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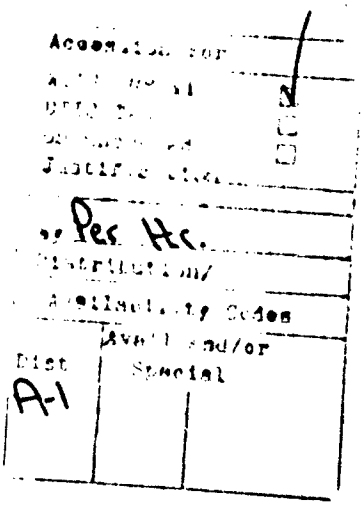
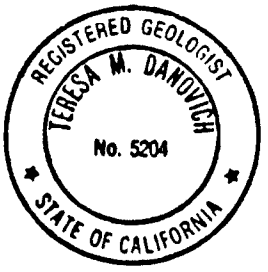
DRAFT FINAL

HEALTH AND SAFETY PLAN
SOIL VAPOR EXTRACTION TREATABILITY INVESTIGATION
SITE S WITHIN OPERABLE UNIT D
MCCLELLAN AIR FORCE BASE



Prepared For

McClellan Air Force Base
Sacramento, CA



Prepared By

CH2M HILL

20030211003

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July 1991

PREFACE

CH2M HILL is a contractor for the RD/RA alternate technology program at the McClellan AFB in California. The specific technology addressed is soil vapor extraction. This document is a secondary document to the primary OUB RI/FS Report/ Proposal Plan. The work is being conducted under Air Force Contract No. F04699-90-0035, Delivery Order No. 5019.

Key CH2M HILL project personnel are:

Starr J. Dehn--Program manager
Gerald R. Tracy--Project manager
Joseph P. Danko--SVE technical coordinator
Donna Morgans--Data validation
Michael McCann--Data coordinator
David Myers--Field task leader
Kathy Brewer--Health and safety

CH2M HILL would like to acknowledge the cooperation of the McClellan AFB Office of Environmental Management for assistance in expediting this project. In particular, CH2M HILL acknowledges the assistance of Captain Fran Slavich.

The work discussed in this document is being conducted between June 1991 and April 1992.

CONTENTS

McCLELLAN AIR FORCE BASE
SITE SAFETY PLAN

The health and safety program for CH2M HILL personnel working at McClellan Air Force Base (McAFB) consists of a base site safety plan (SSP) and task specific amendments. The base SSP contains general information that applies to all or most areas of the site. The base SSP contains: the project description, personnel responsibilities, site hazards, personal protective equipment (PPE), air monitoring guidelines, site control, decontamination procedures, and an emergency response plan. The task specific amendments are written to add additional information regarding the specific areas and field activities. The amendments not only define the specific field activities and team members, but they contain changes or clarifications of: the potential hazards, air monitoring requirements, PPE, decontamination procedures, and emergency contacts. The amendments can be more or less restrictive than the base SSP, depending on the type of field activities being conducted. **Neither the base SSP or the amendments are stand-alone documents; both documents contain important information and they must be used in conjunction with each other.**

GENERAL INFORMATION

CLIENT: McClellan Air Force Base
PROGRAM MANAGER: Starr Dehn/SAC
SITE NAME: McClellan Air Force Base
SITE LOCATION: **TO BE IDENTIFIED IN TASK SPECIFIC AMENDMENTS**
PURPOSE OF FIELD VISIT(S): Source testing, site survey, waste minimization and treatability studies, site inspections (see Attachment A in Appendix D).
DATE OF VISIT(S): April 30, 1990, through 1991
BACKGROUND INFORMATION: Complete ____ Preliminary X
INFORMATION AVAILABLE FROM: SAC (office)
OVERALL HAZARD SUMMARY: **TO BE IDENTIFIED IN TASK SPECIFIC AMENDMENTS**

SITE CHARACTERISTICS

A. Site Description and Overview of Planned Activities (location map attached as Figure 1):

- McAFB is located north of Sacramento, California. The base is approximately 3 miles north-south and approximately 2 miles east-west in length.
- The base is in the Central California Valley with excellent city street and interstate highway access. Access by air is also excellent.

- Descriptions of planned activities are listed in Attachment A. **THE TASK SPECIFIC AMENDMENTS IDENTIFY WHICH ACTIVITIES ARE BEING CONDUCTED DURING THAT FIELD EFFORT.**

B. Status (active, inactive, unknown; and nature of any site activity):

Active air force base.

C. History (worker or nonworker injury; complaints from public; previous investigations or remedial action):

The McAFB is a RCRA facility and a CERCLA site. The site is on the National Priority List (NPL).

The predominant functions at McAFB have been to manage, maintain, and repair aircraft, missiles, space vehicles, electronics, and communication equipment. These operations have required the use of toxic and hazardous materials. Some of the hazardous materials that have been used or generated on the base include: industrial solvents and caustic cleaners, electroplating waste heavy metals, oils contaminated with polychlorinated biphenyls (PCBs), contaminated jet fuels, low-level radioactive wastes, unused chemicals, and a variety of oils and lubricants.

McClellan has, in the past, used a variety of disposal facilities ranging from burial pits (refuse, demolition material, excess military equipment, possibly chemicals, etc.), sludge/oil pits, burn pits (refuse, oil, chemicals, etc.), to assorted miscellaneous disposal pits (sodium valves, etc.). Industrial waste sludge was also disposed of on-base at the Class II-I site approved by the Regional Board. This practice has since been eliminated. The industrial waste sludge is known to contain high concentrations of tetrachloroethylene, trichloroethylene, chloroform, and 1,1,2-trichloro-2,2,1-trifluoroethane. These types of materials could also have been disposed of in the sludge/oil pits.

Characterization and remediation of the areas affected by these waste disposal practices are ongoing. Today, these wastes are either placed in drums and hauled to an approved Class I disposal site or discharged into the Industrial Wastewater Treatment Plant (IWTP). Sludge from the IWTP is also hauled to an approved Class I disposal site.

D. Principal Materials Handling Activities (type, amount, and location of wastes or hazardous materials disposed of, stored, treated, or handled at the site):

Contaminated drill cuttings and purge water will be generated during field activities. The purge water will be disposed of at the industrial wastewater treatment plant (IWTP) or groundwater treatment plant. The drill cuttings and any

(cont) contaminated soil will be handled in accordance with the McAFB Soils Management Plan.

E. Features and Unusual Features (water supply, telephone, radio, power lines, gas lines, water mains, suspect terrain, etc.):

Utility lines, both above ground and below ground, may pose a safety hazard for team members during excavation or boring. If a drill rig is used, the driller must maintain a safe clearance (at least 20 feet) between overhead utility lines and the drill-rig mast at all times during site operations. The location of utility lines must be determined prior to startup, and the utility must be notified 48 hours prior to excavation or drilling by contacting Underground Services Alert at 800/422-4133 and Tom Egan, McAFB Engineering at 916/643-4875.

WASTE CHARACTERISTICS

ALL WASTE TYPES AND CHARACTERISTICS MAY NOT BE PRESENT IN ALL AREAS. THE TASK SPECIFIC AMENDMENTS WILL IDENTIFY WHICH WASTE TYPES AND CHARACTERISTICS ARE OF CONCERN FOR THAT SPECIFIC AREA AND TASK.

A. Waste Type(s):

Liquid X Solid X Sludge X Gas X

B. Characteristic(s):

Corrosive X Ignitable X Radioactive X Mixed Waste ___

Volatile X Toxic X Reactive ___ Unknown ___ Other (name) ___

HAZARD EVALUATION

A. Overall Hazard Level:

THE OVERALL HAZARD LEVEL WILL BE IDENTIFIED IN THE TASK SPECIFIC AMENDMENT.

B. Chemical Hazards:

The major types of processes in operation on the base are paint removal, painting, plating, and foundry. Each process has particular types of chemicals that are associated with it. For example, paint removers contain volatile organic compounds such as methylene chloride. In the painting operations, toluene- and xylene-based paints are applied to parts. Plating processes use degreasers, acids, rust removers, and cyanide. Finally, foundries may emit metallic fumes.

THE ABOVE PROCESSES ARE NOT INCLUSIVE OF ALL THE BASE OPERATIONS; THEREFORE, FOR EACH TASK AND/OR SITE VISIT, AN AMENDMENT WILL BE ATTACHED TO THE OVERALL SSP TO ADDRESS PARTICULAR HAZARDS AT EACH SITE. THE AMENDMENT WILL CONTAIN MORE DETAILED INFORMATION ON CHEMICAL HAZARDS AND WILL ADDRESS TASK AND/OR SITE-SPECIFIC CHEMICAL HAZARDS.

C. Physical Hazards:

The major potential physical hazards possible at the site are: flammable vapors and explosive conditions; utilities; moving and mobile equipment; trips, slips, and falls; and heat stress. **THESE PHYSICAL HAZARDS MAY NOT BE REPRESENTED AT EVERY SITE. THEREFORE, FOR EACH TASK AND/OR SITE, AN AMENDMENT WILL BE WRITTEN WHICH CONTAINS MORE DETAILED INFORMATION ON TASK AND SITE-SPECIFIC PHYSICAL HAZARDS.**

Explosions of vapor in confined spaces can be fatal, and workers must be attentive to this danger and guard against carelessness at all times. The lower explosive limit (LEL) is compound specific. When the vapors are heavier than air, their explosivity and flammability hazard are increased, since they will tend to concentrate near the ground and in low lying areas and will not be readily mixed or diluted with ambient air. When monitoring LEL, it is important to take measurements at ground level. To prevent explosivity and flammability hazards, each team member must make sure that no spark sources, such as lighters, matches, unapproved flashlights, etc., are brought into the exclusion zone. The Site Safety Coordinator (SSC) must inspect the exclusion zone for spark sources including wiring, motors, etc., and enforce the requirements for fire prevention, including intrinsically safe electrical equipment, spark arrestors on vehicles, and exclusion of unauthorized personnel.

There is potential for exposure to excessive noise. If a conversation has to be shouted at a distance of 3 feet or if noise levels exceed 85 dBA, hearing protection will be worn.

