUBSTANCES CONTROL ACT (TSCA), 40 CFR 710
Sources of the raw materials used in this mixture assure that all chemical ingredients present are in compliance with Sect. 8(b) Chemical Substance Inventory, or are otherwise in compliance with TSCA.

NA-Not applicable ND-Data not available
CS-Cancer Suspect Agent OX-Oxidizer COR-Corrosive
CALC-Calculate EST-Estimated
STEL-Short Time Exposure Limit TLV-Threshold Limit Value
PEL-Permissable Exposure Limit TWA-Time Weighted Average, 8 hours
HMIS, PPI-Hazardous Material Identification System, Personal Protection Index

Tne data presented is true and correct to the best of our knowledge and belief, however, neither seller nor preparer makes any warranties, express or implied, concerning the information presented. The user is cautioned to perform his own hazard evaluation and to rely upon his own determinations.

SCIENTIFIC INFORMATION SERVICES
CHEMICAL ASSESSMENT, RESPONSE AND EVALUATION CORPORATION
Telephone (817) 560-4631
Form essentially the same as OSHA Form 174 Dated September 1985

Fisher Scientific Company

Chemical Manufacturing Division
P. O. Box 375, 1 Reagent Lane
Fair Lawn, NJ 07410

MATERIAL SAFETY DATA SHEET (Adapted from USDL From LSD-005-4) (201) 796-7100

SECTION I. IDENTIFICATION OF PRODUCT

CHEMICAL NAME: Nitric Acid	FORMULA: HNO_3
SYNONYM OR CROSS REFERENCE:	

SECTION II. HAZARDOUS INGREDIENTS

MATERIAL	NATURE OF HAZARD
Nitric Acid	Oxidizer, Corrosive

SECTION III. PHYSICAL DATA

BOILING POINT: 120°C	MELTING POINT: approximately -30°C
VAPOR PRESSURE(mm Hg): unknown	SPECIFIC GRAVITY: 1.42
VAPOR DENSITY (AIR = 1): unknown	PERCENT VOLATILE BY VOLUME (%): 100%
WATER SOLUBILITY: complete	EVAPORATION RATE (ether = 1): greater than 1
APPEARANCE: Colorless to yellow liquid	

SECTION IV. FIRE AND EXPOSION HAZARD DATA

FLASH POINT (method used) (°F): NA	FLAMMABLE LIMITS: NA	Uel:	Lel:
FIRE EXTINGUISHING MEDIA: NA			

SPECIAL FIRE-FIGHTING PROCEDURES: Use self contained breathing apparatus as toxic vapors of NO_x are liberated.

UNUSUAL FIRE AND EXPLOSION HAZARD: Moderate fire hazard by chemical reaction with reducing agents, organic compounds.

SECTION V. HEALTH HAZARD

THRESHOLD LIMIT VALUE: 2ppm (air)

HEALTH HAZARDS: Causes severe burns to eyes and skin and respiratory tract. May be fatal if swallowed. Vapors hazardous and may cause nitrons gas poisoning.

FIRST AID PROCEDURES: Inhalation - remove patient to fresh air. Skin or eye - immediately flush eyes or skin with water for at least 15 min. Ingestion - do not give emetics. Give tap water, milk or milk of magnesia. Give whites of eggs beaten with water. Call a physician.

SECTION VI. REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		reaction with metals can liberate hydrogen and oxides of nitrogen Reaction with organic compounds can cause fire.
	STABLE	X	

MATIBILITY (material to avoid)

Metals, strong bases, organic compounds

HAZARDOUS DECOMPOSITION PRODUCTS

Oxides of nitrogen

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII. SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Neutralize with soda ash. Scoop up and place in a suitable container.

WASTE DISPOSAL METHOD

DISPOSE OF BY MEANS AS TO COMPLY WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS OR CONTACT AN APPROVED AND LICENSED DISPOSAL AGENCY.

SECTION VIII. PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

Gas mask with canister for absorbing acid vapors.

VENTILATION		
	LOCAL	SPECIAL
	MECHANICAL (general) fume hood	OTHER

PROTECTIVE GLOVES	EYE PROTECTION
rubber	safety glasses

OTHER PROTECTIVE EQUIPMENT

rubber apron

SECTION IX. HANDLING AND STORAGE PRECAUTIONS

STORAGE AND HANDLING

Store portected from light.

SECTION X. MISCELLANEOUS INFORMATION

INFORMATION FURNISHED BY:	TITLE
Gaston L. Pillori	Manager of Quality Assurance

The above information is believed to be accurate and represents the best information currently available to us. However, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

REV. NO. _____ DATE: _____

Form No. 757
11-73

MATERIAL SAFETY DATA SHEET

CORPORATE RESEARCH & DEVELOPMENT

SCHENECTADY, N. Y.

MATERIALS INFORMATION SERVICES

NO. 3

SODIUM HYDROXIDE

Revision A

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: [redacted]
OTHER DESIGNATIONS: Caustic Soda, Soda Lye, NaOH, GE Material D4B4, ASTM D456,
DESCRIPTION: This material is an anhydrous solid (flake, pellet, etc.) CAS# 001 310 732
MANUFACTURER: Available from many suppliers.

SECTION II. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Typical content:		
Sodium Hydroxide (NaOH)	96	Ceiling Limit 2 mg/m^3
Impurities:		
Sodium Carbonate (Na_2CO_3)	0.5-2.5	
Sodium Chloride (NaCl)	0.01-2.1	
Sodium Sulfate (Na_2SO_4)	0.02-0.1	
Potassium, Calcium and Magnesium	0.1	
Silicon Dioxide (SiO_2)	0.03	
Other metals (total)	0.01	

SECTION III. PHYSICAL DATA

Boiling point, 1 atm, deg C --- 1388
Specific gravity (20/4 C) ----- 2.13
Volatiles ---------- non-volatile at room temperature
Melting point, deg C ---------- 318

Vapor pressure, mm Hg @ 1000 C ---- 42
@ 1200 C ---- 232
Viscosity at 350 C, cps ---------- 4.0
Water solubility, %, @ 0 C ------ 29.6
@ 100 C ------ 77.5

Appearance & odor: White or off-white, hygroscopic solid; no odor.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
None - not combustible	N/A	N/A	N/A	N/A

Although it is not combustible, it can be hazardous if present in a fire area. The following should be known for fire fighting: (1) It can melt and flow when heated (m.p. 318 C). (2) Hot or molten material can react violently with water (splattering). (3) Can react with certain metals, such as aluminum, to generate flammable hydrogen gas. (See also Reactivity Data, Section V)

SECTION V. REACTIVITY DATA

It is a stable material under normal conditions of storage. No self-polymerization. No hazardous decomposition products. Slowly it can pick up moisture from the air and react with carbon dioxide from the air to form sodium carbonate.

Sodium hydroxide can react violently with strong acids and with many organic chemicals, expecially with nitrocarbons and chlorocarbons. (Will react with trichloroethylene to form spontaneously flammable dichloroacetylene.) It generates much heat when it dissolves in water.

Avoid contact with leather and wool and with aluminum, tin, zinc, and alloys which contain these metals.

GENERAL ELECTRIC

SECTION VI. HEALTH HAZARD INFORMATION

TLV (Ceiling Value) 2 mg/m^3

Sodium hydroxide is a strong alkali and is dangerous when improperly handled. It can be destructive to all human tissue it contacts, producing severe burns. Eye contact can produce severe or permanent injury. Dust or mist inhalation can injure the entire respiratory tract.

FIRST AID

Eye contact - Wash eyes immediately with plenty of running water for no less than 15 minutes, including under the eyelids and all surfaces. Speed in rinsing out the eyes with water after contact is extremely important if permanent injury is to be avoided. Contact physician as soon as possible.

Ingestion - Immediately dilute chemical by drinking large amounts of water or milk, then neutralize with dilute vinegar or fruit juice. Vomiting may occur spontaneously, but do not induce it. Contact a physician promptly.

Inhalation - Remove from exposure to mist or dust and get prompt medical help.

Skin contact - Wash contact area promptly with large quantities of water. (Dilute acetic acid, vinegar, can be used to neutralize.) Remove contaminated clothing under the shower. Prolong washing in serious cases until medical help arrives - even for an hour or longer. Physician should see all cases other than minor exposures to small areas of skin.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

When solid sodium hydroxide is spilled in a dry condition, it can be promptly shoveled up for recovery or disposal. (CAUTION! Avoid dusting. Avoid contact with the skin.) Control the disposal of the waste solid. (Delay in clean up may allow absorption of moisture from the atmosphere and may increase the difficulties of clean up.) Flush contaminated surfaces with water and neutralize with dilute acid, preferably acetic acid, to remove final traces. (Sodium bicarbonate may also be used to partially neutralize.) Finally, rinse with water.

Disposal of waste is greatly dependent on local conditions and requirements. Pre-emergency plans should be made to meet legal and technical requirements. Waste caustic should never be deliberately discharged directly into sewers or surface waters. (First, convert to neutral salts and dilute well with water.)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide adequate ventilation to meet TLV requirements, especially where dusting or misting conditions can exist. Use filter-type respirator for mist and dust protection where needed.

Use chemical safety goggles! A plastic face shield can also be used.

Use rubber gloves, rubber apron or protective clothing, rubber boots where needed to prevent contact with sodium hydroxide, especially when solutions are prepared.

Eye wash fountains and safety showers must be immediately available!

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Workers should not be permitted to handle this material without proper training or to work with it without protective equipment.

Store in well-sealed containers. Avoid handling conditions that may lead to spills and leaks, or to formation of mist or dust.

Wherever this material is stored, unloaded, handled or used abundant water (preferably running water) should be available for emergency use.

Drains for storage or use areas for this material should have retention basins for pH adjustment and dilution of spills and flushings before discharge.

This material is classified as a CORROSIVE by the Department of Transportation.

The pellet form is probably the safest solid form for handling and dispensing.

APPROVED: C R White
Industrial Hygienist and
Chemical Safety Coordinator,
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Syracuse, NY 13201

ETHYL ALCOHOL

EAL

Common Synonyms	Watery liquid	Colorless	Alcohol odor
Ethanol Alcohol Grain alcohol Denatured alcohol Cologne spirit Fermentation alcohol	Floats and mixes with water. Flammable, irritating vapor is produced		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, alcohol foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
Move to fresh air.

LIQUID
Not harmful.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Disperse and flush

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Alcohol, glycol
3.2 **Formula:** C_2H_5OH
3.3 **IMO/UN Designation:** 3.2/1170
3.4 **DOT ID No.:** 1170
3.5 **CAS Registry No.:** 64-17-5

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Mild, rather pleasant; like wine or whiskey. (Denatured alcohol may be unpleasant.)

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** All-purpose canister; safety goggles. Avoid contact with liquid and inhalation of vapors.
5.2 **Symptoms Following Exposure:** Irritation of eyes, nose and throat. Headache and drowsiness may occur. Liquid causes intoxication.
5.3 **Treatment of Exposure:** INHALATION: if breathing is affected, remove victim to fresh air; call physician; administer oxygen. Speed is of primary importance. EYES OR SKIN: flush with water.
5.4 **Threshold Limit Value:** 1,000 ppm
5.5 **Short Term Inhalation Limits:** 5,000 ppm for 15 min.
5.6 **Toxicity by Ingestion:** Grade 1; LD_{50} = 5 to 15 g/kg
5.7 **Late Toxicity:** None
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** No appreciable hazard. Practically harmless to the skin.
5.10 **Odor Threshold:** 10 ppm
5.11 **IDLH Value:** Data Not Available

6. FIRE HAZARDS

6.1 **Flash Point:** 55°F C.C.; 64°F O.C.
6.2 **Flammable Limits in Air:** 3.3%-19%
6.3 **Fire Extinguishing Agents:** Carbon dioxide, dry chemical, water spray, alcohol foam
6.4 **Fire Extinguishing Agents Not to be Used:** None
6.5 **Special Hazards of Combustion Products:** None
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** 689°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 3.9 mm/min.
6.10 **Adiabatic Flame Temperature:** Data Not Available
6.11 **Stoichiometric Air to Fuel Ratio:** Data Not Available
6.12 **Flame Temperature:** Data Not Available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data Not Available
7.8 **Reactivity Group:** 20

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 250 ppm/6 hr/goldfish/lethal/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 125%, 5 days; 44.2% (theor.), 5 days; 71.2% (theor.), 20 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Anhydrous (200 proof); 190 proof, specially denatured; completely denatured
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P-Q-R-S

11. HAZARD CLASSIFICATIONS

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

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

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 46.07
12.3 **Boiling Point at 1 atm:** 172.9°F = 78.3°C = 351.5°K
12.4 **Freezing Point:** −173°F = −114°C = 159°K
12.5 **Critical Temperature:** 469.6°F = 243.1°C = 516.3°K
12.6 **Critical Pressure:** 926 psia = 63.0 atm = 6.38 MN/m²
12.7 **Specific Gravity:** 0.790 at 20°C (liquid)
12.8 **Liquid Surface Tension:** Not pertinent
12.9 **Liquid Water Interfacial Tension:** Not pertinent
12.10 **Vapor (Gas) Specific Gravity:** 1.6
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.128
12.12 **Latent Heat of Vaporization:** 360 Btu/lb = 200 cal/g = 8.37 × 10⁵ J/kg
12.13 **Heat of Combustion:** −11,570 Btu/lb = −6425 cal/g = −268.8 × 10⁵ J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** −99 Btu/lb = −55 cal/g = −2.3 × 10⁵ J/kg
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data Not Available
12.26 **Limiting Value:** Data Not Available
12.27 **Reid Vapor Pressure:** 2.3 psia

NOTES

ETHYLENE GLYCOL

EGL

Common Synonyms	Thick liquid	Colorless	Odorless
Glycol Monoethylene glycol 1,2 Ethanediol 1,2 Dihydroxyethane Ethylene dihydrate	Sinks and mixes with water		

Stop discharge if possible
Call fire department
Isolate and remove discharged material
Notify local health and pollution control agencies.