D. Hazards Posed by Site Activities:

Hazards may exist from moving process equipment (such as pumps and conveyors) and mobile equipment (such as forklifts). Personnel must be alert for these hazards, and protect clothing and hair from entrapment in equipment, and use common sense in these situation. To protect from slips, trips, and falls, proper precautions and good judgement must be exercised. Personnel should be especially alert when working near pits and excavations. Exercising caution, using safe ladder practices, and using the buddy system around stacks is important.

E. Heat and Cold Stress Hazards:

Heat stress is a hazard of concern during summer months. Heat stress at hazardous waste sites usually occurs because impermeable protective clothing decreases natural body ventilation. Attachment B addresses heat stress hazards specifically.

F. Biological Hazards:

None.

G. Unusual Hazards:

Slight possibility of exposure to the bacteria that causes Lyme disease through contact with the rabbit population in the area.

H. Hazards Posed by Chemical Substances Provided by CH2M HILL:

In accordance with 20 CFR 1910.1200, Hazard Communication, Material Safety Data Sheets are provided in each project specific addendum to this base plan.

PROCEDURES

A. Site Organization:

Map/Sketch Attached Yes Site Secured Yes

Perimeter Identified Yes

Zone(s) of Contamination Identified No

B. Site Personnel:

Team Organization

Team Member/Office	Responsibility
TEAM MEMBERS AND RESPONSIBILITIES WILL BE IDENTIFIED IN THE TASK-SPECIFIC AMENDMENTS.	

Each of the team members will be certified as fit for the anticipated work by the CH2M HILL medical surveillance program, and has completed the training requirements of 29 CFR 1910.120. In addition, each is currently certified by the American Red Cross, or equivalent, in both first aid and CPR. A SSC with the appropriate level of experience will be present during all field activities.

All medical and training records are housed in the WDC office. They are maintained in accordance with federal and state regulations.

C. Onsite Engineering Controls:

Onsite engineering controls include covers for waste piles and cuttings and barricades to keep unauthorized people from entering contaminated areas.

D. Work Practices:

Site personnel will avoid any visibly contaminated areas onsite. In general, work practices shall be designed to decrease time of exposure, increase distance to the source, or shield the exposed individual. Whenever possible, work will be conducted from an upwind position.

E. Personal Protective Equipment (PPE):

Basic Site Level of Protection:

A ____ B X C X D X

For Level D, polycoated Tyvek coveralls with nitrile outer gloves and latex inner gloves will be worn when splash protection is needed. Nitrile outer gloves and latex inner gloves will be worn during sampling and when handling samples. Safety glasses, hard hat, and neoprene steel toe/shank boots will be worn while onsite. A TLD badge must be worn by all team members who have been issued badges.

Level C will include the equipment listed above plus a full-face air purifying respirator (APR) with organic vapor cartridges (GMC-H).

Level B includes the equipment for Level D but adds a MSA 401 SCBA and a 5-minute escape pack. Upgrade to Level B will require refresher training for the field team.

Task	Initial Level of Protection
Site inspection and walkthrough	Level D
Source testing	Level C (may be downgraded to Level D by SSC if HNu readings are less than 1 ppm or upgraded to Level B if HNu readings exceed 5 ppm or if vinyl chloride is present).

Treatability studies	**MUST PREPARE AN AMENDMENT WITH FURTHER DESCRIPTIONS OF EACH ACTIVITY TO BE CONDUCTED.**
Other tasks	**MUST PREPARE AN AMENDMENT WITH FURTHER DESCRIPTIONS OF TASK.**

THE TASK SPECIFIC AMENDMENT WILL IDENTIFY CHANGES IN PPE REQUIRED FOR SPECIFIC ACTIVITIES OR AREAS OF THE SITE.

F. General Hazardous Waste Site Monitoring Equipment and Procedures:

Periodic monitoring of the site is required to determine the effectiveness of engineering controls, to re-evaluate levels of protection, and determine if site conditions have changed. At a minimum, monitor at the beginning of each shift, periodically (e.g., every 15 minutes) throughout the work, whenever work begins at a new area onsite, or when different contaminants are encountered or a different work activity begins. Specific monitoring locations and frequencies are given below.

Carefully inspect each piece of monitoring equipment prior to work startup. Failure of any of the equipment listed below to work properly must be reported to the Project Manager immediately.

Table 1 summarizes the air monitoring equipment and action levels that may be required. **SPECIFIC MONITORING REQUIREMENTS ARE DEPENDENT ON THE FIELD ACTIVITIES AND CHANGES IN THE AIR MONITORING PROGRAM WILL BE IDENTIFIED IN THE TASK SPECIFIC AMENDMENTS.**

G. Site Entry Procedures:

- Conduct Site Safety briefing before starting field activities.
- Determine wind direction, install wind flags, and establish work zones onsite (e.g., exclusion zone, contamination reduction zone, and support zone).
- Set up decontamination facilities.
- If toilet facilities are not located within a 3-minute walk from the decontamination facilities, either provide a chemical toilet and hand washing facilities or have a vehicle available (not the emergency vehicle) for transport to nearby facilities.

Table 1
Required Monitoring Equipment and Action Levels of Upgrading Personnel Protective Equipment (PPE)

Equipment	Reading[a]	Action
Explosimeter/O_2	< 10% LEL*	Continue with caution.
	10-20% LEL	Continue with caution while implementing control measures such as mechanical ventilation.
	> 20% LEL	Halt operations and evacuate the area until the readings are below 10% LEL.
	19.5-21% O_2	Continue operations in Level D PPE.
	Needle detects upward and then drops to zero	Halt operations and evacuate the area until the readings are approximately 20% O_2.
	< 15% O_2	Halt operations and evacuate the area until readings are approximately 20% O_2.
	< 19.5% O_2	Level B PPE required.
	> 21% O_2	Halt operations and evacuate the area until readings are approximately 20% O_2.
HNu (with 10.2eV lamp) or OVA	< 1 ppm	Continue operations in Level D PPE.
	1 - 5 ppm	Continue operations in Level C PPE. Vinyl chloride detector tubes must be collected.
	> 5 ppm	Level B PPE required.
	> 500 ppm	Halt work.

*Lower Explosive Limit

Table 1
Required Monitoring Equipment and Action Levels of Upgrading Personnel Protective Equipment (PPE)

Equipment	Reading[a]	Action
Mini-Ram	<1 mg/m^3	Continue operation in Level D PPE.
	1-5 mg/m^3	Continue operations in Level D PPE. Implement measures such as covering contaminated soils or wetting soils to control airborne dust.
	5-10 mg/m^3	Continue operations in Level C PPE.
	> 10 mg/m^3	Halt operations.
Sound Level Meter (SLM)	<85 dBA	Continue operations.
	85-120 dBA	Continue operations with hearing protection.
	>120 dBA	Continue operations with hearing protection, audiometric monitoring, and training.

Table 1
Required Monitoring Equipment and Action Levels of Upgrading Personnel Protective Equipment (PPE)

Equipment	Reading[a]	Action
Rad-Mini	< 0.3 mR/hr	Continue operations, monitor continuously, and record readings every 30 minutes.
	0.3 mR/hr - 1 mR/hr	Continue operations, monitor continuously, and record readings every 10 minutes.
	1 mR/hr - 2 mR/hr	Continue operations, monitor continuously, and record readings every 10 minutes. SSC will record approximate daily radiation exposure based on rad-mini readings and exposure time (mR/hr x hr = mR/day). Personnel radiation exposure will be kept below 40 mR/wk. The plan approver will be notified of results greater than 30 mR/wk.
	> 2 mR/hr	Halt work. Plan must be revised by health physists.
Vinyl Chloride Detector Tube[b]	Any color change	Halt work. Level B is required.

[a]Readings are above background.
[b]Must be collected whenever HNu readings are greater than 1 ppm.

- Conduct site entry monitoring.

H. Work Limitations: (time of day, etc.)

- No eating, drinking, or smoking onsite.
- No contact lenses onsite.
- No facial hair that would interfere with respirator fit.
- Buddy system at all times in exclusion zone.
- CH2M HILL employees who have been issued TLD badges will wear them at all times when on or near the site.
- Site work will be performed during daylight hours whenever possible. However, some predawn work is anticipated to minimize activities during the hottest part of the day. Any work conducted during hours of darkness will require the following minimum illumination intensity:

General Site Areas	5 foot-candles
First Aid Station/Office/Lab	30 foot-candles
Storerooms, Changehouse, Toilets, Rest Areas	10 foot-candles

- Motor used in the exclusion zone will be nonsparking electrical motors or equipped with spark arrestors.
- Fuel supplies will be properly stored and grounded.

I. Decontamination Procedures:

Set up decontamination area upwind of the exclusion zone. Water and TSP detergent should be placed in buckets prior to beginning work. The decontamination area should be a sufficient distance from the work in the exclusion zone so that the decon area will not become contaminated by splashing water or flying dirt.

Personnel Decontamination Procedures:

- Wash boots and outer gloves in detergent and water, rinse, and remove outer gloves.

- Remove and bag coveralls. If cotton coveralls are used, bag in plastic bags and wash prior to rewearing.
- Remove respirator, if worn.
- Remove surgical gloves and dispose in a plastic trash bag.
- Wash hands and face.
- Sanitize respirator nightly, if used.
- Take a shower and wash hair as soon as possible after leaving the site.

Equipment Needed:

Buckets, detergent, cleaner-sanitizer, brush, garbage bags, hand soap, and paper towels.

Sampling Equipment Decontamination Procedures:

The decontamination process will include:

- Removal of all loose dirt
- Scrub with Alconox and water
- Rinse with distilled water
- Rinse with methanol
- Rinse with deionized/distilled water
- Air dry

Heavy Equipment Decontamination Procedures:

Wash off the bucket of the backhoe or the drilling equipment with detergent and water. Rinse in water. Use the HNu to monitor the backhoe or drilling equipment. If HNu readings are detected from the equipment, steam clean it prior to removing it from the site.