Fire

Combustible
Extinguish with dry chemical, alcohol foam, or carbon dioxide
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

LIQUID
Irritating to skin and eyes.
If swallowed, will cause loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Disperse and flush

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Alcohol, Glycol
3.2 Formula: $HOCH_2CH_2OH$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: Data Not Available
3.5 CAS Registry No.: 107-21-1

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Slight odor

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Goggles; shower and eye bath.
5.2 Symptoms Following Exposure: Inhalation of vapor is not hazardous. Ingestion causes stupor or coma, sometimes leading to fatal kidney injury.
5.3 Treatment of Exposure: INGESTION: induce vomiting and call a physician. SKIN AND EYES: flush with water.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg (rat, guinea pig, mouse)
5.7 Late Toxicity: Fatal kidney injury may result if ingested.
5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat.
5.9 Liquid or Solid Irritant Characteristics: No appreciable hazard. Practically harmless to the skin.
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: Data Not Available

6. FIRE HAZARDS

6.1 Flash Point: 240°F O.C.; 232°F C.C.
6.2 Flammable Limits in Air: LEL = 3.2%; UEL not listed
6.3 Fire Extinguishing Agents: Water fog, alcohol foam, carbon dioxide, or dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Water or foam may cause frothing
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 775°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 1.0 mm/min.
6.10 Adiabatic Flame Temperature: Data Not Available
6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 20

8. WATER POLLUTION

8.1 Aquatic Toxicity: > 100 ppm/48 hr/shrimp/LC_{50}/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 12.5% (theor.), 5 days; 78% (theor.), 20 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Industrial grade; low-conductivity grade
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P-Q

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation:

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

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 62.07
12.3 Boiling Point at 1 atm: 387.7°F = 197.6°C = 470.8°K
12.4 Freezing Point: 8.6°F = 13°C = 260°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.115 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.095
12.12 Latent Heat of Vaporization: 344 Btu/lb = 191 cal/g = 8.00×10^5 J/kg
12.13 Heat of Combustion: −7259 Btu/lb = −4033 cal/g = -168.9×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: (est.) −20 Btu/lb = −12 cal/g = -0.5×10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 43.26 cal/g
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 0.008 psia

NOTES

KEROSENE

KRS

Common Synonyms	Watery liquid	Colorless	Fuel oil odor
Illuminating oil Kerosene Range oil Fuel oil No. 1 Jet Fuel JP-1	Floats on water		

Stop discharge if possible
Call fire department
Avoid contact with liquid
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Combustible.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** None
2.2 **Class:** Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Miscellaneous Hydrocarbon Mixtures
3.2 **Formula:** $C_nH_{1.8n}$
3.3 **IMO/UN Designation:** 3.3/1223
3.4 **DOT ID No.:** 1223
3.5 **CAS Registry No.:** 8008-20-6

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless to light brown
4.3 **Odor:** Characteristic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Protective gloves; goggles or face shield.
5.2 **Symptoms Following Exposure:** Vapor causes slight irritation of eyes and nose. Liquid irritates stomach; if taken into lungs, causes coughing, distress, and rapidly developing pulmonary edema.
5.3 **Treatment of Exposure:** ASPIRATION: enforce bed rest; administer oxygen; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: wash with plenty of water. SKIN: wipe off and wash with soap and water.
5.4 **Threshold Limit Value:** 200 ppm
5.5 **Short Term Inhalation Limits:** 2500 mg/m³ for 60 min.
5.6 **Toxicity by Ingestion:** Grade 1; LD_{50} = 5 to 15 g/kg
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 1 ppm
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** 100°F (min) C.C.
6.2 **Flammable Limits in Air:** 0.7%-5%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** 444°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** 4 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 33

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 2990 ppm/24 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 53%, 5 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Light hydrocarbon distillate: 100%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Combustible liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

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

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** Not pertinent
12.3 **Boiling Point at 1 atm:** 392-500°F = 200—260°C = 473—533°K
12.4 **Freezing Point:** —50°F = —45.6°C = 227.6°K
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 0.80 at 15°C (liquid)
12.8 **Liquid Surface Tension:** 23-32 dynes/cm = 0.023-0.032 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 47-49 dynes/cm = 0.047-0.049 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
12.12 **Latent Heat of Vaporization:** 110 Btu/lb = 60 cal/g = 2.5 X 10⁵ J/kg
12.13 **Heat of Combustion:** —18,540 Btu/lb = —10,300 cal/g = —431.24 X 10⁵ J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.1 psia

NOTES

OILS, FUEL: 1-D

OOD

Common Synonyms	Oily liquid	Yellow-brown	Lube or fuel oil odor
Diesel oil (light)	Floats on water		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemical, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.1/1270
3.4 DOT ID No.: 1270
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Light brown
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: INHALATION causes headache and slight giddiness. INGESTION causes nausea, vomiting, and cramping; depression of central nervous system ranging from mild headache to anesthesia, coma, and death; pulmonary irritation secondary to exhalation of solvent; signs of kidney and liver damage may be delayed. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema; later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system excitement followed by depression.
5.3 Treatment of Exposure: INGESTION: do NOT induce vomiting; seek medical attention. ASPIRATION: enforce bed rest; administer oxygen. EYES: wash with copious quantity of water. SKIN: remove solvent by wiping and wash with soap and water.
5.4 Threshold Limit Value: No single value applicable.
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5-15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Slight smarting of eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin.
5.10 Odor Threshold: 0.7 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 100°F C.C.
6.2 Flammable Limits in Air: 1.3%-6%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 350—625°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: 204 mg/l/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: 20 mg/kg LD_{50} (mallard)
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Diesel fuel 1-D (ASTM)
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 380—560°F = 193—293°C = 466—566°K
12.4 Freezing Point: —30°F = —34°C = 240°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.81—0.85 at 15°C (liquid)
12.8 Liquid Surface Tension: 23—32 dynes/cm = 0.023—0.032 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 47—49 dynes/cm = 0.047—0.049 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 110 Btu/lb = 60 cal/g = 2.5 X 10^5 J/kg
12.13 Heat of Combustion: —18,540 Btu/lb = —10,300 cal/g = —431.24 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

POLYCHLORINATED BIPHENYL

PCB

Common Synonyms	Oily liquid to solid powder	Light yellow liquid, or white powder	Weak odor
PCB Chlorinated biphenyl Aroclor Halogenated waxes Polychlorobiphenyls	Sinks in water		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and solid
Call fire department
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Combustible.
Extinguish with water, foam, dry chemical, or carbon dioxide

Exposure

CALL FOR MEDICAL AID

LIQUID OR SOLID
Irritating to skin and eyes
Flush affected areas with plenty of water
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-water contaminant
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** None
2.2 **Class:** Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Not listed
3.2 **Formula:** $(C_{12}H_{10-n}Cl_n)$
3.3 **IMO/UN Designation:** Not listed
3.4 **DOT ID No.:** 2315
3.5 **CAS Registry No.:** 1336-36-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid or solid
4.2 **Color:** Pale yellow (liquid); colorless (solid)
4.3 **Odor:** Practically odorless

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Gloves and protective garments.
5.2 **Symptoms Following Exposure:** Acne from skin contact.
5.3 **Treatment of Exposure:** SKIN: wash with soap and water.
5.4 **Threshold Limit Value:** 0.5 to 1.0 mg/m³
5.5 **Short Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Grade 2; oral rat LD_{50} = 3980 mg/kg
5.7 **Late Toxicity:** Causes chromosomal abnormalities in rats, birth defects in birds
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause severe irritation of eyes and throat and cause eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 **Liquid or Solid Irritant Characteristics:** Contact with skin may cause irritation.
5.10 **Odor Threshold:** Data not available
5.11 **IDLH Value:** 5 to 10 mg/m³

6. FIRE HAZARDS

6.1 **Flash Point:** >266°F
6.2 **Flammable Limits in Air:** Data not available
6.3 **Fire Extinguishing Agents:** Water, foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Irritating gases are generated in fires
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** Data not available
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Data not available
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

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

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 0.278 ppm/96 hr/bluegill/TL_m/fresh water
0.005 ppm/336-1080 hr/pinfish/TL_m/salt water
8.2 **Waterfowl Toxicity:** LD_{50} 2000 ppm (mallard duck)
8.3 **Biological Oxygen Demand (BOD):** Very low
8.4 **Food Chain Concentration Potential:** High

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** 11 grades (some liquid, some solids) which differ primarily in their chlorine content (20%-68% by weight)
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** ORM E
11.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
11.3 **NFPA Hazard Classification:** Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Solid
12.2 **Molecular Weight:** Not pertinent
12.3 **Boiling Point at 1 atm:** Very high
12.4 **Freezing Point:** Not pertinent
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 1.3—1.8 at 20°C (liquid)
12.8 **Liquid Surface Tension:** Not pertinent
12.9 **Liquid Water Interfacial Tension:** Not pertinent
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
12.12 **Latent Heat of Vaporization:** Not pertinent
12.13 **Heat of Combustion:** Not pertinent
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Data not available

NOTES

SODIUM HYDROXIDE

SHD

Common Synonyms	Solid flakes or pellets. White - Odorless
Caustic soda Lye	Sinks and mixes with water.

Avoid contact with solid and dust. Keep people away.
Wear rubber overclothing (including gloves)
Stop discharge if possible.
Isolate and remove discharged material
Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be produced on contact with metals.
Wear rubber overclothing (including gloves).
Flood discharge area with water.
Cool exposed containers with water

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.
IF IN EYES, hold eyelids open and flush with plenty of water.

SOLID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-corrosive
Restrict access
Disperse and flush

2. LABEL

2.1 Category: Corrosive
2.2 Class: 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: NaOH
3.3 IMO/UN Designation: 8.0/1823
3.4 DOT ID No.: 1823
3.5 CAS Registry No.: 1310-73-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White
4.3 Odor: Odorless

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Chemical safety goggles; face shield; filter or dust-type respirator; rubber boots; rubber gloves.
5.2 Symptoms Following Exposure: Strong corrosive action on contacted tissues. INHALATION: dust may cause damage to upper respiratory tract and lung itself, producing from mild nose irritation to pneumonitis. INGESTION: severe damage to mucous membranes; severe scar formation or perforation may occur. EYE CONTACT: produces severe damage.
5.3 Treatment of Exposure: INHALATION: remove from exposure; support respiration; call physician. INGESTION: give water or milk followed by dilute vinegar or fruit juice; do NOT induce vomiting. SKIN: wash immediately with large quantities of water under emergency safety shower while removing clothing; continue washing until medical help arrives; call physician. EYES: irrigate immediately with copious amounts of water for at least 15 min.; call physician.
5.4 Threshold Limit Value: 2 mg/m³
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: (10% solution) oral rabbit LD_{Lo} = 500 mg/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Non-volatile
5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second-and third-degree burns on short contact and is very injurious to the eyes.
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: 200 mg/m³

6. FIRE HAZARDS

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

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Dissolves with liberation of much heat; may steam and splatter
7.2 Reactivity with Common Materials: When wet, attacks metals such as aluminum, tin, lead, and zinc to produce flammable hydrogen gas.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water, rinse with dilute acetic acid
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 125 ppm/96 hr/mosquito fish/TL_m/fresh
180 ppm/23 hr/oysters/lethal/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical flakes; USP pellets
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

SS

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Corrosive material
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	1

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 40.00
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: 604°F = 318°C = 591°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 2.13 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 50.0 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

JUNE 1985

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SODIUM HYPOCHLORITE

SHC

Common Synonyms	Watery liquid	Green to yellow	Bleaching liquid odor
Clorox Liquid bleach	Sinks and mixes with water.		

Stop discharge if possible.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk, and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Harmful to aquatic life in very low concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-corrosive
Disperse and flush

2. LABEL

2.1 Category: Corrosive
2.2 Class: 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: NaOCl-H_2O
3.3 IMO/UN Designation: 8.0/1791
3.4 DOT ID No.: 1791
3.5 CAS Registry No.: 7681-52-9

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Green-yellow
4.3 Odor: Like bleach solution

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Rubber gloves; goggles.
5.2 Symptoms Following Exposure: Liquid can be irritating to skin and eyes if contact is maintained.
5.3 Treatment of Exposure: INGESTION: induce vomiting, give water, and repeat. SKIN: wash off contacted skin area. EYES: flush with plenty of water for 15 min. and consult a physician.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: Grade 1; oral rat LD_{50} = 8.91 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Slight irritation of eyes and mucous membranes.
5.9 Liquid or Solid Irritant Characteristics: Irritates eyes and skin on prolonged contact.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

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

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Destroy with sodium bisulfite or hypo and water, then neutralize with soda ash.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

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

9. SHIPPING INFORMATION

9.1 Grades of Purity: Several grades and concentrations, typified by ordinary household bleach.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Corrosive material
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not applicable
12.3 Boiling Point at 1 atm: Decomposes
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.06 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: (est.) —90 Btu/lb = —50 cal/g = —2 X 10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

SULFURIC ACID

SFA

Common Synonyms	Oily liquid	Colorless	Odorless
Oil of vitriol Battery acid Fertilizer acid Chamber acid	Sinks and mixes violently with water. Irritating mist is produced.		

AVOID CONTACT WITH LIQUID. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be produced on contact with metals.
POISONOUS GAS MAY BE PRODUCED IN FIRE.
Wear goggles, self-contained breathing apparatus, and rubber overclothing.
DO NOT USE WATER ON ADJACENT FIRES.
Extinguish with dry chemical or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

MIST
Irritating to eyes, nose and throat.
If inhaled, will cause coughing, difficult breathing, or loss of consciousness.
Move to fresh air.
IF IN EYES, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.
LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Tissue warning-corrosive
Restrict access
Disperse and flush with care

2. LABEL

2.1 Category: Corrosive
2.2 Class: 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Sulfuric acid
3.2 Formula: H_2SO_4
3.3 IMO/UN Designation: 8.0/1830
3.4 DOT ID No.: 1830
3.5 CAS Registry No.: 7664-93-9

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless (pure) to dark brown
4.3 Odor: Odorless unless hot, then choking

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Safety shower; eyewash fountain; safety goggles; face shield; approved respirator (self-contained or air-line); rubber safety shoes; rubber apron.
5.2 Symptoms Following Exposure: Inhalation of vapor from hot, concentrated acid may injure lungs. Swallowing may cause severe injury or death. Contact with skin or eyes causes severe burns.
5.3 Treatment of Exposure: Call a doctor. INHALATION: observe victim for delayed pulmonary reaction. INGESTION: have victim drink water if possible; do NOT induce vomiting. EYES AND SKIN: wash with large amounts of water for at least 15 min.; do not use oils or ointments in eyes; treat skin burns.
5.4 Threshold Limit Value: 1 mg/m³
5.5 Short Term Inhalation Limits: 10 mg/m³ for 5 min.; 5 mg/m³ for 10 min.; 2 mg/m³ for 30 min.; 1 mg/m³ for 60 min.
5.6 Toxicity by Ingestion: No effects except those secondary to tissue damage.
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors from hot acid (77-98%) cause moderate irritation of eyes and respiratory system. Effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: 77-98% acid causes severe second- and third-degree burns of skin on short contact and is very injurious to the eyes.
5.10 Odor Threshold: Greater than 1 mg/m³
5.11 IDLH Value: 80 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Water used on adjacent fires should be carefully handled.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not flammable
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: None
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts violently with evolution of heat. Spattering occurs when water is added to the compound.
7.2 Reactivity with Common Materials: Extremely hazardous in contact with many materials, particularly metals and combustibles. Dilute acid reacts with most metals, releasing hydrogen which can form explosive mixtures with air in confined spaces.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Dilute with water, then neutralize with lime, limestone, or soda ash.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent

(Continued)

8. WATER POLLUTION

8.1 Aquatic Toxicity: 24.5 ppm/24 hr/bluegill/lethal/fresh water
42.5 ppm/48 hr/prawn/LC_{50}/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: CP; USP; Technical, at 33% to 98% (50° Be to 66° Be).
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P-O

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Corrosive material
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	2
Liquid or Solid Irritant	4
Poisons	2
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	4
Water	3
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	2
	W

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 98.08
12.3 Boiling Point at 1 atm: 644°F = 340°C = 613°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.84 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: −418.0 Btu/lb = −232.2 cal/g = −9.715 X 10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Low

*Physical properties apply to concentrated (98%) acid unless otherwise stated. More dilute acid is more water-like.

7. CHEMICAL REACTIVITY (Continued)

7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 2

TRICHLOROFLUOROMETHANE

TCF

Common Synonyms	Liquid	Colorless	Odorless
F-11, Freon 11 Genetron 11 Arcton 9 Isotron 11; Estimon 11 Frigen 11 Ixetron 11; Ucon 11	Sinks in water. Harmful vapor is produced. Boiling point is 75°F.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS GASES MAY BE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.

Exposure

CALL FOR MEDICAL AID.

VAPOR
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Not harmful.

Water Pollution

Not harmful to aquatic life.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed

Chemical and physical treatment

2. LABEL

2.1 **Category:** None

2.2 **Class:** Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Not listed

3.2 **Formula:** $CFCl_3$

3.3 **IMO/UN Designation:** Not listed

3.4 **DOT ID No.:** Data not available

3.5 **CAS Registry No.:** 75-69-4

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid

4.2 **Color:** Colorless

4.3 **Odor:** Odorless; weak chlorinated solvent

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Air line respirator; rubber gloves; monogoggles

5.2 **Symptoms Following Exposure:** Breathing concentrations approaching 10% in air will cause dizziness and drowsiness. Contact with tissues may cause frostbite.

5.3 **Treatment of Exposure:** INHALATION: remove victim to non-contaminated area and apply artificial respiration if breathing has stopped; call a physician immediately; oxygen inhalation may be utilized. SKIN: if frostbite has occurred, flush areas with warm water.

5.4 **Threshold Limit Value:** 1000 ppm

5.5 **Short Term Inhalation Limits:** Data not available

5.6 **Toxicity by Ingestion:** Data not available

5.7 **Late Toxicity:** Data not available

5.8 **Vapor (Gas) Irritant Characteristics:** Non-irritating

5.9 **Liquid or Solid Irritant Characteristics:** May cause frostbite

5.10 **Odor Threshold:** Data not available

5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** Not flammable

6.2 **Flammable Limits in Air:** Not flammable

6.3 **Fire Extinguishing Agents:** Not pertinent

6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent

6.5 **Special Hazards of Combustion Products:** Produces irritating and toxic products when heated to decomposition temperatures.

6.6 **Behavior in Fire:** Not pertinent

6.7 **Ignition Temperature:** Not flammable

6.8 **Electrical Hazard:** Not pertinent

6.9 **Burning Rate:** Not flammable

6.10 **Adiabatic Flame Temperature:** Data not available

6.11 **Stoichiometric Air to Fuel Ratio:** Data not available

6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction

7.2 **Reactivity with Common Materials:** No reaction

7.3 **Stability During Transport:** Stable

7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent

7.5 **Polymerization:** Not pertinent

7.6 **Inhibitor of Polymerization:** Not pertinent

7.7 **Molar Ratio (Reactant to Product):** Data not available

7.8 **Reactivity Group:** Data not available

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** None

8.2 **Waterfowl Toxicity:** None

8.3 **Biological Oxygen Demand (BOD):** None

8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Technical

9.2 **Storage Temperature:** Ambient

9.3 **Inert Atmosphere:** No requirement

9.4 **Venting:** Safety relief

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-C-I-J

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Not listed

11.2 **NAS Hazard Rating for Bulk Water Transportation:** Data not available

11.3 **NFPA Hazard Classification:** Data not available

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Data not available

12.2 **Molecular Weight:** Data not available

12.3 **Boiling Point at 1 atm:** Data not available

12.4 **Freezing Point:** Data not available

12.5 **Critical Temperature:** Data not available

12.6 **Critical Pressure:** Data not available

12.7 **Specific Gravity:** Data not available

12.8 **Liquid Surface Tension:** Data not available

12.9 **Liquid Water Interfacial Tension:** Data not available

12.10 **Vapor (Gas) Specific Gravity:** Data not available

12.11 **Ratio of Specific Heats of Vapor (Gas):** Data not available

12.12 **Latent Heat of Vaporization:** Data not available

12.13 **Heat of Combustion:** Data not available

12.14 **Heat of Decomposition:** Not pertinent

12.15 **Heat of Solution:** Not pertinent

12.16 **Heat of Polymerization:** Not pertinent

12.25 **Heat of Fusion:** Data not available

12.26 **Limiting Value:** Data not available

12.27 **Reid Vapor Pressure:** Data not available

NOTES

AMERICAN COLLOID COMPANY

One North Arlington • 1500 West Shure Drive
Arlington Heights, Illinois 60004-1434 • USA
(312) 392-4600 • Telex ITT 4330321
Fax (312) 506-6199

51601
51401

PRODUCT NAME: 1/4" VOLCLAY TABLETS

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point	- Not Applicable	Specific Gravity (H_2O = 1)	- 2.5
Vapor Pressure (mm Hg.)	- Not Applicable	Melting Point	- Not Applicable
Vapor Density (AIR = 1)	- Not Applicable	Evaporation Rate (Butyl Acetate = 1)	- Not Applicable
Solubility in Water	- Negligible		
Appearance and Odor	- Pale grey to buff tablets, odorless		

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used) - Not Applicable
Flammable Limits - Not Applicable LEL- - UEL- -
Extinguishing Media - Not Applicable
Special Fire Fighting Procedures - Inorganic Mineral/Non-Flammable
Unusual Fire and Explosion Hazards - Not Applicable

Section V REACTIVITY DATA

Stability Unstable -
Stable - X
Conditions to Avoid - None Known

Incompatibility (Materials to Avoid) - None Known
Hazardous Decomposition or By-products - None Known

Hazardous Polymerization May Occur -
Will Not Occur - X
Conditions to Avoid - None Known

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No

Health Hazards (Acute and Chronic) - May cause delayed respiratory disease if dust inhaled over a prolonged period of time.

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No

IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 42, 1987) concludes that there is "limited evidence" of the carcinogenicity of crystalline silica to humans. IARC classification 2A.

Signs and Symptoms of Exposure - Excessive inhalation of dust may result in shortness of breath and reduced pulmonary function.

Medical Conditions Generally Aggravated by Exposure - Individuals with pulmonary and/or respiratory disease including but not limited to asthma and bronchitis should be precluded from exposure to dust.

Emergency and First Aid Procedures - Eyes - Flush with water.
- Gross inhalation of dust - Remove to fresh air; give oxygen or artificial respiration if necessary; get medical attention.

MONSANTO PRODUCT NAME

TRISODIUM PHOSPHATE (TSP CRYSTALLINE)

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167

Emergency Phone No.
(Call Collect)
314-694-1000

PRODUCT IDENTIFICATION

Synonym(s):	TSP/C; Trisodium orthophosphate; Sodium phosphate, tribasic; Trisodium phosphate dodecahydrate
Chemical Name:	Phosphoric acid, trisodium salt
Chemical Formula:	$Na_3PO_4 \cdot 12H_2O \cdot 1/4$ NaOH (approximately)
Chemical Family:	Phosphate salts
CAS No.:	10101-89-0
TSCA Inventory:	Since hydrated materials could not be reported on the Inventory of Chemical Substances published by the U.S. Environmental Protection Agency (EPA) under authority of the Toxic Substances Control Act (TSCA), trisodium phosphate crystalline was reported as anhydrous with the CAS No. 7601-54-9.
DOT Proper Shipping Name:	Sodium Phosphate, Tribasic (see *Note* below)
DOT Hazard Class/ I.D. No.:	ORM-E/NA9148
DOT Label(s):	Not Applicable
U.S. Surface Freight Classification:	Trisodium Phosphate
Reportable Quantity (RQ) Under U.S. EPA CERCLA Regulations:	5,000 lbs.
Hazardous Chemical(s) Under OSHA Hazard Communication Standard:	The substance listed below is identified as a hazardous chemical under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200): Trisodium phosphate crystalline, CAS Reg. No. 10101-89-0

Note: Packages containing less than 5,000 lbs. are not regulated.

WARNING STATEMENTS

DANGER!
CAUSES BURNS TO EYES
CAUSES IRRITATION TO EYES AND SKIN

PRECAUTIONARY MEASURES

Do not get in eyes, on skin, on clothing.
Avoid breathing dust.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

EMERGENCY AND FIRST AID PROCEDURES

FIRST AID: IF IN EYES, immediately flush with plenty of water for at least 15 minutes. Call a physician.

IF ON SKIN, immediately flush with plenty of water. Remove contaminated clothing. Wash clothing before reuse.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical safety goggles to prevent eye contact. Have eye baths immediately available where eye contact can occur.

Skin Protection: Wear appropriate impervious gloves and protective clothing to prevent skin contact. Launder contaminated clothing and clean protective equipment before reuse.

Respiratory Protection: Use NIOSH approved equipment when airborne exposure is excessive. Consult respirator manufacturer to determine appropriate type equipment for given application.

Ventilation: Provide ventilation to minimize exposure. Local exhaust ventilation preferred.

Airborne Exposure Limits:

Product: Trisodium phosphate crystalline

Although no specific exposure limit has been established for this material, OSHA and ACGIH have established the following limits for nuisance dusts:

OSHA PEL/TWA: Total 15 mg/m³; Respirable 5 mg/m³
ACGIH TLV®/TWA: Total 10 mg/m³; Respirable 5 mg/m³

These limits are stated only to indicate the least stringent airborne dust exposure levels applicable to nuisance dusts.

FIRE PROTECTION INFORMATION

This material is not combustible.

REACTIVITY DATA

Materials to Avoid: Trisodium phosphate crystalline could be corrosive to aluminum surfaces because of high pH. Sealed containers should be kept free of water because of its corrosivity when wet.

Hazardous Decomposition Products: None.

Hazardous Polymerization: Does not occur.

HEALTH EFFECTS SUMMARY

The following information presents both human experience and the results of scientific experiments used by qualified experts to assess the effects of trisodium phosphate crystalline on the health of industrially exposed individuals and to support the Precautionary Statements and Occupational Control Procedures recommended in this document. To avoid misunderstanding, the data provided in this section should be interpreted by individuals trained in evaluation of this type of information.