Documentation:

It is the responsibility of the SSC to make sure that all equipment coming offsite is properly decontaminated according to the procedures outlined above. At a minimum, visual indication of contamination will be removed, and no organic vapors detectable above background should remain. The equipment and samples will be clean, dry, and free from stains, deposits, encrustations, or discoloration. Documentation of decontamination must be made in the field log notebook, which will become part of the permanent project file. A suitable tag is to be placed on each piece of decontaminated CH2M HILL equipment (or

group of equipment, such as a bag of hand tools) stating the date of decontamination and initialed by the SSC.

J. Material Handling Procedures:

The following general material handling procedures apply:

- Drums and containers meeting the appropriate DOT, OSHA, and EPA regulations for the waste contents (e.g., decon water) will be used.
- Site operations will be organized to minimize the amount of drum or container movement.
- DOT salvage drums and suitable quantities of absorbent will be available and used on sites where hazardous waste spills could occur.
- Electrically powered material handling equipment used to transfer decon solutions will meet the requirements of 29 CFR 1910.307 for the classification of materials being handled.

Disposal of Materials Generated During Fieldwork:

- Material generated during fieldwork (decontamination fluids, disposable protective gear or sampling devices, drilling cuttings, well development fluids, etc.) will be considered as contaminated and handled accordingly unless adequate monitoring or analytical data exists to properly classify the materials as nonhazardous.
- Material generated offsite (well drilling fluids, etc.) will be returned to the site unless otherwise specified by the site owner or responsible party.
- Ultimate responsibility for disposal of the material rests with the site owner or responsible party. CH2M HILL may coordinate analysis, packaging, storage, transport and disposal of waste material, but will not assume responsibility for the waste (i.e., sign manifests as generator, etc.). Prior to beginning fieldwork, the waste handling procedures will be agreed to with the client, site owner, and/or responsible party.
- Laboratory samples will be returned to site, client, site owner, or responsible party for disposal following analysis unless otherwise specified.

EMERGENCY RESPONSE PLAN

A. Pre-Emergency Planning:

The SSC is to perform the following pre-emergency planning tasks before starting field activities and will coordinate emergency response with the operating facility when appropriate:

- Locate nearest telephone to the site and inspect onsite communications (air horns, two-way radios).
- Confirm and post emergency telephone numbers (see Form 311) and route to hospital.
- Post site map marked with locations of emergency equipment and supplies.
- Review emergency response plan for applicability to any changed site conditions, alterations in onsite operations, or personnel availability.
- Drive route to hospital.
- Evaluate capabilities of local response teams.
- Where appropriate and acceptable to the client, inform emergency room/ ambulance service and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle and place hospital directions and map inside. Keys should be kept in ignition during field activities.
- Inventory and check-out site emergency equipment and supplies.
- Set up emergency personnel decontamination station(s).

B. Personnel Roles and Lines of Authority:

The SSC takes the lead in emergencies. The SSC has the authority to stop any site activities posing an immediate health and safety hazard to site personnel and must notify the Project Manager or designee as soon as practical of this action. The Project Manager is ultimately responsible for health and safety of the CH2M HILL workers.

C. Training:

At least two personnel currently certified in both first-aid and CPR will be present during field activities within the exclusion zone. The site's Emergency Response plan will be reviewed in the initial site safety briefing and will include:

- Emergency procedures for personnel injury or suspected overexposures, fires, explosions, and chemical spills or vapor releases.
- Location of onsite emergency equipment and supplies of clean water.
- Local emergency contacts, hospital routes, evacuation routes, and assembly points.
- Site communication and location of nearest phone to the site.
- Names of onsite personnel trained in first aid and CPR.
- Notification procedures for contacting CH2M HILL's medical consultant and team member's occupational physician.

The emergency response plan will be rehearsed at least once before site activities begin, and periodically afterwards. New workers on the site will be briefed on the emergency response plan before entering the exclusion zone.

D. Communications:

The "buddy system" will be enforced for field activities involving potential exposure to hazardous, toxic or radioactive materials, and during any work within the exclusion zone. Each person will observe his/her partner for symptoms of chemical overexposures or heat stress and provide emergency assistance when warranted. Personnel working in the exclusion zone will maintain line of sight contact or maintain communications (e.g., two-way radios) with the site support facilities. Offsite communications will consist of either onsite telephone service or use of the nearest telephone to the site.

E. Emergency Signals:

The following emergency signals shall be used:

Grasping throat with hand	Emergency--help me
Thumbs up	OK, understood
Grasping buddy's wrist	Leave site now
2 short blasts or sounds, repeated	All clear
Continual sounding of horn	Emergency--leave site

F. PPE and Emergency Equipment and Supplies:

The following emergency equipment and supplies will be available onsite with the locations marked on the site map and posted in the support zone:

- 20-lb ABC fire extinguisher(s)
- First-aid kit
- Stretcher or blanket
- Supplies of clean water
- Eye wash
- Deluge shower (when required for emergency decon)
- PPE (protective clothing, boots, and gloves)
- Air monitoring equipment

G. Emergency Recognition and Prevention:

Prevention of emergencies will be aided by the effective implementation of the health and safety procedures specified in this SSP. The initial site safety briefing will emphasize recognition of the types of emergencies anticipated onsite. Periodic safety briefings will be conducted by the SSC as field activities proceed. Hazards that warrant specific emergency recognition and prevention techniques will be discussed.

H. Site Security and Control:

Access to McClellan Air Force Base is controlled. Visitors must check in with the guard house at the entrance and present their driver's license and car registration. Once inside the base, access to Areas A, B, C, and D is not controlled, though the areas are delineated with a low fence.

Access to specific areas where tasks are being conducted will be controlled by establishing and clearly delineating work zones. The SSC is responsible for prohibiting unauthorized personnel from entering the exclusion and contamination reduction zones.

I. Emergency Medical Treatment and First-Aid:

The SSC will assume charge during a medical emergency. The following procedures should be used:

- Prevent further injury, perform appropriate decontamination, and notify the SSC and the Project Manager.

- Initiate first aid and get medical attention for the injured immediately.

- Depending upon the type and severity of the injury, call the medical consultant and/or occupational physician.
- Notify the Health and Safety Manager.
- Notify the injured person's personnel office.
- Notify the client representative.
- If an injury occurs, it will be reported to the SSC, medical consultant, Health and Safety Manager, and the regional personnel office.
- Prepare an incident report. The SSC is responsible for preparing and submitting the report to the Director of Health and Safety and to the CH2M HILL corporate personnel office within 48 hours.

J. Emergency Routes and Telephone Numbers (Map to be Posted)

	Building 123
Duty Officer	32751 (on base) 916/643-2751 (off base)
Police	112 (on base) 916/643-6168 (off base)
Fire	117 (on base) 916/643-5622 (off base)
Emergency Assistance	116 (on base)
Ambulance	116 (on base)
Site Contact	916/643-1250--Captain Fran Slavich
Utilities	34875 (on base) 916/643-4875 (off base)
McClellan Clinic	35420 (on base) 916/646-8420 Urgent Care Hours: 0730 to 1900
General Hospital	American River Hospital 4747 Engle Road. Carmichael, CA 95608 916/848-2100
Directions to Hospital	Exist McClellan Air Force Base through the main gate to Watt Avenue. Turn right onto Watt Avenue and travel south to Whitney Avenue. Turn left onto Whitney Avenue and travel east to Mission Avenue. Turn left onto Mission Avenue and travel north to Engle Road. Turn right (east)onto Engle Road. Hospital is at 4747 Engle Road. (See attached map.)
CHEMTREC	800/424-9300

TOSCA Hotline	202/554-1404
CDC	404/452-4100
National Response Center	800/424-8802
EPA ERT Emergency	201/321-6660
RCRA Hotline	800/424-9346

K. Emergency Decontamination:

Personnel will be decontaminated to the extent feasible (usually a "gross decon" or deluge) but life saving and first-aid procedures take priority over personnel decontamination efforts. The personnel decontamination procedures specified in Procedures, Section I of this SSP, will apply for injuries deemed nonlife threatening by the SSC.

L. Evacuation Routes and Procedures:

Onsite evacuation routes will be designated. Personnel will exit the site exclusion zone/contamination reduction zone and assemble at the onsite assembly point in the support zone. The SSC will account for personnel at the onsite assembly point and notify local emergency responders. The SSC will assess the need for site evacuation based on the degree of hazard posed to site personnel remaining in the support zone. Offsite evacuation routes and assembly points will also be designated. A person designated by the SSC will account for personnel at the offsite assembly point. The SSC and an assistant will remain onsite in the event of site evacuation (if feasible) to assist local responders and advise them on the nature and location of the incident.

Onsite and offsite evacuation routes/assembly points will be designated on the site map and posted. They will be based on site topography and layout; anticipated safe distances for places of refuge; prevailing weather conditions; and anticipated location or magnitude of site emergencies. Wind flags will be installed in the exclusion and support zones to assist personnel in determining upwind evacuation routes.

Evacuation Routes (Onsite and Offsite): Evacuation routes will be dependent on the type of accident and wind direction. McAFB has first and second responders to handle evacuations (see Site Characteristics, Section A).

Assembly Points (Onsite and Offsite): Assembly points vary by building and areas. Therefore, it will be the responsibility of the SSC to determine the assembly point for each location from the appropriate base representative.

M. Critique of Response and Followup:

The SSC will evaluate the effectiveness of the emergency response and recommend procedures for improving emergency response to the SSP approver.

Followup activities include notification of the injured person's personnel office within 24 hours of the injury. Incidents of suspected overexposures will require the notification of CH2M HILL's medical consultant and the injured person's occupational physician so that they may provide assistance and relevant information to the local hospital's emergency room physician.