Human Experience

Inhalation and dermal contact are expected to be the primary routes of occupational exposure to trisodium phosphate crystalline. Trisodium phosphate crystalline is corrosive to the eyes. Due to the high pH, dermal contact with this material may result in irritation. Occupational exposure to this material has not been reported to cause significant adverse human health effects when recommended safety precautions are followed.

Toxicological Data

Data from Monsanto studies and the scientific literature indicate the following:

Oral LD_{50} (Rat): 6,500 mg/kg, Practically Nontoxic
Dermal LD_{50} (Rabbit): Greater than 7,940 mg/kg, Practically Nontoxic
Eye Irritation (Rabbit): (FHSA) Corrosive
Skin Irritation (Rabbit): (FHSA) 3.3 on a scale of 8.0, Moderately Irritating

Trisodium phosphate produced no increase in chromosomal aberrations or recessive lethal mutations in assays using *Drosophila melanogaster.*

PHYSICAL DATA

Appearance and Odor:	White, crystalline, free-flowing granules or powder; odorless
pH (1% solution @ 25°C):	12
Bulk Density (lbs./cu. ft.):	Powder 61-65 Granular 58-64
Solubility (g/100 g H_2O) (Anhydrous Salt Basis):	11.6 @ 25°C 17.5 @ 40°C 35.3 @ 60°C 61.3 @ 80°C 84.5 @ 100°C

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

SPILL, LEAK & DISPOSAL INFORMATION

Emergency Spill and Leak Information: Sweep, scoop or vacuum up all spilled material, contaminated soil and other contaminated material and place in containers. If possible, complete cleanup on a dry basis. After all practical dry cleanup has been done, residual contamination can be flushed with plenty of water.

(Spill, Leak & Disposal Information Continued On The Next Page)

SPILL, LEAK & DISPOSAL INFORMATION (Continued)

Sodium phosphate, tribasic, as currently defined, is a *hazardous substance* under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). If 5,000 pounds or more are released into the environment, it must be reported to the National Response Center (800-424-8802 or 202-426-2675). Since local, state and federal laws may vary, consult your attorney or appropriate regulatory officials for information relating to spill reporting.

Disposal Information: Dispose of in a landfill in accordance with all applicable local, state and federal regulations.

ADDITIONAL COMMENTS

Environmental Toxicity Information:

96-hr LC_{50} Bluegill: 440 mg/l, Practically Nontoxic
96-hr LC_{50} Rainbow Trout: 260 mg/l, Practically Nontoxic

DATE: 10/1/85 **SUPERSEDES:** 8/1/83

MSDS NO.: 010101890

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

Product Acceptability Coordinator
Detergent Materials
Monsanto Industrial Chemicals Co.
314-694-2096
(A Unit of Monsanto Company)

MATERIAL SAFETY DATA SHEET

I. MATERIAL IDENTIFICATION

Name: Super Unleaded Gasoline
Conoco Product Code: 1420
Synonyms: Automotive Unleaded Gasoline
Chemical Family: Mixed Petroleum Hydrocarbons
Manufacturer: Conoco Inc.
Address: P. O. Box 1267, Ponca City, OK 74603

CAS Reg. No.: Mixture
Transportation Emergency No.:
(800) 424-9300 (Chemtrec)
Product Information No.:
(405) 767-6000

II. HAZARDOUS INGREDIENTS — HAZARD DATA

Hazard Determination:

Health Effect Properties:

Hydrocarbons (Aromatic and paraffinic hydrocarbons)	Potential to cause kidney toxicity and tumors of the liver, skin, and kidney in laboratory animals.
Benzene (71-43-2)	A few studies have indicated that workers exposed many years to high concentrations of benzene have a slightly higher incidence of leukemia.

Physical Effect Properties:

Product/Mixture:	Class I A Flammable Liquid per NFPA Code No. 30-1984.

III. PHYSICAL DATA

Appearance and Odor: Red liquid; gasoline odor.

Boiling Range (Deg.F)	85-437	Specific Gravity (H_2O=1)	70-0.77
Vapor Pressure (mmHg) at 68F	275-475	% Volatile (by volume)	100
Solubility in Water	Insoluble		

IV. REACTIVITY DATA — Stable: X — Unstable:

Hazardous Decomposition Products: Carbon monoxide may be formed from incomplete combustion.

Conditions to Avoid: Oxidizing materials, heat, flame.

Hazardous Polymerization: Will not occur.

V. FIRE AND EXPLOSION HAZARD DATA — LFL: 1.3 — UFL: 6.0

Flash Point (Method used): As low as -50F (TCC)
Handle and store in accordance with NFPA procedure for Class I A Flammable Liquid.

Extinguishing Media: Use dry chemical, foam, or carbon dioxide.

V. FIRE AND EXPLOSION HAZARD DATA (continued)

Special Fire Fighting Procedures: Water may be ineffective to extinguish, but water should be used to keep fire-exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect personnel attempting to stop a leak. Water spray may be used to flush spills away from exposure.

Unusual Fire and Explosion Hazards: Highly flammable. Products of combustion may contain carbon monoxide, carbon dioxide and other toxic materials. Do not enter enclosed or confined space without proper protective equipment including respirator protection.

National Fire Protection Agency (NFPA) CLASSIFICATION			HAZARD RATING		
Health 1	Fire 3	Reactivity 0	Least - 0	Slight - 1	Moderate - 2
				High - 3	Extreme - 4

VI. TRANSPORTATION AND STORAGE — DOT HAZARD CLASS: Flammable liquid

Precautions To Be Taken In Handling And Storing: Product is Class I A Flammable Liquid per NFPA Code No. 30-1984. Store and handle accordingly.

Shipping Paper Description: Gasoline, flammable liquid, UN 1203.

Placard: Flammable.

D.O.T. Label: Flammable liquid.

OSHA Label: CAUTION: Minimize exposure. This product contains benzene and certain other hydrocarbons which are potentially toxic or carcinogenic.

If ingested, do not induce vomiting. Call a physician immediately. Wash thoroughly with soap and water after contact.

Flammable Liquid.

VII. HEALTH HAZARD INFORMATION

PEL Not Established TLV 300 ppm
Ceiling Value Not Established AEL Not Established

Primary Routes of Exposure/Entry: Inhalation, skin.

Signs and Symptoms of Exposure/Medical Conditions Aggravated by Exposure: Studies with rodents have shown that petroleum distillates have caused kidney damage and kidney or liver tumors. However, the kidney effects were not seen in similar studies involving guinea pigs, dogs, or monkeys. Several studies evaluating petroleum workers have not shown significant increases of kidney damage nor kidney or liver tumors.

VII. HEALTH HAZARD INFORMATION (continued)

Mouse skin painting studies have shown that unrefined petroleum distillates having a boiling point of 120-700F, and which are similar to ingredients in this product, caused a low incidence of skin tumors. Studies of petroleum workers have not shown a significant increased incidence of skin tumors.

The product may cause irritation to eyes, lungs, or skin after prolonged or repeated exposure. Overexposure may cause central nervous system depression.

Data from animal studies with a generic unleaded gasoline, funded by the American Petroleum Institute:

Median lethal dose, rat oral: 18.8 ml/kg
Skin toxicity, rabbits: No mortality at dose of 5 ml/kg
Slight irritation to skin.
Eye irritation, rabbits: Non-irritating
Genotoxic studies: Negative
Reproductive toxicity: No abnormalities in newborn rats.

Listed as Carcinogen or Potential Carcinogen by: NTP No IARC No OSHA No

VIII. EMERGENCY AND FIRST AID PROCEDURES

Eyes: Immediately wash with fresh water for at least 15 minutes and get medical attention.

Skin: Remove contaminated clothing as soon as possible. Wash exposed skin thoroughly with soap and water. If irritation persists, consult a physician.

Launder contaminated clothing before reuse. Extremely contaminated leather shoes should be discarded.

Inhalation: If overexposure occurs, remove individual to fresh air. If breathing stops, administer artificial respiration.

Ingestion: If this material is swallowed, do not induce vomiting. If vomiting begins, lower victim's head in an effort to prevent vomitus from entering lungs. Immediately consult a physician. Do not attempt to give liquid to an unconscious person.

Note to Physicians: Gastric lavage by qualified medical personnel may be considered, depending on quantity of material ingested.

IX. SPILL, LEAK AND DISPOSAL PROCEDURES

RCRA HAZARDOUS WASTE: Yes X No

In Case of Spill or Leak: Contain spill immediately in smallest area possible. Recover as much of the product itself as possible by such methods as vacuuming, followed by soaking up of residual fluids by use of absorbent materials. Remove contaminated items including contaminated soil and place in proper containers for disposal. Avoid washing, draining or directing material to storm or sanitary sewers.

Waste Disposal Method: Recycle as much of the recoverable product as possible. Dispose of nonrecyclable material as a RCRA hazardous waste by such methods as incineration, complying with federal, state and local regulations.

X. PRECAUTIONARY MEASURES

Respiratory Protection: Use air mask or hydrocarbon absorbing respirator.

Ventilation: Use adequate ventilation to meet recommended concentrations. Avoid sparking hazards and explosive mixtures.

Protective Gloves: Impervious as needed to avoid skin contact.

Eye Protection: Goggles or face shield for sprays/mists or if splashing is probable.

Other Protective Equipment: Protective clothing should be worn. Soiled clothing should be removed and laundered.

Allied Chemical
An ALLIED Company

SULFURIC ACID

PRODUCT SAFETY DATA SHEET

A. GENERAL INFORMATION

TRADE NAME (COMMON NAME OR SYNONYM)	☒ C.A.S. NO. ☐ ALLIED PRODUCT CODE
[redacted]	7664-93-9

CHEMICAL NAME
Sulfuric Acid

FORMULA	MOLECULAR WEIGHT
77 to 99 wt. % H_2SO_4 in water	98.08

ADDRESS (No., STREET, CITY, STATE AND ZIP CODE)
ALLIED CHEMICAL
P.O. Box 1139R
Morristown, N.J. 07960

CONTACT	PHONE NUMBER	ISSUED DATE	REVISED DATE
Director, Product Safety	(201) 455-4157	June, 1980	July, 1982

B. FIRST AID MEASURES

EMERGENCY PHONE NUMBER
(201) 455-2000

Skin or Eyes: Immediately flush with plenty of water continuing for at least 15 minutes. Remove contaminated clothing. Continue flushing with water if medical attention is not immediately available.

Ingestion: Drink large amounts of water (or milk if available) to dilute the acid. Do not induce vomiting.

Inhalation: Remove to fresh air. Observe for possible delayed reaction. If breathing has stopped, give artificial respiration. If breathing with difficulty, give oxygen, provided a qualified operator is available.

GET PROMPT MEDICAL ATTENTION for ingestion, inhalation, eye contact, irritation, or burns. Additional procedures are outlined in References listed in Section J.

C. HAZARDS INFORMATION

HEALTH

INHALATION
Inhalation of fumes or acid mist can cause irritation or corrosive burns to the upper respiratory system, including nose, mouth, and throat. Lung irritation and pulmonary edema can also occur. LC_{50} (mist, animals): 20-60 mg/cu.m – Ref. (a)

INGESTION
Can cause irritation and corrosive burns to mouth, throat, and stomach. Can be fatal if swallowed.
Applicable to dilute solutions: LD_{50} (rat): 2140 mg/kg – Reference (b).

SKIN
Can cause severe burns or irritation.

EYES
Liquid contact can cause irritation, corneal burns, and conjunctivitis. Blindness may result, or severe or permanent injury. Mist contact may irritate or burn. Reference (b).

PERMISSIBLE CONCENTRATION AIR (SEE SECTION J): 1 mg/cu.m. (as H_2SO_4) (OSHA) BIOLOGICAL

TLV same (ACGIH)

[illegible] CHRONIC TOXICITY
(1) Erosion of teeth, (2) lesions of the skin, (3) tracheo bronchitis, (4) mouth inflammation, (5) conjunctivitis, (6) gastritis. Reference (a)

CC1,54 236 12/81

HAZARDS (Cont.)

FIRE AND EXPLOSION

FLASH POINT °C	AUTO IGNITION TEMPERATURE °C	FLAMMABLE LIMITS IN AIR (% BY VOL.)
Not Flammable [ ] OPEN CUP [ ] CLOSED CUP	Not applicable	Not applicable

UNUSUAL FIRE AND EXPLOSION HAZARDS

Flammable and potentially explosive hydrogen gas can be generated inside metal drums and storage tanks. Concentrated [illegible] (as sold) can ignite combustible materials on contact.

PRECAUTIONS/PROCEDURES

FIRE EXTINGUISHING AGENTS RECOMMENDED

Use water spray or other suitable agent for fires adjacent to non-leaking tanks or other containers of sulfuric acid.

FIRE EXTINGUISHING AGENTS TO AVOID

Do not use solid water streams near ruptured tanks or spills of sulfuric acid. Acid reacts violently with water and can spatter acid onto personnel.

SPECIAL FIRE FIGHTING PRECAUTIONS

At high temperatures, sulfuric acid mist or sulfur trioxide gas can be released from vented or ruptured containers. If water is added to concentrated sulfuric acid, violent spattering can occur, and considerable heat may be evolved. Wear NIOSH-approved self-contained breathing apparatus with full facepiece and full protective clothing. Cool non-leaking fire-exposed containers with water spray.