EMERGENCY CONTACTS

- CH2M HILL Medical Consultant

  Name: Dr. Kenneth Chase, Washington Occupational Health Associates, Inc.
  Phone: 202/463-6698 (8-5 eastern standard time)
  202/463-6440 (after hours answering service; physician will return call within 30 minutes)

- CH2M HILL Director of Health and Safety

  Name: Marty Mathamel/WDC
  Phone: 703/471-1441

- District Health and Safety Manager

  Name: Mollie Netherland
  Phone: 206/453-5005

- Radiation Health Officer

  Name: George Stevens/ORO
  Phone: 615/483-9032

- CH2M HILL Occupational Physician

  Name: Corvallis Clinic
  Phone: 503/754-1150
  Address: Corvallis, Oregon

  Team members under their care: Jo Danko/CVO, Dave Myers/CVO, Barry Collom/CVO, Teresa Danovich/CVO

- CH2M HILL Occupational Physician

  Name: Dr. Patrick J. Clancy, ERGO Test and Diagnostic Medical Group
  Phone: 916/444-2717
  Address: 2828 Q Street, Sacramento, CA

Team members under their care: Ken White/SAC

- CH2M HILL Occupational Physician

  Name: Dr. Kirby Griffin, Center for Occupational Health
  Phone: 503/297-4411
  Address: 9205 SW Barnes Road, Suite 103, Portland, OR

  Team members under their care: Kevin Leary/PDX

- CH2M HILL Program Manager

  Name: Starr Dehn/SAC
  Phone: 916/920-0300

- Client Contact

  Name: Captain Fran Slavich
  Phone: 916/643-1250

- CH2M HILL Regional Manager

  Name: Steve DeCou/SAC
  Phone: 916/920-0300

- Personnel Office

  Name: Lynne Robertson/CVO
  Phone: 503/752-4271

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured. Notification MUST be made within 24 hours of the injury.

- CH2M HILL Director of Health and Safety for Waste Management and Industrial Processes

  Name: Marty Mathamel/WDC
  Phone: 703/471-1441

- CH2M HILL Corporate Personnel Office

  Name: Beth Brown/DEN
  Phone: 303/771-0900

PLAN APPROVAL

This site safety plan has been written for the use of CH2M HILL's employees and subcontractors. CH2M HILL claims no responsibility for its use by others. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if these conditions change.

PLAN PREPARED BY: Robert Evangelista/SAC Date: 4/24/90
(name/office/home phone)

APPROVED BY: Jane Stansfield/DEN Date: 4/27/90
(name/office/home phone)

APPROVED BY: _____ Date: _____
(name/office/home phone)

(Note to Preparer: SSPs for sites where the potential exists for exposure to ionizing radiation require the approval of the Radiation Health Officer.)

MODIFIED BY: Kathy Brewer/CVO Date: 4/10/91
503/752-4271

MODIFICATIONS
APPROVED BY: Mollie Netherland/SEA Date: 4/23/91
(206/453-5005)

Attachments:

- Site Map
- Form 311, Emergency Phone Numbers
- Form 533, Record of Hazardous Waste Field Activity
- MSDS where applicable
- Attachment A--Description of Planned Activities
- Attachment B--Heat Stress/Cold Stress Hazards
- Attachment C--Health and Safety Site Meeting
- Site Safety Plan Amendment

Distribution of approved plan:

Project Manager (responsible for distribution to team members and client)
Director of Health and Safety

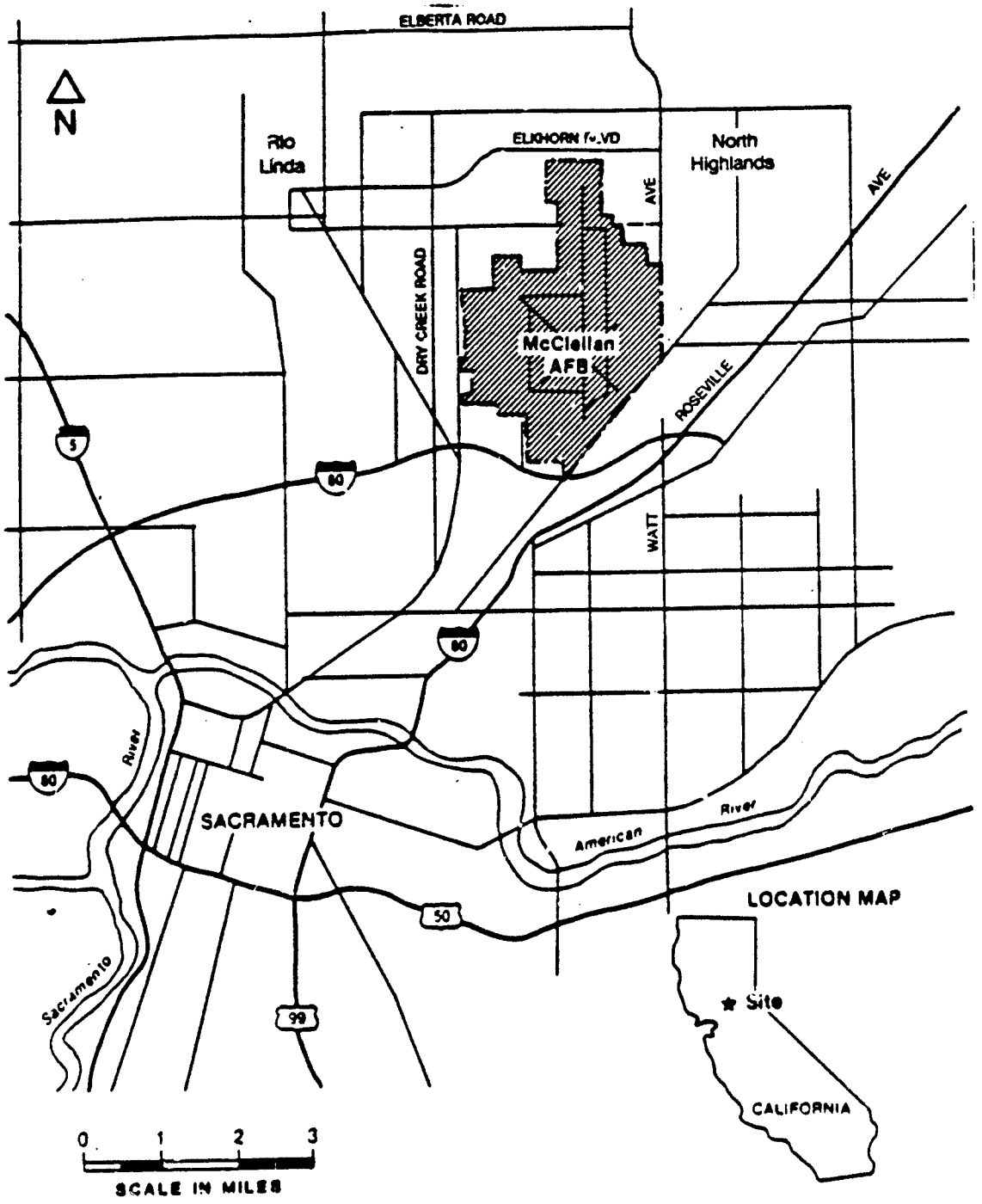


FIGURE 1

LOCATION OF MCCLELLAN AFB, NEAR SACRAMENTO, CALIFORNIA

CH2MHILL

FORM 311
EMERGENCY TELEPHONE NUMBERS

Police Department	Address:	2852nd SPS McClellan AFB	Phone: 916/643-6168 112 911 (off-base)
Fire Department	Address:	2852nd DEF/ABG McClellan AFB	Phone: 916/643-5622 117 911 (off-base)
Paramedic	Address:		Phone: 116 911 (off-base)
Fire Report	Address:		Phone: 117 911 (off-base)
Ambulance Service	Address:		Phone: 116 911 (off-base)
Water Department	Address:		Phone: 916/643-4875 366-2000 (off-base)
Gas Utility	Address:		Phone: 916/643-4875 383-2323 (off-base)
Electric Utility	Address:		Phone: 916/643-4875 383-2323 (off-base)
Telephone Utility	Address:		Phone: 916/643-4875 811-9000 (off-base)
Hospital	Address:	American River Hosp. 4747 Engle Road Carmichael, CA (off-base)	Phone: 916/643-5420 848-2100 (off-base)
Owner	Address:		Phone: Contact:

This notice is located at : _____

FORM 533

RECORD OF HAZARDOUS WASTE FIELD ACTIVITY

Site Name: McClellan Air Force Base; California
Site Safety Coordinator: Barry Collom/CVO
Project Number: SAC28722.19
Record of Activities For (Dates):

Empl. Number	Employee Name	Total Days Onsite	Days at the Site in			or	Number of Days as SSC			Activities Employees Performed While Onsite
			Level B	Level C	Level D		Level B	Level C	Level D	

Signature of SSC: _____

Attachment A
DESCRIPTION OF PLANNED ACTIVITIES

This Description of Planned Activities encompasses a broad range of possible tasks to be issued as task orders against contract No. F04699-90-D-0035. This section defines the range of tasks CH2M HILL shall be responsible to perform as per Section 4.0 (Technical Requirements) of the above contract.

- Conduct field sampling of drums, spill sites, tanks (above and underground), monitoring wells, past waste disposal sites, etc., and perform sample characterization studies to include analysis of a wide variety of contaminants in complex matrices, including up to 297 compounds listed as hazardous by EPA.

- Perform laboratory and field tests of environmental monitoring and testing equipment, to include validation of manual/instrumental methods, continuous monitors, analytical support and Mathematical models using EPA, ASTM, NR, and/or equivalent procedures specified by the Air Force.

- Perform photogrammetric analyses of environmental and infrared photographs.

- Perform geophysical studies to include, but not be limited to, studies involving magnetometer, metal detection, earth resistivity, terrain conductivity, seismic, gravity, ground penetrating radar and shallow (less than 400 feet, in most cases) borehole logging.

- Perform hydrogeological investigations to determine the magnitude and extent of groundwater contamination.

- Determine the direction and rate of movement of contaminants and estimate the degree of risk associated with contaminant migration.

- Develop methods to mitigate the adverse environmental effects of pollutant migration.

- Develop leachate monitoring and analysis programs to comply with state or EPA regulations required for landfills and other hazardous waste treatment and disposal sites which are currently operated or have been operated in the past by the U.S. Air Force.

- Perform onsite geological/hydrological investigations required to assist the Air Force in selecting proper locations for new solid/hazardous waste treatment, storage, or disposal sites or other facilities.

- Perform sampling of soil and water in the unsaturated (vadose) zone above the water table using techniques recommended by the National Water Well Association (NWWA).

- Perform aquifer tests to determine the porosity, permeability, specific yield, drawdown and extent of cones of depression developed in aquifers in which contamination has been found or is suspected.

- Conduct comprehensive water supply and water distribution studies.

- Perform evaluations of domestic water, industrial wastewater, domestic wastewater, and groundwater treatment plants.

- Perform water and wastewater characterization, to include ambient short-term and continuous water monitoring.

- Conduct inflow/infiltration studies into industrial, reclamation and groundwater extract/treatment systems at McClellan AFB and its Satellite Locations.

- Perform treatability studies, pilot plant investigations, and toxicity and bioassay determinations.

- Prepare evaluations and analyses providing sufficient detail to allow development of National Pollutant Discharge Elimination Systems (NPDES) permit applications, certifications and discharge monitoring reports.

- Conduct instream biological monitoring and fish-kill investigations.

- Perform laboratory analyses of potable water, groundwater, wastewater, soil, sludges, biologicals, fuels or commercial products and other environmental samples.

- Perform studies to ensure personnel safety, including the use of explosimeters, gas detectors, and survey meters and other equipment necessary to monitor air quality during site operations.

- Prepare evaluations and analyses, providing sufficient details to aid development of state or EPA-mandated permit applications, certifications, discharge monitoring reports and groundwater monitoring reports.

- Perform necessary analysis and reduction of any physical/chemical sample or data acquired under activities outlined herein.

- Provide analytical results in both hard copy and other formats suitable for archiving, including computer format.

- When required and specified in the delivery order, prepare sites for sampling/monitoring and restore sites upon completion of work.

- Identify, evaluate, design and prototype processes, equipment, and facilities which minimize the generation of hazardous wastes or improve environmental quality.

- Develop permits and various applications as required by the guidance documents.

- Conduct Community Relations Program requirements in accordance with SARA.

- Prepare Site-Specific Spill Plans to be maintained and reviewed annually in accordance with Air Force policy, guidance and directives.

- Develop Base Spill Prevention and Response Plans.

- Conduct quarterly review of regulatory requirements regarding the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the Superfund amendments and ongoing RCRA and CERCLA/ SARA Programs and other background documents as required.

- Prepare Statements of Work.

- Perform waste minimization assessments and recommend process modifications that eliminate or reduce the use, generation, and disposal of hazardous materials within production process. To do this, project personnel will do the following:

  - Analyze the results of waste audits to identify the most promising areas for waste minimization.

  - Identify, devise, and prototype new approaches to reduce and minimize hazardous wastes through process modification of emission/effluent control.

- Investigate process technology and develop conceptual system designs to prevent and reduce industrial pollution and hazardous waste generation.

- Determine the environmental consequences of present and proposed environmental regulations of any recommended process or equipment changes.

- Recommend control technology for toxics and pollutants to address recovery/recycle and reduction, optimization treatment (chemical and biological), onsite treatment, and substitution with less toxic/hazardous materials.

- Prepare detailed drawing packages, plans, and designs for waste minimization pilot projects relative to equipment design and modifications including charts, graphs, return on investments, and cost estimates.

- Document, evaluate, and integrate the results of pilot projects in ongoing industrial processes operations through process modifications or prototype development.

- Conduct and administer the Hazardous Waste Training Program to Base employees including requirements under 29 CFR 1910.120.

- Conduct Underground Storage Tank Annual Precision Leak Testing.

- Conduct Environmental Audit Assessment of base facilities and operation in accordance with Air Force and SM-ALC/EM policy, guidance, and directives.

- Perform Inspection Services and Construction Management for Environmental Investigations, construction Project or Remedial Action Implementation.

- Develop and maintain a computer data base for tracking hazardous waste generator/management data and all delivery order project information.

- Maintain an inventory of McClellan Air permits. Develop tracking system to monitor environmental compliance. This inventory and tracking system will be maintained in a microcomputer within the Directorate of Environmental Management.

- Provide engineering and services to operate and maintain interim Remedial Measures and Remedial Actions implemented by McClellan AFB in accordance with CERCLA/SARA. This includes the McClellan

Groundwater and Treatment Plant and existing and future groundwater extraction systems. Operation and maintenance shall be conducted in accordance with existing procedures.

- Prepare Environmental Assessments for proposed Air Force activities in water usage, wastewater discharge, solid waste disposal, hazardous waste cleanup, and contaminated groundwater cleanup.

- Document performance of existing and future McClellan water, wastewater, solid waste, and groundwater treatment facilities (including groundwater extraction systems) to include performance evaluations of individual unit processes within a treatment facility.

- Prepare comprehensive studies to determine potable water supply, storage and distribution requirements for McClellan AFB and its Satellite Locations.

Attachment B
HEAT STRESS/COLD STRESS HAZARDS

Heat Stress

Wearing PPE puts a hazardous waste worker at considerable risk of developing heat stress. This can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at hazardous waste sites, regular monitoring and other preventive precautions are vital.

Monitoring Heat Stress. Because the incidence of heat stress depends on a variety of factors, all workers, even those not wearing protective equipment, should be monitored. Workers wearing semipermeable or impermeable protective clothing should be monitored when the temperature in the work area is above 70°F (21°C).

To monitor the worker, measure:

- Heart 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 by one-third and keep the rest period the same.
  - If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third again.
- Oral temperature--Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
  - If oral temperature exceeds 99.6°F (37°C), shorten the next work cycle by one-third without changing the rest period.
  - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third again.
  - Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C).

- Body Water Loss (if possible)--Measure weight on a scale accurate to ±0.25 lb at the beginning and end of each work day to see if enough fluids are being taken to prevent dehydration. Weights should be taken while the employee wears similar clothing or, ideally, is nude. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 1). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

Table 1
Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers[a]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

[a]For work levels of 250 kilocalories/hour.
[b]Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
[c]A normal working ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Prevention of Heat Stress. Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat injuries. To avoid heat stress, management should take the following steps:

- Adjust work schedules:
  - Modify work/rest schedules according to monitoring requirements

- Mandate work slowdowns as needed
- Rotate personnel: alternate job functions to minimize overstress or overexertion at one task
- Add additional personnel to work teams.
- Perform work during coolers hours of the day if possible or at night if adequate lighting can be provided.

- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain workers' body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, i.e., 8 fluid ounces (0.23 liters) of water must be ingested for approximately every 8 ounces (0.32 kg) of weight lost. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
  - Maintain water temperature at 50° to 60°F (10° to 15.6°C).
  - Provide small disposable cups that hold about 4 ounces (0.1 liter).
  - Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
  - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
  - Weigh workers before and after work to determine if fluid replacement is adequate.
- Encourage workers to maintain an optimal level of physical fitness:
  - Where indicated, acclimatize workers to site work conditions, including temperatures, protective clothing, and workload.
  - Urge workers to maintain normal weight levels.
- Provide cooling devices to aid natural body heat exchange during prolonged work or severe heat exposure. Cooling devices include:

- Field showers or hose-down areas to reduce body temperature and/or to cool off protective clothing.

- Cooling jackets, vests, or suits.

- Train workers to recognize and treat heat stress. As part of training, identify the signs and symptoms of heat stress (see Table 2).

Table 2
Signs and Symptoms of Heat Stress

• Heat rash may result from continuous exposure to heat or humid air
• Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include: - Muscle spasms - Pain in the hands, feet, and abdomen
• Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include: - Pale, cool, moist skin - Heavy sweating - Dizziness - Nausea - Fainting
• Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are: - Red, hot, usually dry skin - Lack of or reduced perspiration - Nausea - Dizziness and confusion - Strong, rapid pulse - Coma

Cold Stress

Although northern California is not prone to bitter-cold temperatures, cold stress may still be a potential problem. Cold stress is possible when work performed over water is at temperatures of 50°F or less. The ultimate effects of cold stress is hypothermia, which is a decrease in the deep core body temperature. At temperatures of 35°F, workers in water, or whose clothing becomes wet, should be provided with an

immediate change of clothing. They may need to be treated for hypothermia. Workers who wear impermeable protective clothing are susceptible to chilling because their cotton underclothing may become wet with perspiration.

Windchill index. The windchill factor is the cooling effect of any combination of temperature and wind velocity of air movement. The windchill index is shown in Table 3. The windchill index does not take into account that part of the body which is exposed to cold, the level of activity and its effect on body heat production, and the amount of clothing being worn.

Table 3
Windchill Index

Actual Thermometer Reading (F)										
Wind speed in r.	50	40	30	20	10	0	-10	-20	-30	-40
Equivalent Temperature (F)										
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (little added effect)	LITTLE DANGER (for properly clothed person)				INCREASING DANGER (danger from freezing of exposed flesh)			GREAT DANGER (Danger from freezing of exposed flesh)		

Note: The human body senses "cold" as a result of both the air temperature and the wind velocity. Cooling of exposed flesh increases rapidly as the wind velocity goes up. Frostbite can occur at relatively mind temperatures if wind penetrates the body insulation. For example, when the actual air temperature of the wind is 40°F (4.4°C) and its velocity is 30 mph (48 km/h), the exposed skin would perceive this situation as an equivalent still air temperature of 13°F (-11°C).

Attachment C
HEALTH AND SAFETY SITE MEETING

We the undersigned have read this Site Safety Plan and fully understand its contents and will adhere to procedures set forth in this document.