VENTILATION

Sufficient to reduce vapor and acid mists to permissible levels. Packaging and unloading areas and open processing equipment may require mechanical exhaust systems. Corrosion-proof construction recommended.

NORMAL HANDLING

Keep sources of ignition away. Do not get in eyes, on skin, on clothing. Do not breathe vapor or mist. Use with adequate ventilation and use protective equipment as outlined in Section E. Procedures are detailed in references listed in Section J (Allied). Do not add water to acid. When diluting, always add acid to water, using caution and proper agitation.

STORAGE

Store in cool, well-ventilated area away from combustibles and reactive chemicals. Vent metal containers weekly or more frequently in hot weather to prevent hydrogen gas build-up. Diking of storage tanks is recommended.

SPILL OR LEAK

Dilute small spills or leaks cautiously with plenty of water. Neutralize residue with alkali such as soda ash or lime. Adequate ventilation is required for soda ash due to release of carbon dioxide gas. No smoking in spill area. For major spills, keep unprotected persons away. Protected persons should contain the acid by diking the spill with soil or clay. Recover the acid if possible. (See Section I for disposal methods.) Attempt to keep out of sewer. Any release to the environment of these products may be subject to Federal and/or state reporting requirements. Check with appropriate agencies.

SPECIAL PRECAUTIONS/PROCEDURES/LABEL INSTRUCTIONS

Vapor may contain explosive hydrogen. To prevent ignition of this if present, smoking, flames, and sparks should not be permitted in storage areas. Causes severe burns. Label signal word: DANGER!

PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY PROTECTION

Where required, use a respirator approved by NIOSH for sulfuric acid or mists, as applicable. Some exposures may require a self-contained breathing apparatus with full facepiece or supplied-air respirator with a full facepiece, helmet, or hood. —References (e, f, g).

EYES AND FACE

As a minimum, wear hard hat, chemical safety goggles, and full-face plastic shield. Do not wear contact lenses. For increased protection, use supplied-air acid hood.

HANDS, ARMS, AND BODY

As a minimum, wear acid-resistant apron, protective clothing, boots and gauntlet gloves for routine product use. For increased protection, include acid-resistant trousers and jacket.

OTHER CLOTHING AND EQUIPMENT

Eye wash and quick-drench shower facilities, protected from freezing, should be available wherever Sulfuric Acid is stored or handled.

PHYSICAL DATA

MATERIAL IS (AT NORMAL CONDITIONS):	APPEARANCE AND ODOR	
☒ LIQUID ☐ SOLID ☐ GAS ☐ _____	Oily, colorless to slightly yellow, clear to turbid liquid. Odorless.	
BOILING POINT *a. 193 °C b. 279 MELTING POINT c. 310 °C	SPECIFIC GRAVITY (H_2O = 1) *a. 1.706 b. 1.835 c. 1.842	VAPOR DENSITY (AIR = 1) Not applicable
SOLUBILITY IN WATER (% by Weight) Complete	pH 1% solution: pH = 0.9	VAPOR PRESSURE (mm Hg at 20° C) ☐ (PSIG) ☐ negligible @ ambient
EVAPORATION RATE (Butyl Acetate = 1) ☐ (Ether = 1) ☐ Not applicable	% VOLATILES BY VOLUME (At 20° C) Not applicable	*a. 60°Be= 77.7% H_2SO_4 b. 66°Be=93% H_2SO_4 c. 99% H_2SO_4

REACTIVITY DATA

STABILITY	CONDITIONS TO AVOID
☐ UNSTABLE ☒ STABLE	Temperatures of 300°C or higher: yields sulfur trioxide gas, which is toxic, corrosive, and an oxidizer.

INCOMPATIBILITY (MATERIALS TO AVOID)

Nitro compounds, carbides, dienes, alcohols (when heated): cause explosions-Refs. (i, j, k). Oxidizing agents, such as chlorates and permanganates: cause fires and possibly explosions. Allyl compounds and aldehydes: undergo polymerization, possibly violent–Ref. (i), (continued, Section K).

HAZARDOUS DECOMPOSITION PRODUCTS

Sulfur trioxide gas: see above. Also this is a fire risk if in contact with organic materials.

HAZARDOUS POLYMERIZATION	CONDITIONS TO AVOID
☐ MAY OCCUR ☒ WILL NOT OCCUR	

HAZARDOUS INGREDIENTS (Mixtures Only)

MATERIAL OR COMPONENT/C.A.S. #	WT. %	HAZARD DATA (SEE SECT. J)
NOT APPLICABLE		

12. ENVIRONMENTAL

BIODEGRADABILITY/AQUATIC TOXICITY

Aquatic Toxicity:

24.5 ppm/24 hr./bluegill/lethal/fresh water

42.5 ppm/48 hr./prawn/LC_{50}/salt water

OCTANOL/WATER PARTITION COEFFICIENT

EPA HAZARDOUS SUBSTANCE? ☒ YES ☐ NO IF SO, REPORTABLE QUANTITY: 1000 # (100% H_2SO_4 basis) 40 CFR 116.117

WASTE DISPOSAL METHODS (DISPOSER MUST COMPLY WITH FEDERAL, STATE AND LOCAL DISPOSAL OR DISCHARGE LAWS)

Waste sulfuric acid should be cautiously diluted with water and neutralized with an alkali. Neutralized waste must be disposed of in accordance with applicable disposal regulations. Waste may have to be disposed of by an approved contractor. (EPA corrosive waste–D002) applicable to the unneutralized acid).

RCRA STATUS OF UNUSED MATERIAL:

EPA Hazardous Waste No. D002 (corrosive) if discarded 40 CFR 261.22

13. REFERENCES

PERMISSIBLE CONCENTRATION REFERENCES

(1) OSHA standard at 29 CFR 1910.1000 (1981).

(2) TLV from the ACGIH 1981 list, "Threshold Limit Values for Chemical Substances. . .", Am. Conf. of Governmental Industrial Hygienists, Cincinnati 45202.

REGULATORY STANDARDS

D.O.T. CLASSIFICATION Corrosive material 49 CFR

DOT ID Number: UN 1830.

GENERAL

(a) Documentation of the Threshold Limit Values, 4th Edition, 1981, Am. Conf. of Governmental Hygienists, Cincinnati 45202.

(b) NIOSH, Registry of Toxic Effects of Chemical Substances, 1979, Accession #WS 556 00 000, PB81-154478, Nat. Tech. Info. Service, Springfield, VA 22161.

(c) Allied Corporation wall chart.

(d) Allied Corporation product information bulletin.

14. ADDITIONAL INFORMATION

J. REFERENCES–General (continued)

(e) "Criteria for a Recommended Standard. . . Occupational Exposure to Sulfuric Acid", NIOSH U.S. Dept. of HHS, 1974, PB233098, Nat. Tech. Info. Service, Springfield, VA 22161.

(f) NIOSH/OSHA, "Pocket Guide to Chemical Hazards. . .", 1978.

(g) "NIOSH/OSHA–Occupational Health Guidelines for Chemical Hazards–Sulfuric Acid", 1978.

(h) Allied Chemical Technical Service Report for storage and handling procedures.

(i) NFPA Manual 491M, "Manual of Hazardous Chemical Reactions, 1975, Nat. Fire Protection Assoc., Boston 02210.

(j) Allied Corporation Product Safety Data Sheet for Sodium Sulfite, 1982.

(k) Bretherick, L., Handbook of Reactive Chemical Hazards, 2nd Ed., 1979, Butterworths, Boston.

G. REACTIVITY DATA–Incompatibility (continued)

Alkalis, amines, water, hydrated salts, carboxylic acid anhydrides, nitriles, olefinic organics, glycols, aqueous acids: cause strong exothermic reactions. –Refs. (i, k). Carbonates, cyanides, sulfides, sulfites, metals such as copper: yield toxic gases. –Refs. (j, k). Also for metals, see hydrogen generation, Section C.

Information (hazards, precautions, first aid, etc.) is abbreviated. More detailed information is contained in references found in Section J.

This product is not for food or drug use.

DRI-MIX CONCRETE CO.

MAILING ADDRESS:
6200 BRYANT STREET
DENVER, COLORADO 80221

MANUFACTURING PLANTS:
DENVER, COLORADO
(303) 429-2111
GRAND JUNCTION, COLORADO
(303) 245-0058

Material Safety Data Sheet
(OSHA 29 CFR 1910.1200)

Product Name: PORTLAND CEMENT

SECTION I

Manufacturer's Name and Address

Dri-Mix Concrete Company
6200 Bryant Street
Denver, Colorado 80221

Emergency Telephone Number

(303) 429-2111

Information Telephone Number

(303) 429-2111

Date of Preparation

August 24, 1987

SECTION II -- HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components	C.A.S. NO.	OSHA PEL	ACGIH TLV
Portland Cement Type I/II	65997-15-1	50 mppcf	10 mg/m^3
(which may contain Crystalline Silica	7631-86-9	0.1 mg/m^3 as quartz	0.1 mg/m^3)

SECTION III -- PHYSICAL/CHEMICAL CHARACTERISTICS

Solubility in water -- slight
Gray colored with low odor

The following properties are not applicable: specific gravity; boiling point; vapor pressure; vapor density; melt point; and evaporation rate.

SECTION IV -- FIRE AND EXPLOSION HAZARD DATA

Noncombustible and not explosive.

SECTION V -- REACTIVITY DATA

Is not incompatible with other materials. Will not decompose into hazardous by-products and will not polymerize.

Keep dry until used to preserve utility.

SECTION VI -- HEALTH HAZARD DATA

Exposure can affect the skin, the eyes, and mucous membranes.

Dust particles of respirable size dust from this product are hazardous to the respiratory system because of the presence of free silica.

Acute Exposure: Can dry the skin and cause alkali burns. Dust can irritate the eyes and upper respiratory system.

Chronic Exposure: Dust can cause inflammation of the lining tissue of the interior of the nose and inflammation of the cornea. Hypersensitive individuals may develop an allergic dermatitis. Over exposure to inhaled quartz dust may lead to chronic fibrotic lung disease known as silicosis, a form of disabling, progressive, and sometimes fatal pulmonary fibrosis. People with pre-existing lung diseases may have increased susceptibility to the health effect of respirable dusts.

Emergency First Aid Procedures: Irrigate (flood) eyes immediately and repeatedly with clean water. Wash exposed skin areas with soap and water. Get prompt medical attention.

SECTION VII -- PRECAUTIONS FOR SAFE HANDLING AND USE

If spilled, can be cleaned up using dry method that does not disperse dust into the air. Avoid breathing the dust. Emergency procedures are not required.

Can be treated as a common waste for disposal or returned to the container for later use if it is not contaminated or wet.

SECTION VIII -- CONTROL MEASURES

In dusty environments, the use of an OSHA, MSHA, or NIOSH approved respirator and tight fitting goggles is recommended.

Local exhaust can be used, if necessary, to control dust levels. The use of barrier creams or impervious gloves, boots, and clothing to protect the skin from contact is recommended. Following work, workers should shower with soap and water.

Precautions must be observed because burns occur with little warning -- LITTLE HEAT IS SENSED.

ASBESTOS FACT SHEET

This fact sheet was prepared from Code of Federal Regulations 29.1910.1001

1. Substance Identification

"Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals that are included in this group are chrysotile, crocodile, amosite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos.

Asbestos is present in pipe and boiler insulation materials, and in sprayed-on materials located on beams, in crawlspaces, and between walls. The potential for a product containing asbestos to release breathable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers.

Permissible exposure: Exposure to airborne asbestos fibers may not exceed 0.2 fibers per cubic centimeter of air (0.2 f/cc) averaged over the 8-hour workday.

11. Health Hazard Data

"Asbestos" can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

Exposure to asbestos has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

III. Respirators and Protective Clothing

Respirators: You are required to wear a respirator when performing tasks that result in asbestos exposure that exceeds the permissible exposure limit (PEL) of 0.2 f/cc.

Air purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos fiber concentrations do not exceed 2 f/cc; otherwise, air-supplied, positive pressure, full facepiece respirators must be used.

Protective Clothing: You are required to wear protective clothing in work areas where asbestos fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin.

IV. Toxicology

Clinical evidence of the adverse effects associated with exposure to asbestos is present in the form of increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos .

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among non-exposed smokers or exposed nonsmokers.

APPENDIX D

CONFINED SPACE ENTRY PROCEDURES

CONFINED SPACE ENTRY PLAN

1.0 Introduction and Application

This confined space entry plan has been developed for the activitiesassociated with the Site Investigation (SI) of the Bennett Army National Guard Titan I Missile Facility. The plan is designed for the SI sampling team which will enter the underground complex for the purpose of collecting environmental samples. The information gained during facility inspection conducted by Stollar & Associates in September 1990 was used in the development of the procedures described in this plan.

This confined space entry plan may not be appropriate for operations outside of the described scope of work.

Entry into the underground missile complex requires a written confined space entry plan due to limited egress from within the complex and the isolation of the underground atmosphere. Each entry shall be preceded by the completion of an entry permit by the site health & safety officer (Section 4.0)

2.0 Regulatory Considerations

This confined space entry plan was developed in accordance with the requirements of 29 CFR 1910.146. In addition, several mandatory and advisory guidance documents apply to the BANGF confined space entry program. In situations where directives may conflict, the most reasonably conservative approach has been applied.