Name	Affiliation	Title	Date

CH2M HILL Site Safety Plan
Addendum No. 1

McClellan Air Force Base
California

The health and safety program for CH2M HILL personnel working at McClellan Air Force Base (McAFB) consists of a base site safety plan (SSP) and task specific addendums. The base SSP contains general information that applies to all or most areas of the site. The base SSP contains: the project description, personnel responsibilities, site hazards, personal protective equipment (PPE), air monitoring guidelines, site control, decontamination procedures, and an emergency response plan. The task specific addendums are written to add additional information regarding the specific source areas and field activities. The addendums not only define the specific field activities and team members, but they contain changes or clarifications of: the potential hazards, air monitoring requirements, PPE, decontamination procedures, and emergency contacts. The addendums can be more or less restrictive than the base SSP, depending on the type of filed activities being conducted. **Neither the base SSP or the addendums are stand-alone documents; both documents contain important information and they must be used in conjunction with each other.**

Client: McClellan Air Force Base
Project No.: SAC28722.19
Project Manager: Jerry Tracy/CVO
Field Task Manager: Dave Myers/CVO
Site Name: McClellan Air Force Base, Operable Unit (O.U.) D, Site S (see Figures AD-1 and AD-2)
Dates of Field Visit: June through November, 1991
Overall Hazard: Low to moderate

Purpose of Field Visit: A soil vapor extraction (SVE) treatability investigation will be conducted at Site S in O.U. D. Soil samples will be taken from borings drilled on the site, and onsite headspace analyses will be conducted. Air permeability testing and SVE pilot testing will be performed at the site.

PHYSICAL HAZARDS

Because the drilling and sampling activities will be taking place during the summer months and personal protective equipment (PPE) is being worn, heat stress is a major concern. See Attachment B to the base SSP for detailed information on heat stress.

To help lessen the effects of heat stress, personnel will be acclimated prior to working in extreme conditions. For nonacclimated workers in good physical condition, full acclimization takes 4 to 5 days. Work schedule will be adjusted as necessary to take advantage of the cooler, early morning hours. Provisions will be made to provide adequate lighting for predawn activities.

The work/rest schedule, as outlined in Attachment B, will be followed. In addition, cooling devices such as MSA's Core Control or Ice Chest Cooling Vest will be utilized, if necessary. To determine the effectiveness of these work and engineering controls, heat stress monitoring will be conducted when the ambient temperature is above 85° to 90°F.

Certain chemical substances will be provided by CH2M HILL to accomplish the field work. In accordance with 20 CFR 1920.1200, Hazard Communication, Material Safety Data Sheets for these products are included in Attachment AD-1 to this Addendum.

Soil boring activities pose safety hazards to personnel in the immediate vicinity of the drill rig. To protect personnel from overhead falling objects (i.e., bolts, wrenches, pieces of pipe), hard hats must be worn in the immediate vicinity of the drill rig. Safety glasses are also required to protect against flying projectiles that could be caused by hammering fittings/connections and drive casings. No overhead powerlines or buried utilities are anticipated where the drilling is being conducted. Hearing protection (ear plugs) will also be required when working around the drilling equipment.

Because sampling will take place on the top of the cap and near the wells in O.U. D, trip, slip, and fall hazards are expected. During the rainy season (December to February), the potential for slipping and falling is greater than during the drier months.

CHEMICAL HAZARDS

The contamination at the site is confined to the soils and the underlying groundwater. Because the site is covered with an impermeable, multilayer cap, the contaminated soil is not expected to present a hazard at the site until disturbed by drilling activities.

In all areas of the site during drilling, the volatile organic compounds shown in Table 1 may be encountered in the soil at concentrations ranging from 1 to 100 ppm. In addition, the compounds listed in Table 2 have been detected in soils onsite at levels less than 1 ppm. Except for 1,1,1-trichloroethane, all of these compounds can be detected using a 10.2 eV photoionization detector (PID).

Semivolatile organic compounds detected in the soils at Site S include the chemicals in Table 3. These compounds would not be expected to volatilize, but exposures could occur via inhalation of dust particles. At the concentrations that were detected in the soils, exposures that would occur for dust concentrations below the nuisance dust level of 5 mg/m^3 would be acceptable.

Cyanide was detected in soils on and near Site S at levels ranging from 13 to 33 ppm. The PEL for cyanide is 5 mg/m^3, so the acceptable level for cyanide would not be exceeded for air particulate concentrations less than the nuisance dust levels.

Freon 113 has been detected at other waste sites within O.U. D, and there is a possibility that it could be encountered during drilling activities in Site S. Freon 113 has a high

ionization potential (11.78 eV) and, therefore, cannot be detected with a photoionization detector. It can be detected with an organic vapor analyzer (OVA). The PEL for Freon 113 is 1,000 ppm.

Because O.U. D contains burn pits used for transformer oils and chlorinated solvents, dioxin could be present. Samples taken at another burn pit area on the Base indicates that the dioxin levels are very low (less than 0.17 ppb). However, because the allowable exposure level is also very low, it is possible that overexposures could occur at dust levels below the detection limit of the mini RAM detector. Therefore, Level C must be worn when drilling through the waste pit area, estimated to extend to 20 feet below ground surface.

Site Personnel: This Addendum adds site personnel as follows:

Starr Dehn/SAC	Project Administrator/Observer
Jo Danko/CVO	Project Engineer
Ken White	Project Geologist
Dave Myers/CVO	Project Engineer & Field Task Manager
Teresa Danovich/CVO	Project Hydrogeologist
Barry Collom/CVO	Field Technician/Level C SSC
Kevin Leary/PDX	Project Hydrogeologist

Level of Protection:

A: __ B: __ C: X D: X

Level C is required while drilling through the waste pit area. It is estimated that the first 20 feet of drilling will be completed in Level C, but the depth of the waste pit and other action levels will dictate when Level C is worn. After the drilling has been completed in the waste pit area the levels of protection will be determined based on the action levels outlined in the base SSP and in this addendum. This addendum is not approved for work in Level B.

Monitoring Equipment:

1. Explosimeter/0_2 meter. Monitoring frequencies and action levels outlined in the base SSP will be used.

2. Mini-Rad. Monitoring frequencies and action levels outlined in the base SSP will be used.

3. HNu. Monitoring frequencies and action levels outlined in the base SSP will be used.

4. Vinyl Chloride Detector Tubes. Monitoring frequencies and action levels outlined in the base SSP will be used.

5. OVA. The OVA will be used for the initial survey of each soil boring at the site to check for the presence of Freon 113 and other compounds with ionization potentials (IPs) above 10.2 eV. If during the initial survey it is determined that such compounds are present, OVA monitoring will be completed during all drilling at that location. If elevated readings are obtained on the OVA, it must first be determined if the elevated readings are due to methane. If the OVA and HNu readings are the same and explosimeter readings are not above background, the compounds being detected are those with an IP below 10.2 eV and methane is not present. The action levels for the HNu in the base plan will be followed.

   If the OVA readings are elevated and are higher than the HNu readings, the difference may be due to methane or compounds which have an IP greater than 10.2 eV. If the OVA and explosimeter readings indicate that methane is present, the explosimeter action levels in the base plan will be followed. If it is determine that the elevated readings are not due to methane, the HNu action levels in the base plan will be followed.

Addendum Written By: Kathy Brewer

Date: 4/12/91

Addendum Approved By: Mollie Netherland

Date: 4/22/91

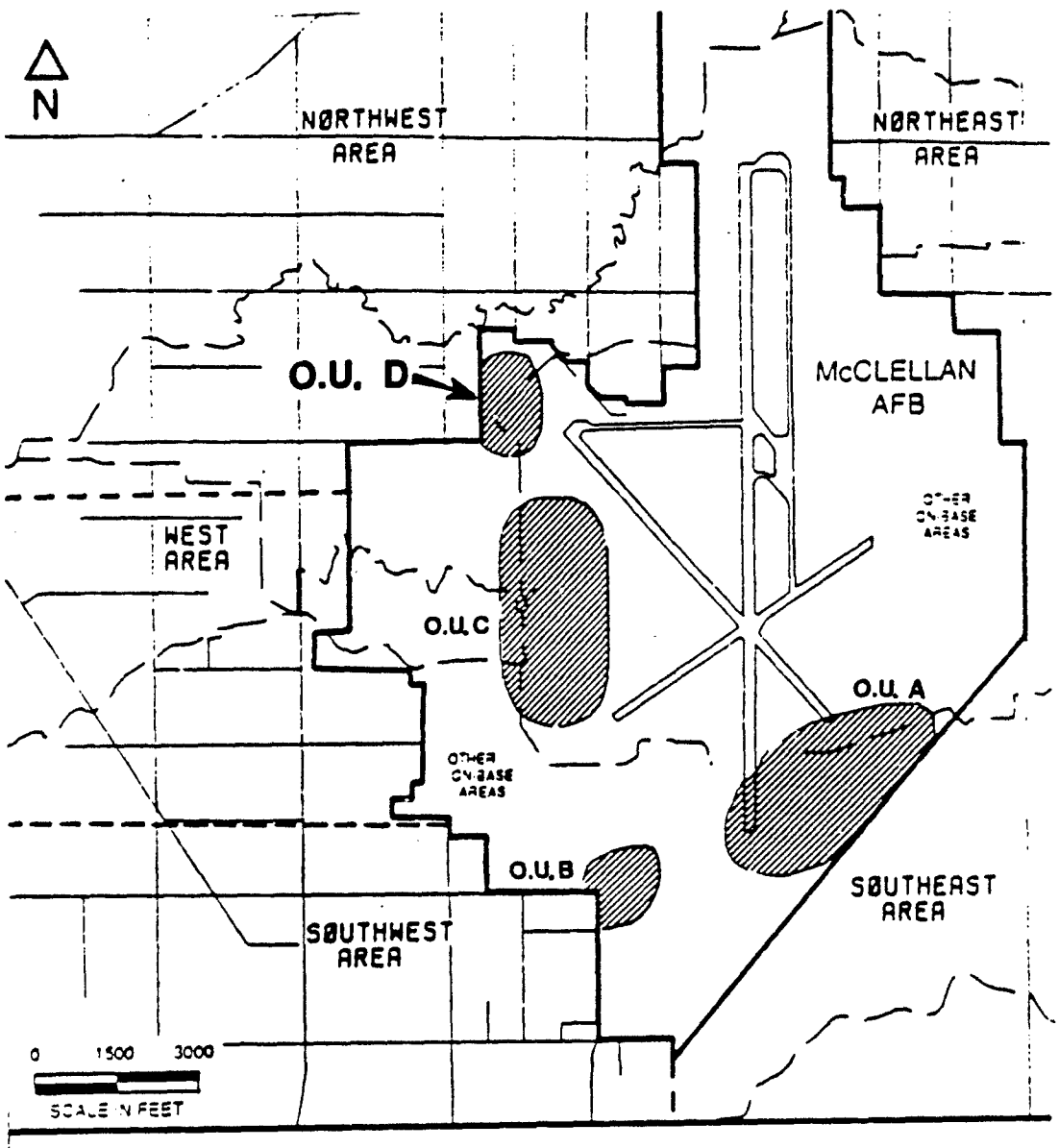
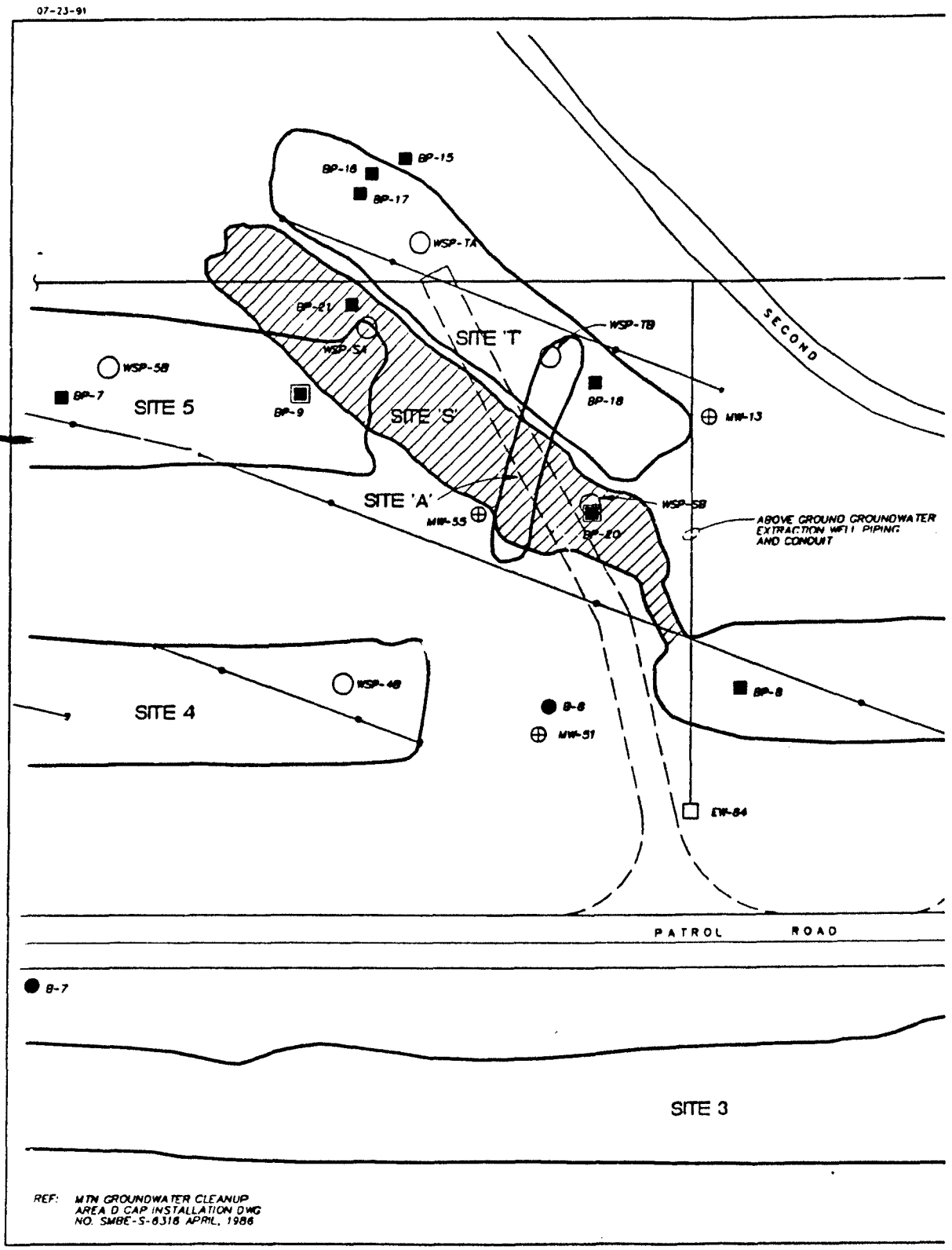


FIGURE AD-1
LOCATION OF O.U D WITHIN MCCLELLAN AFB

CH2MHILL

1 of 2



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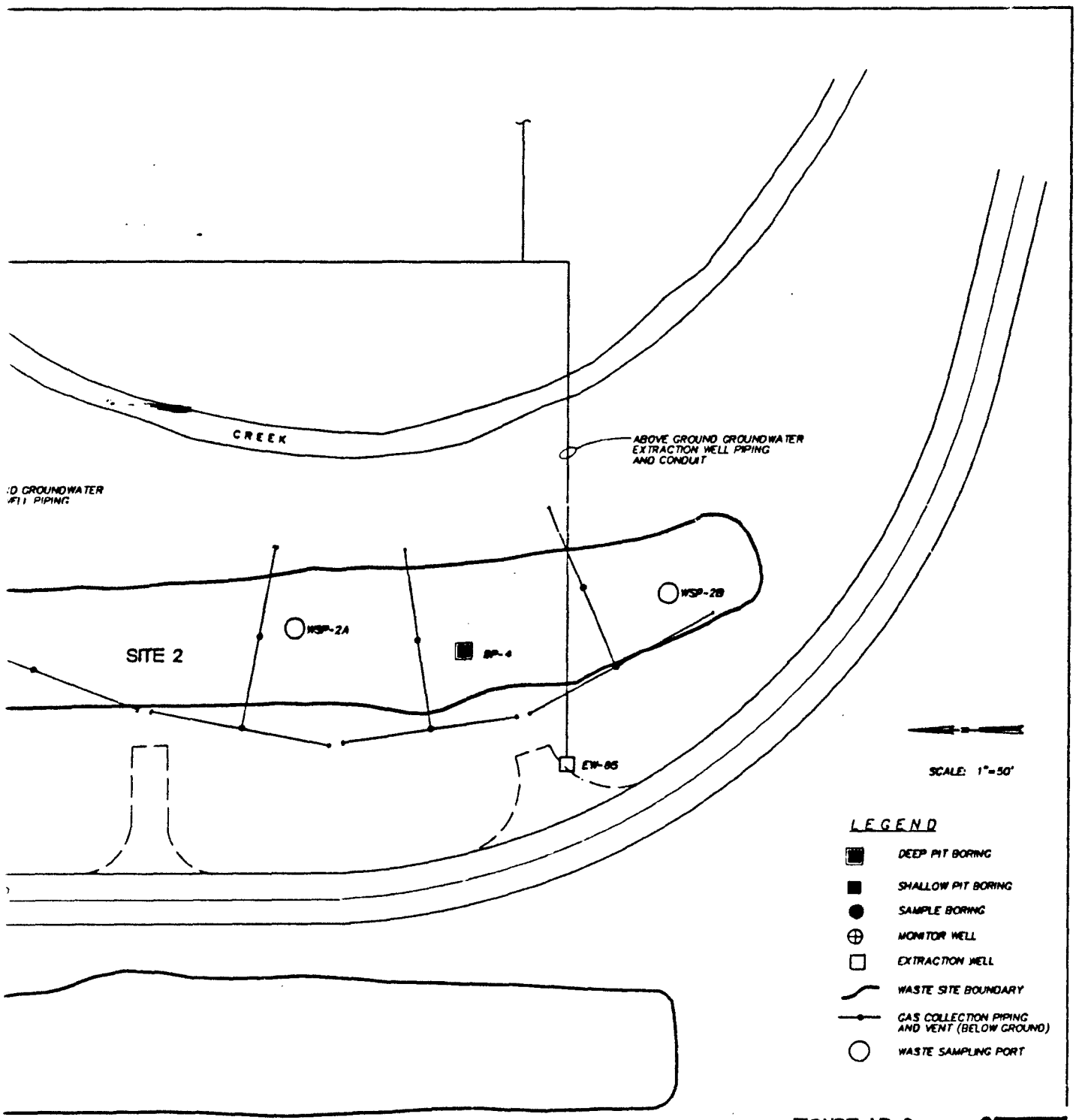

FIGURE AD-2
SITE S, O.U. D
LOCATION MAP

CH2MHILL

Attachment AD-1
MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheets are provided for the following products:

- Alconox
- Hydrogen
- Isobutylene
- Methane
- Methanol

Material Safety Data Sheet
Required under USDL Safety and Health Regulations for Shipyard Employment (29 CFR 1915)

U.S. Department of Labor
Occupational Safety and Health Administration

OMB No. 1218-0074
Expiration Date 05/31/86

PREPARED 1/10/86

Section I

Manufacturer's Name: ALCONOX, INC.	Emergency Telephone Number: (212) 473-1300
Address (Number, Street, City, State, and ZIP Code): 215 PARK AVENUE SOUTH	Chemical Name and Synonyms: N.A.
NEW YORK, N.Y. 10003	Trade Name and Synonyms: ALCONOX
C6300-1, C6301-1, C6301-2,-3,-4,-5	Chemical Family: ANIONIC DETERGENT; Formula: N.A.

Section II - Hazardous Ingredients

ADS1-S02

Paints, Preservatives, and Solvents	%	TLV (Units)	Alloys and Metallic Coatings	%	TLV (Units)
Pigments: NONE			Base Metal: NONE		
Catalyst: NONE			Alloys: NONE		
Vehicle: NONE			Metallic Coatings: NONE		
Solvents: NONE			Filler Metal Plus Coating or Core Flux: NONE		
Additives: NONE			Others: NONE		
Others: NONE					

Hazardous Mixtures of Other Liquids, Solids or Gases	%	TLV (Units)
NONE		

Section III - Physical Data

Boiling Point (°F)	N.A.	Specific Gravity (H_2O=1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Percent Volatile by Volume (%)	N.A.
Vapor Density (AIR=1)	N.A.	Evaporation Rate (_____=1)	N.A.