2.1 U. S. Army Requirements

Two military standards have been reviewed and applied to the development of this plan. They are:

- Army Corps of Engineers Safety and Health Requirements Manual, EM 385-11, October 1987, Chapter 27 (Appendix A)

- Army Technical Manual TM 5-612 Asbestos Control

2.2 Non-Military Guidance Documents

Several guidance documents were applied to the development of the plan in addition to the Army manuals, these included:

- "Confined Space Entry Control System for R&D Operations" National Safety Council Data Sheet 1-704-85

- "Criteria for a Recommended Standard-Working in Confined Spaces" National Institute for Occupational Health

- CFR 1910 & 1926 (OSHA requirements for hazardous waste sites, construction sites, and general industry)

- "Threshold Limit Values and Biological Exposure Indices" The American Conference of Governmental Industrial Hygienists, 1990

3.0 Hazard Assessment

3.1 Atmospheric Hazards

Atmospheric hazards are a major concern underground due to the isolation of the environment. The silos have been partially sealed for several years, with little or no passive ventilation. The ventilation ducts were observed to have been covered with soil and/or flooded with water.

Oxygen deficiency is a potential hazard due to: I) the anticipated presence of rusting metal can consume oxygen 2) biological decomposition which may also consume oxygen, 3) chemical reactions which deplete oxygen content, and 4) the previous use of inert gases and fuels which could result in the displacement of oxygen.

Explosive gases or vapors could result from the accumulation of volatilized fuels and/or the accumulation of methane gas from organic decomposition (i.e. sewage, plants, etc.). Desorption of chemicals from the inner surfaces of tanks and cylinders may occur once the product is emptied and no longer under pressure.

Toxic gases, vapors, and particulates are potential hazards due to the use of fuels, acids, asbestos, dielectric fluids, coolants, and water treatment chemicals while the complex was in operation. Specific materials identified in the PA are:

RP-I (Kerosene-Alcohol propellant)
Sodium Hydroxide
Sodium Hypochlorite
Water Demineralizing Chemicals
Sulfuric Acid
Diesel Fuel
Hydraulic Fluid
PCBs
Ethylene Glycol
Compressed
Oxygen
Compressed Helium

Compressed Nitrogen
Refrigerant
Asbestos

Most of these materials have been removed; however, the entry shall be conducted under the assumption that all products may be present until the assessment confirms otherwise. If all products are present, the potential exists for exposure to products of reaction. The incompatible mixtures could result in the physical and/or toxic products of heat, pressure, hydrogen gas, hydrogen sulfide, chlorine gas, and carbon dioxide. The results of the initial survey indicate no likely mixtures of incompatible chemicals.

The major toxic effects associated with the potential contaminants include:

- eye and skin irritation from acids and bases;
- carcinogenic effects from asbestos
- dermatoses from skin contact with fuels, and Biocides;
- upper airway irritation from chlorinated compounds and solvent vapors;
- adverse effects to the nervous system and kidneys from fuel vapors and coolants
- respectively;
- simple asphyxiation from oxygen displacement; and
- chemical asphyxiation due to hydrogen sulfide exposure.

The results of the industrial hygiene and safety assessment conducted during the site inspection demonstrated oxygen levels of 19.5 percent or greater throughout the accessible areas of the complex. Furthermore, no combustible gases or vapors or hydrogen sulfide gas was detected underground with the MSA 361 trimeter. Total organic vapors were surveyed with a Foxboro 108 Organic Vapor Analyzer, demonstrating an absence of such vapors. Gamma and beta radiation was surveyed with an Eberline GM survey instrument and airborne alpha radiation was monitored with an Eberline Scintillation meter with both instruments demonstrating an absence of ionizing radiation above background. Asbestos containing materials were found in the control room and a strong possibility exists that similar asbestos materials are scattered throughout the facility. However, air samples collected in the main access tunnels did not demonstrate airborne asbestos fibers in those areas. No other chemical analysis or monitoring was conducted during the survey.

3.2 Safety Hazards

The major safety hazards associated with the silo facility confined space entry program include falls, poor footing, missing guard rails and catwalks, submersion under water, entrapment, and related structural concerns. Heat stress is not anticipated at the 45 ft depth. Mechanical and electrical hazards are not a likely concern due to the lack of electrical and hydraulic power.

Special attention will be given to the use of adequate lighting, fall protection, footing, and structural support.

4.0 Entry Procedures

The health and safety officer shall complete the Confined Space Entry Permit Form (Appendix A) prior to each team entry into the underground complex. The specific constituents of the completed form are discussed in this section.

Based on the results of the previous entry of the complex, the SI entries shall be conducted with the knowledge that the facility is not an "immediately dangerous to life or health" (IDLH) environment. It shall be conducted utilizing Level C equipment to include:

- Full face mask respirators with high efficiency particulate, acid gas, and organic vapor cartridges;
- Tyvek or comparable disposable coveralls; Steel-toed rubber boots;
- Nitrile gloves worn under leather work gloves; hard hats and MSHA-approved cap lamps;
- Miners belts with safety D rings; and
- Eye protection.

Certain operations performed underground shall be conducted in level B personal protective equipment to include a self-contained breathing apparatus. Such operations include tank and vessel sampling.

4.1 Entry Logistics

Task I shall be to pry the entry portal hatch open with a back hoe or crane and support the hatch open with duel 1-ton chains, then tie cable to the cement blocks for retrieval. The blocks shall be withdrawn one at a time and placed outside the work area. The hatch will be supported in the fully open position with skids or other suitable supports.

Task 2 shall be to position a ladder down the entry portal and support the head of the ladder at the lip of the hatch. A tripod retrieval system shall be assembled above the hatch and the cable from the winch attached to the health and safety officer during the initial descent. The winch shall be used as a safety and retrieval line in the event of ladder slippage or emergency egress.

Task 3 shall consist of remote sampling of the portal with a 50-ft hose attached to an oxygen, hydrogen sulfide gas, and combustible gas meter. Following the sampling, if the combustible gas levels are less then 20 percent of the lower explosive limit (LEL) for pentane, the oxygen is greater then 19.5 percent, and the hydrogen sulfide is less then 5 ppm, the safety officer and assistant will descend to the bottom of the portal and remotely test the atmosphere at the bottom of the service elevator. If conditions are adequate, he will signal the other team members by radio to climb down using the safety

cable. Table 1 lists conditions which may require upgraded protection and/or ventilation. The standby personnel shall don a SCBA, less the mask, and be prepared to provide emergency support in the event of an accident.

All underground work shall be conducted with combustion-proof cap lamps, safety belts and lines, and atmospheric test equipment. Air movement will be assessed with a ventilation smoke test kit and pH sampled with pH paper.

Use of two-way Motorola radios has been demonstrated to work effectively if an intermediate radio crew is stationed near the bottom of the portal.

All individuals entering the underground facility shall undergo decontamination upon exiting the portal. The techniques for decontamination are describedin the overall site health and safety plan.

Only those individuals with proper training and medical clearances as described in the project health and safety plan shall be permitted underground.All personnel working in investigation areas must complete the training required by 29 CFR 1910.120. This training includes 40 hours of initial hazardous waste operations training, three days of onthe job training, an 8 hour annual refresher training course, and, if acting in an onsite supervisory capacity, 8 hours of supervisory health and safety training. Personnel without documentation of the required training will not be permitted to enter the work areas. Certificates of training will be provided to the SHSO for each person working in the investigation areas. Of the support personnel on the surface, one shall serve as a safety technician with responsibility for the safety support equipment and shall be certified in first aid and CPR.

5.0 Air Monitoring Procedures

The project health and safety officer shall be responsible for the calibration, maintenance and use of air monitoring instrumentation. The air monitoring instruments selected for use prior to and/or during the entry are:

- oxygen, combustible gas, and hydrogen sulfide meter; and
- Organic Vapor Analyzer.

All instruments shall be field calibrated at the site prior to use. The oxygen meter is sensitive to atmospheric pressure changes (partial pressures) therefore, that instrument shall be recalibrated in the silo tunnels using bagged air from the surface.

Table 1 lists the action levels for the major atmospheric hazards of concern, based on the use of the instrument indicated.

Table 1 Air Monitoring Action Levels (breathing zone)

Contaminant	Sampling Method	PEL[1]	Level C Action Level	Level B Action Level	Other
Asbestos	NIOSH Methodology	0.2 Fibers/cc	0.1 Fibers/cc[2]	20 Fibers/cc	1 Fiber is the 30 min. Excursion Limit
Chlorine	Colormetric Tube	0.5 ppm	0.5 ppm	5 ppm	------
Organic Vapors	OVA	Variable	5 Units[2]	50 Units[2]	------
H_2S	H_2S Meter	10 ppm	NA	10 ppm	------
Oxygen	Oxygen Meter	NA	NA	< 19.5%	------
Combustible Gas	Combustible Gas Meter	NA	NA	NA	Ventilate or withdraw if levels exceed 10% LEL[3]
Beta/Gamma Radiation	GM Meter	NA	Above Background	NA	Withdraw if levels exceed 0.5 mr/hr[4]

[1] PEL - OSHA Permissible Exposure Levels.
[2] Pending identification of product.
[3] LEL - Lower Explosive Limit.
[4] mr/hr - milliroentgens per hour.

6.0 Equipment and Supply List

The following lists of equipment and supplies are provided to aid in the procurement and logistical planning of the site.

6.1 Personnel Protective Equipment (PPE)

2- 60 minute SCBA units with airline attachment
disposable coveralls with hoods
cotton or Nomex coveralls
steel-toed boots
hardhats with cap lamp brackets
mine belts with safety rings
leather work gloves and surgical inner gloves
full face respirators with combination acid gas, organic vapor, particulate cartridges

6.2 Instruments

The instruments are listed in section 5.0. These instruments and the manufacturers' recommended calibration gases and check sources (Pentane, Hydrogen Sulfide, Methane, and Cesium source) shall be available at the site.

6.3 Tools and Accessories

1- tripod retrieval system
50 ft safety lines
miner's cap lamps and charger
waterproof notebooks
1- first aid kit
1- eyewash station (10 liter capacity)
radios
1- 20 ft ladder
1 set of decontamination brushes, TSP solution, bags and tubs
4-ton rated cable
2- air horns
1- set of hand tools
1- cooler of potable water

CONFINED SPACE ENTRY PERMIT[1]

LOCATION and DESCTRIPTION
of Confined Space _____ Date _____

PURPOSE of Entry _____ Time _____ M

1

DEPARTMENT _____ Expiration _____ M

PERSON in Charge of Work _____

SUPERVISOR (S) in Charge of Crews	Type of Crew	Phone

2

SPECIAL REQUIREMENTS	YES	NO		YES	NO
Lock Out - De-energize			Escape Harness		
Lines Broken - Capped or Blanked			Tripod Emergency escape unit		
Purge - Flush and vent			Lifelines		
3 Ventilation			Fire Extinguishers		
Secure Area			Lighting		
Breathing Apparatus			Protective Clothing		
Resuscitator - Inhalator			Respirator		

TEST(S) TO BE TAKEN (Valid for one 8-hour turn only)	Permissible Entry Level	Yes	No	Date M	Date M	Date M	Date M	Date M
% of Oxygen	-19.5% +21%							
4 % of Lower Explosion Level	Any % over 10							
Carbon Monoxide	50 ppm							
Aromatic Hydrocarbon	10 ppm							
Beta/gamma radiation	20 m REM/hr							

GAS TESTER _____

Note: Continuous/periodic tests shall be established before beginning job. Any questions pertaining to test requirements contact Safety Officer or the Certified Industrial Hygienist.

INSTRUMENTS USED Name	Type	Indent. No.
5		

SAFETY STANDBY PERSON(S) Name	Ck. No.
YES ☐	
NO ☐	

Supv. Authorization _____

AMBULANCE
FIRE

(1) Source: Federal Registar Vol. 54 No. 106 p. 24108

CONFINED SPACE ENTRY PERMIT

The form will be initiated by the Health and Safety Officer.

Part 1, 2, 3, and 4 (yes or no) can be completed at the procedure meeting, namely:

Location - Purpose - Person in Charge - Date - Time of job start - Estimated time of completion - Special requirements - Tests to be taken/how often

(Note) If job will continue an estimate of 6 turns, 6 copies of the entry permit will be initiated at the procedure meeting with the same information as stated above.

The supervisor in charge at the job site will negotiate the following:

Part 2 - Outside supervisor(s) - Group Leader - Type of Crew (Electrical, carpenter, boilermaker. etc.)

Part 4 - Results of tests taken prior to job entry - (Lab or certified gas tester will note all information on form, and sign.) List all other tests taken during turn.

Part 5 - List all instruments used for tests (Lab will note information on form.)

The supervisor at the job site will list name(s) of safety standby person(s) if needed.

The supervisor authorizing all the above conditions to his satisfaction will sign, date and time prior to work start. (Each turn)

Confined Space Entry Permit and Procedure will remain at the job site.

When job is completed -

Original to CKY, Inc.
Duplicate to USAEC Project Safety Officer

APPENDIX E

HEALTH AND SAFETY FORMS

HEALTH AND SAFETY PLAN ACCEPTANCE FORM

Instructions: This form is to be completed by each person to work on the subject project work site and returned to the Project Manager and Health and Safety Coordinator.

Project Name _____

Project Number _____

Date _____

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

_____
Name (Print)

_____
Signature

_____
Date

_____
Company/Division

ACCIDENT REPORT FORM

TO: _____

FROM: _____

Name of Injured of Ill Employee: _____

Date of Accident: _____

Exact Location of Accident:

_____

Project Name/Number: _____

Description of Accident: _____

_____

Nature of Illness or injury and Part of the Body Involved: _____

_____

Corrective Action Taken: _____

_____

_____

Corrective Action Remaining to be Taken (By Whom and By When): _____

_____

What can be done to prevent a recurrence of this type of accident?

_____

Signature of Supervisor/Manager: _____

Date: _____

NOTE: DO NOT USE FOR VEHICLE ACCIDENTS

U.S. ARMY ACCIDENT REPORT

For use of this form, see AR 385-40, the proponent agency is OCSA

FOR USASC USE ONLY

Requirement Control Symbol CSOCS-308

SECTION A - ACCIDENT INFORMATION

1. CHECK ONE
   - ☐ a. INITIAL
   - ☐ b. CHANGE

2. UIC *(Unit Identification Code) (6-Digit Code of Unit Having Accident)*

3a. UNIT NAME AND MILITARY ADDRESS

3b. BRANCH *(Armor, Infantry, etc.)*

4. DATE OF ACCIDENT
   - a. YR.
   - b. MO.
   - c. DAY

5. TIME OF ACCIDENT *(Local Military Time)*

6. PERIOD OF DAY *(Check one)*
   - ☐ a. Day
   - ☐ b. Night

7. ACCIDENT OCCURRED *(Check one)*
   - ☐ a. On Post
   - ☐ b. Off Post

8. IF ON POST, NAME OF INSTALLATION/FACILITY

9. ACCIDENT OCCURRED DURING *(Check one)*
   - ☐ a. Combat
   - ☐ b. Non-Combat

10. WERE EXPLOSIVES OR AMMUNITION INVOLVED OR PRESENT?
   - ☐ Yes *(See Instruction Book)*
   - ☐ No

11. EXACT LOCATION OF ACCIDENT *(Detailed enough to locate site) (State type of location.)*

SECTION B - PERSONNEL INFORMATION

12. NAME *(Last, First, MI)*

13. SOCIAL SECURITY NUMBER *(SSN)*

14. AGE

15. SEX *(Check)*
   - ☐ a. Male
   - ☐ b. Female

16. RANK OR GRADE

17. MOS OR JOB SERIES

18. ADDRESS *(Use Official Address for All Military or Government Personnel) (If different than block 3, add UIC.)*

19. DUTY STATUS AT TIME OF ACCIDENT *(Check one)*
   - ☐ a. On Duty
   - ☐ b. Off Duty

20. FLIGHT STATUS *(Check one)*
   - ☐ a. Yes
   - ☐ b. No

21. CONTINUOUS DUTY *(hrs.) (Without sleep)*

22. HRS. SLEEP IN LAST 24

23. DAYS LOST *(Est. no. of days lost from work; not counting day of injury. Bed rest/on quarters.)*

24. DAYS HOSPITALIZED *(Est. no. of days hospitalized receiving treatment; not for observation only.)*

25. DAYS OF RESTRICTED WORK ACTIVITY *(Est. number of days person cannot perform regular duties; light duty/profile.)*

26. SEVERITY OF ILLNESS/INJURY *(Check One)*

- a. **Fatal.**
- b. **Permanent Total Disability.** Person can never again do gainful work.
- c. **Permanent Partial Disability.** Person loses or can never again use a body part.
- d. **Days Away from Work.** Person misses one or more workdays; bed rest/on quarters.
- e. **Restricted Work Activity.** Person is temporarily unable to perform regular duties; light duty/profile.
- f. **First Aid Only** Person has one-time treatment of minor injury. *(No lost work days.)*
- g. **No Injury.**

27. CLASSIFICATION AT TIME OF ACCIDENT *(Check)*

- a. Active Army
- b. Army Civilian
- c. Army Contractor
- d. Nonappropriated Fund *(NAF)*
- e. Other U.S. Military
- f. ROTC
- g. Dependent
- h. NGB Tech
- i. NGB IDT
- j. NGB AT
- k. NGB ADSW
- l. NGB AGR
- m. NGB ADT
- n. USAR IDT
- o. USAR AT
- p. USAR ADT
- q. USAR FTM
- r. Foreign Nat. Direct Hire
- s. Foreign Nat. Indirect Hire
- t. Foreign Nat. KATUSA
- u. Foreign Mil. Attached to the U.S. ARMY
- v. Public
- w. Not reported

28. CAUSE OF INJURY/OCCUPATIONAL ILLNESS *(Check the most serious)*

- a. Struck Against
- b. Struck By
- c. Fell from Elevation
- d. Fell from Same Level
- e. Caught In/ Under/ Between
- f. Rubbed/abraded
- g. Bodily Reaction
- h. Overexertion
- i. Exposure
- j. External Contact
- k. Ingested
- l. Inhaled

29. BODY PART(S) AFFECTED *(Check primary) (No more than 3)*

- a. Body *(General)*
- b. Head
- c. Forehead
- d. Eyes
- e. Nose
- f. Jaw
- g. Neck
- h. Trunk
- i. Chest
- j. Heart
- k. Back
- l. Shoulder
- m. Arm
- n. Wrist
- o. Hand
- p. Fingers
- q. Leg
- r. Knee
- s. Ankle
- t. Foot
- u. Toes
- v. OTHER *(Specify)*

30. TYPE OF INJURY/ILLNESS *(Check the most serious)*

- a. Burns *(Chemical)*
- b. Burns *(Thermal)*
- c. Amputation
- d. Decompression Sickness
- e. Asphyxiation *(Suffocation)*
- f. Fractures
- g. Dislocation
- h. Abrasions
- i. Concussion
- j. Sprain/Strain
- k. Cuts/Lacerations
- l. Contusion
- m. Puncture Wound
- n. Hernia, Rupture
- o. Frostbite
- p. Heat Stroke
- q. Heat Exhaustion
- r. Noise Injury/Illness

SECTION B - PERSONNEL INFORMATION *(Continued)*

31. Person's action(s) at time of accident *(Check one and explain in Block 32.)*

a. Soldiering	j. Test/Study/Experiments	s. Fabricating	aa. Hobbies
b. Combat Soldiering	k. Educational	t. Handling Material/Passengers	bb. Passenger
c. Physical Training	l. Information and Arts	u. Janitorial/ Housekeeping/ Grounds Keeping	cc. Human movement
d. Weapons Firing	m. Food and Drug Inspection		dd. Horseplay
e. Engineering or Construction	n. Laundry/Dry Cleaning Services	v. Food/Drink Preparations	ee. Bystanding/spectating
f. Communications	o. Pest/Plant Control	w. Supervisory	ff. Personal Hygiene/Food/Drink Consumption/Sleeping
g. Security/Law Enforcement	p. Operating Vehicle or Vessel	x. Office	gg. Parachuting *(See Instructions)*
h. Fire Fighting	q. Handling Animal	y. Counseling/Advisory	
i. Patient Care *(People/Animals)*	r. Maintenance/Repair/Servicing	z. Sports	

32. SPECIFIC DESCRIPTION OF ACTIVITY/TASK

33. ON FIELD EXERCISE *(Check one)*
- ☐ a. Yes (If YES, specify name of exercise.)
- ☐ b. No

34. ACTIVITY PART OF TACTICAL TRAINING? *(Check one)*
- ☐ a. Yes
- ☐ b. No

35. Type of training facility being used *(Check one)*

a. Garrison	d. NTC	g. Std. range facility/ live fire
b. Local training area	e. JRTC	h. Other *(Specify)*
c. Major training area	f. CMTC	

36. Type of training participating in at the time of accident *(Check/specify)*

a. School *(Specify)*			
b. **Unit →**	(1) Platoon	(2) Crew	(3) Individual
c. On-the-job training	d. Other *(Specify)*		

37. Last time individual received training prior to accident on activity specified in block 31? *(Check one)*

a. 0 - 3 months	e. 1 - 2 years
b. 3 - 6 months	f. More than 2 years
c. 6 - 9 months	g. Never
d. 9 - 12 months	h. Not applicable

38. Required protective equipment

CHECK APPROPRIATE BLOCK(S)	AVAILABLE? YES	AVAILABLE? NO	USED? YES	USED? NO	N/A
a. Seat belt					
b. Helmet					
c. Goggles/glasses					
d. Gloves					
e. Ear plugs					
f Other *(Specify)*					

39. INDIVIDUAL LICENSED TO OPERATE VEHICLE/EQUIPMENT? *(Check one)*
- ☐ a. Yes ☐ b. No ☐ c. N/A

40. DID ALCOHOL CAUSE/CONTRIBUTE TO THIS ACCIDENT? *(Check one)*
- ☐ a. Yes ☐ b. No ☐ c. Unknown

41. If drugs caused/ contributed to this accident, check appropriate block.
- ☐ a. Prescription
- ☐ b. Illegal
- ☐ c. Over-the-counter
- ☐ d. None

42. Were vision enhancement devices being used? *(Check appropriate block.)*
- ☐ a. Yes *(Specify type/model in c and d.)*
- ☐ b. No

c. TYPE	d. MODEL

43. Standard/Reference covering activity/task

a. Soldier's Manual *(Task No.)*	
b. CTT *(Task No.)*	
c. AR/TM/FM *(Specify)*	
d. SOP	e. None *(Go to block 45.)*

44. WAS ACTIVITY/TASK PERFORMED IAW STANDARD/REFERENCE? *(Check one)*
- ☐ a. Yes ☐ b. No *(If NO, complete blocks 46-47.)*

45. DID INDIVIDUAL MAKE A MISTAKE? *(Check one)*
- ☐ a. Yes *(If YES, complete blocks 46-47.)* ☐ b. No

46. What was the mistake? How was the activity/task performed incorrectly? *(Explain below.)*

47. Why was mistake made/activity performed incorrectly? *(Check the most important reason and specify in Block 63.)*

a. Inadequate school training *(content/amount)*	f. In a hurry	k. Inadequate services
b. Inadequate unit training *(content/amount)*	g. Poor/bad attitude	l. Improper equipment design
c. Inadequate on-the-job training *(content/amount)*	h Lack of rest/sleep	m. Inadequate written procedures *(AR, TM SOP)*
d. Fear/ excitement	i. Effects of alcohol/drugs	n. Improper supervision
e. Overconfident in own/others abilities	j. Inadequate facilities	o. Other *(Specify in narrative)*

SECTION B - PERSONNEL INFORMATION *(Continued)*

48. Time licensed on this vehicle *(Check one)*	49. Total AMV driving mileage *(Check one)*	50. Total time in unit *(Check one)*
☐ a. Less than one year	☐ a. Less than 1,000 miles	☐ a. Less than 6 months
☐ b. One to two years	☐ b. 1,000 - 5,000 miles	☐ b. 6 months - 1 year
☐ c. Over two years	☐ c. 5,000 - 10,000 miles	☐ c. Over one year
☐ d. Unlicensed	☐ d. Over 10,000 miles	

51. WHICH ITEM FROM SECTION C APPLIES TO THE INDIVIDUAL NAMED IN BLOCK 12? *(This is needed in order to relate the person in block 12 to the equipment/vehicle below.)*

☐ Item A ☐ Item B ☐ Item C ☐ OTHER *(Specify)*

SECTION C - PROPERTY/MATERIAL INVOLVED *(Whether Damaged or Not)*

	ITEM A	ITEM B	ITEM C
52. Type of item			
53. Model number			
54. Ownership *(DOD, DA, POV, Unit, Person)*			
55. Dollar cost of damage			
56. Rollover protection system installed?	☐ Yes ☐ No ☐ NA	☐ Yes ☐ No ☐ NA	☐ Yes ☐ No ☐ NA
57. Was this item being towed?	☐ Yes ☐ No ☐ NA	☐ Yes ☐ No ☐ NA	☐ Yes ☐ No ☐ NA
58. If towed, enter letter for item doing towing			
59 Types of collision codes *(Pick up to three from list below and enter in blocks.) (In sequence.)*			

Types of Collisions

1 - Going forward and collided with moving vehicle
2 - Going forward and collided with parked vehicle
3 - Collision while backing
4 - Collision with pedestrian
5 - Collision with object (other than vehicle/pedestrian
6 - Overturned
7 - Ran off the road
8 - Jackknifed
9 - Going forward and rear-ended moving vehicle
10 - Going forward and rear-ended parked vehicle
11 - Collision while turning
12 - Other *(Specify)*

60. Component/Part that Failed/Malfunctioned ***(Complete this section if a materiel failure/malfunction caused/contributed to the accident.)***

	ITEM A	ITEM B	ITEM C
a. National Stock Number			
b. Part Number			
c. Describe Part			
d. Manufacturer's Identification Code			
e. EIR/QDR Number			

61. How/Why Part Malfunctioned *(Select code from "How" list below and enter in first block; select code from "Why" list and enter in second block.)*	ITEM A HOW	ITEM A WHY	ITEM B HOW	ITEM B WHY	ITEM C HOW	ITEM C WHY

***How Part Failed/Malfunctioned* Codes**

1 - Overheated/burned/melted
2 - Froze *(temperature)*
3 - Obstructed/pinched/clogged
4 - Vibrated
5 - Rubbed/worn/frayed
6 - Corroded/rusted/pitted
7 - Overpressured/burst
8 - Pulled/stretched
9 - Twisted/torqued
10 - Compressed/hit/punctured
11 - Bent/warped
12 - Sheared/cut
13 - Decayed/decomposed
14 - Electric current action
15 - Unknown/Other
Blank - Not reported

***Why Part Failed/Malfunctioned* Codes**

1 - Improper equipment design
2 - Inadequate maintenance
3 - Inadequate manufacture of equipment
4 - Inadequate written procedures *(AR, TM, SOP)*
5 - Improper supervision
6 - Unknown
7 - Other *(Specify in narrative)*

SECTION D - ENVIRONMENTAL CONDITIONS INVOLVED

62. Environmental conditions. *(Check environmental conditions present and indicate if condition caused/contributed to the accident.)*

PRESENT	CAUSED/ CONTRIBUTED	CONDITION	PRESENT	CAUSED/ CONTRIBUTED	CONDITION
		a. Clear/dry; visibility unlimited			k. Wind gust/turbulence
		b. Bright, glare			l. Vibrate, shimmy, sway, shake
		c. Dark, dim			m. Radiation, laser, sunlight
		d. Fog, condensation, frost			n. Holes, rocky rough, rutted, uneven
		e. Mist, rain, sleet, hail			o. Inclined/steep
		f. Snow, ice			p. Slippery *(not due to precipitation)*
		g. Dust, fumes, gasses, smoke, vapors			q. Air pressure *(bends, decompression, altitude, hypoxia)*
		h. Noise, bang, static			r. Lightning, static electricity, ground
		i. Temperature/humidity *(cold, heat)*			s. OTHER *(Specify)*
		j. Storm, hurricane, tornado			

SECTION E - ACCIDENT DESCRIPTION/NARRATIVE *(From blocks 10, 47)*

63. GIVE THE SEQUENCE OF EVENTS THAT AMPLIFY/EXPLAIN WHAT HAPPENED, LEADING UP TO AND INCLUDING THE ACCIDENT. ***(Explain why accident happened.)***

64a. PRINTED/TYPED NAME OF PERSON COMPLETING THIS REPORT	64b. RANK	64c. TITLE	
64d. SIGNATURE		64e. DATE OF SIGNATURE *(YY/MM/DD)*	64f. TELEPHONE NO.

SECTION F - CORRECTIVE ACTION AND COMMAND REVIEW

65. DESCRIBE THE ACTIONS TAKEN, PLANNED, OR RECOMMENDED TO ELIMINATE THE CAUSE(S) OF THIS ACCIDENT *(from unit level up to HQDA).*

66a. PRINTED/TYPED NAME OF COMMANDER		66b. RANK
66c. SIGNATURE	66d. DATE OF SIGNATURE *(YY/MM/DD)*	66e. TELEPHONE NO.

	a. TYPED NAME	b. SIGNATURE	c. TITLE	d. RANK / DATE
67				
68				
69				

SECTION G - *SAFETY OFFICE USE ONLY*

70. LOCAL REPORT NO.	71. MACOM

72. Accident type *(Check choice)*

	a. Army Motor Vehicle		h. Other Army Vehicle		o. Personal Injury - Other
	b. Army Combat Vehicle		i. Fire		p. Property Damage - Other
	c. Army Operated Vehicle		j. Chemical Agent		q. POV - On Official Business
	d. POV - Not on Official Business		k. Explosive		r. Space
	e. Marine Diving		l. Missile		s. Commercial Carrier/Transportation
	f. Marine Underway		m. Radiation		
	g. Marine Not Underway		n. Nuclear		

73. NAME OF SAFETY POINT OF CONTACT *(POC)*	74. PHONE NO. OF SAFETY OFFICE POC *(AUTOVON, Commercial, Etc.)*	75. DATE REPORT COMPLETED BY SAFETY OFFICE *(YY/MM/DD)*

SECTION H - SPECIAL INTEREST AND/OR SUPPLEMENTAL INFORMATION

76.	
77.	
78.	
79.	

U.S. ARMY ACCIDENT REPORT Instructions

General. The unit having the accident must investigate it and complete this report. Complete the shaded portions ***only*** for: Military off-duty, non-fatal accidents; and military on-duty accidents resulting in less than 20 lost workdays. Accidents involving 20 or more lost workdays and/or total property damage of $2,000 or more will require completion of the entire report. Type or legibly print the report. Items may be continued on a blank sheet of paper and attached to the report. Items listed below are keyed to the block numbers of DA Form 285, May 91. Items not listed here are self explanatory. Specific questions concerning this form should be referred to the local safety office.

SECTION A - Accident Information

Note: This section should be completed for the initial report and for any changes to a previously submitted report.

1. Check "INITIAL" if this is the first report on the accident. Check "CHANGE" if this report is a change to a previously submitted report of the accident.

2. Enter the 6-digit Unit Identification Code *(UIC)* for the unit responsible for the accident *(e.g., WXXXXX).*

3. Provide military unit information for the unit listed in Block *2.*

a. Full military address *(e.g., C Troop, 1/17 Cavalry, Ft. Bragg, NC 12345-6789).*

b. Provide the unit branch *(e.g., Armor, Infantry, Transportation).*

4. Enter the year, month, and day of the accident *(e.g., 90 11 07 {7 November 1990}).*

5. Enter the military time the accident occurred *(e.g., 0815, 2300).*

7. Check either item *a* or *b*, depending on the location of the accident.

8. If item *a* is checked, state name of post or installation *(e.g., Ft. Bragg, NC; Federal Center, Atlanta, GA; Ft. Hood, TX; Shaw AFB, SC).*

9. Check item *a* if accident occurred in a theater of hostile fire or enemy action, but not as a result of such fire/action. This includes direct preparation for combat, actual combat, or redeployment from a combat theater.

10. Check "Yes" of explosives *(C-4, TNT)*, ammunition, or pyrotechnics were involved and explain in Block *63* its involvement and specify the National Stock Number *(NSN).*

11. Give enough detail to find the exact location of the accident *(e.g., building number, street or highway name, state and/or country).* Also state the type of location *(e.g., road intersection, tank trail, family housing, firing range).*

SECTION B - Personnel Information

Note: Complete this section for each individual involved and/or injured in the accident. "Involved"means any person who was injured, or who took actions, or made decisions which caused or contributed to the accident. If more than one person was involved, enter information on one person on the initial form and complete only Sections A and B on additional forms for others. Staple all forms together.

16. Enter individual's rank/grade *(e.g., E5/SGT, O3/CPT, GS-11, WG-8).* Complete for all Government personnel.

17. Enter individual's full MOS/Job Series *(e.g., 54E20, 11B40, GS-301).*

18. Provide individual's full ***Military*** address for all Government personnel. If this address is not the same as that in Block *3a*, provide the unit UIC.

21. State how many continuous hours without sleep this individual was on-duty prior to the accident.

22. Indicate how many hours of continuous sleep this individual had in the past 24 hours.

23. State the estimated number of days this individual will be away from work *(totally unable to perform any work, bed rest/on quarters).* Does not include days hospitalized.

24. State the estimated *(or actual)* number of days this individual is hospitalized *(inpatient/admitted)* receiving treatment. Days hospitalized for "observation only" are not reported.

25. State the estimated number of days this individual will not be able to perform his or her regular duties *(light duty, profile).*

26. Check appropriate block. If more than one applies, check the most severe.

28. For this individual's "most severe injury", check the appropriate block(s) *(no more than 3)* that indicate the cause of the injury.

29. **Number** the body part(s) most seriously injured *(no more than 3)* in their order of priority *(the most serious first).* Be as specific as possible.

30. For each body part numbered in block *29*, place a corresponding number to indicate the type of injury received *(select only the most serious).*

31. Check the appropriate block that best describes the individual's action at the time of the accident. If Block *31gg* is checked, complete Blocks *76* and *77* of Section H, as indicated by these instructions.

32. Provide a short but detailed explanation of the item checked in Block *31.*

Note: For this report, the following definitions apply:

Tactical Training - Training in a field environment that uses or develops combat or combat support skills.

Field Exercise and Tactical Training - This begins when the individual reports to his or her primary duty location for movement to the field site and ends when he or she arrives back at the primary duty location from the field.

33. Check "Yes" if activity listed in Block *31* was part of a field exercise. State name of exercise if it has a name *(e.g., Team Spirit, Reforger).*

42. If vision enhancement device(s) were used, specify type and model numbers, and whether they caused the accident *(e.g., Night Vision Goggle, AN-PVS5A).*

43. Provide standard or reference *(Soldier's Manual, AR, TM, etc.),* if it exists, that covers performance of the activity identified in Block *31.*

46. Provide a simple explanation of the mistake(s) or how the activity or task was performed incorrectly *(e.g., SGT Smith improperly backed his M915 truck without a ground guide).*

47. **In your opinion,** why was the mistake made or the activity performed incorrectly? Check the most important reason.

51. Check the block corresponding to the piece of equipment associated with the person in Block *12 (e.g., SGT Adams was driving the "at-fault" HMMWV; his name will be in Block 12, and his vehicle will be Item a in Section C below).*

SECTION C - Property/Material Involved

Complete Blocks *52-59* on each piece of property or item of equipment involved in the accident *(whether damaged or not).* Include Army and non-Army, as well as equipment whose use or misuse contributed to the accident. Include up to 3 items of equipment on the initial form. Use additional blank sheets of paper for other equipment if necessary, continuing letter sequence *(e.g., A, B, C, D, and E).*

52. Type of equipment *(e.g., sedan, truck, generator).*

53. Full military equipment model number or civilian make *(e.g., M109A2, M60A2, Ford Taurus, M16 Rifle).*

55. Estimated cost of damage *(ECOD)* or actual cost of damage *(ACOD)* for each piece of property, which includes costs of parts and labor.

57. Indicate if this specific item was being towed ***at the time of the accident.***

58. If Block *57* is "yes", indicate which item was doing the towing.

60. Complete for each component or part whose failure or malfunction contributed to the accident. Include the EIR/QDR number in Block *60e.*

61. Indicate how and why each component or part failed or malfunctioned by selecting from the lists provided and entering the appropriate number in the blocks provided.

SECTION D - Environmental Conditions Involved

62. Check the environmental conditions present at the time of the accident *(no more than 3)* by checking appropriate blocks, whether contributing to the accident or not. Also check whether they caused or contributed to the accident.

SECTION E - Accident Description/Narrative

63. Fully describe the sequence of events that lead up to and caused the accident. Explain how and why the accident occurred. Also include information required from Blocks *10* and *47.*

SECTION F - Corrective Action and Command Review

Note: The level of command review *(Company, Battalion, Division, etc.)* is determined by either the major Army command *(MACOM)* or installation policy.

65. Fully describe all actions taken, planned, or recommended to eliminate the cause(s) of this accident. Actions should be identified as appropriate at unit level, and all the way up to HQDA level.

SECTION G - SAFETY OFFICE USE ONLY

71. MACOM responsible for this accident *(FORSCOM, TRADOC, etc.).*

SECTION H - Special Interest/Supplemental Information

This section is for use by the U.S. Army Safety Center, MACOMs, or interested safety offices to obtain additional "Special Interest/Supplemental Information" on this accident as needed *(e.g., M1 tank fires, tactical parachute accidents, etc.).* Blocks *76* and *77* have been designated for collection of supplemental information on parachuting accidents.

Blocks *76* and *77.* If Block *31gg* was checked, provide the following supplemental information for each individual:

a. Name of jumper;
b. Jumper height;
c. Jumper weight;
d. Type of jump *(static line, non-tactical; static line, mass technical; freefall, non-tactical; freefall, tactical);*
e. Type of parachute and model;
f. Jumper's equipment *(list);*
g. Weight of equipment;
h. Wind direction and speed at
(1) Jump height,
(2) Drop zone;
i. Jump altitude;
j. Jumper's position in stick and door exited;
k. Time pre-jump conducted;
l. Date of last jump and type of jump;
m. Number of previous jumps;
n. Date graduated from basic airborne training *(year and month);*
o. Type of aircraft;
p. Accident cause(s): Improper exit, static line injury, broken static line, parachute malfunction, entanglement, lost or stolen air, oscillation, unstable position, dragged on DZ, tree landing, drop zone hazard *(specify),* or other.

Environmental Monitoring

Description

Name(s): _____ Project Name: _____

Date: _____ Project Number: _____

Location: _____

Weather Conditions: _____

Estimated Wind Direction: _____

Estimated Wind Speed: _____

Background Level: _____

Location of Background Level: _____

On-Site Activities Conducted: _____

_____

Combustible Gas Indicator: _____

Calorimetric Tubes
(Type): _____

HNU/OVA: _____

Other: _____

_____

_____

_____

INSTRUMENT CALIBRATION CHECKLIST

Instrument: _____

Serial Number: _____

Date: _____

Calibrated by: _____

Pure Air: Y/N

Calibration Gas (PPM):

Battery Check: Good/Bad

NOTES:

MEDICAL DATA SHEET

This Medical Data Sheet will be completed by all on-site personnel and will be kept in the Support Zone during the conduct of site operations. It is in no way a substitute for the Medical Surveillance Program requirements consistent with the RI/FS Contractor Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance is required or if transport to hospital facilities is required. If more information is required, use the back of this sheet.

Project: _____

Name: _____

Address: _____

Home Telephone: Area Code (_____)_____

DOB: _____ Height: _____ Weight: _____

In case of emergency, contact: _____

Address: _____

Telephone: Area Code (_____)_____

Do you wear contacts? ( ) Yes ( ) No

Allergies: _____

List medication taken regularly: _____

Particular sensitivities: _____

Provide a checklist of previous/recent illnesses or exposures to hazardous chemicals:

_____

Name of personal physician: _____

Telephone: Area Code (_____)_____