Solubility in Water: APPRECIABLE

Appearance and Odor: WHITE POWDER INTERSPERSED WITH CREAM COLORED FLAKES - ODORLESS

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	Lel	Uel
NONE	N.A.	N.A.	N.A.

Extinguishing Media: WATER, CO_2, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures:
FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS

Unusual Fire and Explosion Hazards:
NONE

 (Continued on Reverse Side)

Section V - Health Hazard Data

Threshold Limit Value

NO DATA AVAILABLE - TREAT AS NUISANCE DUST

Effects of Overexposure

PROLONGED EXPOSURE TO DUST MAY IRRITATE MUCOUS MEMBRANES

Emergency First Aid Procedures

EYES - FLUSH WITH PLENTY OF WATER FOR 15 MINUTES, SKIN-FLUSH WITH PLENTY OF WATER. INGESTION - DRINK LARGE QUANTITIES OF WATER TO DILUTE MATERIAL. GET MEDICAL ATTENTION FOR DISCOMFORT.

Section VI - Reactivity Data

Stability	Unstable		Conditions to Avoid: NONE
	Stable: X		

Incompatability (Materials to Avoid): AVOID STRONG ACIDS

Hazardous Decomposition Products: MAY RELEASE CO_2 GAS ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid: NONE
	Will Not Occur: X		

Section VII - Spill or Leak Procedures

Steps to be Taken in Case Material is Released or Spilled: MATERIAL FOAMS PROFUSELY, SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method: SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT

Section VIII - Special Protection Information

Respiratory Protection (Specify Type): DUST MASK

Ventilation	Local Exhaust: NORMAL		Special: N.A.	
	Mechanical (General): N.A.		Other: N.A.	

Protective Gloves: USEFUL - NOT REQUIRED

Eye Protection: USEFUL - NOT REQUIRED

Other Protective Equipment: NOT REQUIRED

Section IX - Special Precautions

Precautions to be Taken in Handling and Storing: SHOULD BE STORED IN A DRY AREA TO PREVENT CAKING

Other Precautions: NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

LIQUID AIR CORPORATION
INDUSTRIAL GASES DIVISION

Material Safety Data Sheet

	PRODUCT NAME: Hydrogen	
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
LIQUID AIR CORPORATION INDUSTRIAL GASES DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	TRADE NAME AND SYNONYMS: Hydrogen, Normal Hydrogen, Water Gas	CAS NUMBER: 1333-74-0
	CHEMICAL NAME AND SYNONYMS: Hydrogen	
ISSUE DATE AND REVISIONS: OCTOBER 1, 1985 CORPORATE SAFETY DEPT.	FORMULA: H_2 MOLECULAR WEIGHT: 2.016	CHEMICAL FAMILY: Inorganic flammable gas

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

Hydrogen is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Inhalation: High concentrations of hydrogen so as to exclude an adequate supply of oxygen to the lungs causes dizziness, deeper breathing due to air hunger, possible nausea and eventual unconsciousness.

TOXICOLOGICAL PROPERTIES

Hydrogen is inactive biologically and essentially nontoxic; therefore, the major property is the exclusion of an adequate supply of oxygen to the lungs.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	I.A.R.C. Monographs	OSHA
	Yes ☐	Yes ☐	Yes ☐
	No ☒	No ☒	No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO HYDROGEN. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Hydrogen is flammable over a very wide range in air.

PHYSICAL DATA

BOILING POINT	LIQUID DENSITY AT BOILING POINT
-422.98°F (-252.77°C)	4.4307 lb/ft^3 (70.973 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C) above the critical temp. of -399.84°F (-239.91°C)	GAS DENSITY AT 70°F 1 atm .005209 lb/ft^3 (.08344 kg/m^3)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen coefficient = .0178	FREEZING POINT -434.565°F (-259.203°C)
APPEARANCE AND ODOR Colorless, odorless gas. Specific gravity @70°F (Air = 1.0) is .07.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED)	AUTO IGNITION TEMPERATURE	FLAMMABLE LIMITS % BY VOLUME
Gas	1058°F (570°C)	LEL = 4; UEL = 74.5
EXTINGUISHING MEDIA Water, carbon dioxide, dry chemical		ELECTRICAL CLASSIFICATION Class 1, Group B

SPECIAL FIRE FIGHTING PROCEDURES

If possible, stop the flow of hydrogen. Cool surrounding containers with water spray. Hydrogen burns with an almost invisible flame of relatively low thermal radiation.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Hydrogen is very light and rises very rapidly in air. Should a hydrogen fire be extinguished and the flow of gas continue, increase ventilation to prevent an

(Continued on last page.)

REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID
Unstable		
Stable	X	

INCOMPATIBILITY (Materials to avoid)

Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS

None

HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID
May Occur		
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366

OR CALL CHEMTREC AT [illegible]

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
Hood with forced ventilation	To prevent accumulation above the LEL.	
	MECHANICAL (General) In accordance with electrical codes.	**OTHER**

PROTECTIVE GLOVES
Plastic or rubber

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Hydrogen or Hydrogren, compressed I.D. No.: UN 1049
DOT Shipping Label: Flammable Gas DOT Hazard Class: Flammable Gas

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedie de Gaz or Compressed Gas Association Pamphlet P-1

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedie de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS
Hydrogen is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Earth-ground and bond all lines and equipment associated with the hydrogen system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

LIQUID AIR CORPORATION
INDUSTRIAL GASES DIVISION

ADDITIONAL DATA

UNUSUAL FIRE AND EXPLOSION HAZARDS: (Continued)

explosion hazard, particularly in the upper portions of buildings or sheds where the gas might "collect".

Specialty Gas Material Safety Data Sheet

Air Products
BYRNE SPECIALTY GASES
pure and mixed gases • gas handling equipment • cryogenics
Byrne Specialty Gases, Inc.
514 S. River Street
Seattle, Washington 98108 (206) 764-4633

	PRODUCT NAME ISOBUTYLENE
	EMERGENCY PHONE (800) 523-9374; IN PENNSYLVANIA (800) 322-8092
AIR PRODUCTS AND CHEMICALS, INC. BOX 538 ALLENTOWN, PA 18105 (215) 398-8257	**TRADE NAME AND SYNONYMS** Isobutylene
	CHEMICAL NAME AND SYNONYMS Isobutylene, Isobutene, 2-Methylpropene
ISSUE DATE AND REVISIONS 1 June 1978	**FORMULA** (iso) C_4H_8 — **CHEMICAL FAMILY** Aliphatic Hydrocarbon

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

Nontoxic but may act as a simple asphyxiant.

SYMPTOMS OF EXPOSURE

Symptoms of exposure to isobutylene depending on concentration and duration of exposure, may include rapid respiration, air hunger, incoordination, fatigue, nausea, vomiting, convulsions, loss of consciousness, and death. Contact of liquid isobutylene with the skin may cause frostbite. Symptoms of frostbite are skin color change to gray or white, cold feeling and numbness.

TOXICOLOGICAL PROPERTIES

Isobutylene acts as a simple asphyxiant through the exclusion of oxygen from breathing atmospheres. Anesthetic properties may be evident at very high concentrations. There exists an immediate fire and explosion hazard when the concentration of isobutylene in the atmosphere exceeds the lower flammable limit (1.8% by volume).

RECOMMENDED FIRST AID TREATMENT

RESCUE PERSONNEL SHOULD AVOID UNNECESSARY EXPOSURE. SELF-CONTAINED BREATHING APPARATUS MAY BE REQUIRED.

Inhalation: Extreme hazard of fire or explosion may result from static electrical discharge or other ignition sources. Do not enter explosive atmospheres except in clearly life saving situations. Move the affected person to an uncontaminated atmosphere. If breathing has stopped or is labored, give artificial respiration (e.g. mouth-to-mouth). Supplemental oxygen should be administered. Keep victim warm and quiet. Seek medical assistance promptly.

Skin Contact: In the event of freezing of the skin, frozen tissues should be flooded

(Continued on last page)

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Isobutylene reacts vigorously with oxidizing materials.

PHYSICAL DATA

BOILING POINT 19.6°F (-6.9°C)	**LIQUID DENSITY AT BOILING POINT** 39.1 lb/ft^3 (626.3 kg/m^3)
VAPOR PRESSURE at 70°F (21.1°C) 39.05 psia (269.24 kPa)	**GAS DENSITY AT 70°F, 1 atm** 0.1493 lb/ft^3 (2.3916 kg/m^3)
SOLUBILITY IN WATER Insoluble	**FREEZING POINT** -220.7°F (-140.4°C)
APPEARANCE AND ODOR Colorless gas with a sweet, gasoline-like odor. Isobutylene is stored as a liquid under its own vapor pressure.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) Gas	**AUTO IGNITION TEMPERATURE** 869°F (465°C)	**FLAMMABLE LIMITS % BY VOLUME** LEL 1.8 UEL 9.6
EXTINGUISHING MEDIA Carbon dioxide or dry chemical for small fires		**ELECTRICAL CLASSIFICATION** Class I, Group not specified

SPECIAL FIRE FIGHTING PROCEDURES

Stop flow of gas. Keep fire-exposed containers cool with water spray from a distance. Allow the fire to burn itself out.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area.

REACTIVITY DATA

STABILITY Unstable		**CONDITIONS TO AVOID** Sources of heat and ignition
Stable	X	
INCOMPATIBILITY (Materials to avoid)	Oxygen and strong oxidizers	
HAZARDOUS DECOMPOSITION PRODUCTS	None	
HAZARDOUS POLYMERIZATION May Occur		**CONDITIONS TO AVOID**
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Eliminate all sources of ignition. Detect leaks with a soap water solution, never use a flame. Ventilate enclosed areas.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or surplus isobutylene. Return all unused quantities to Air Products and Chemicals, Inc. for proper disposal.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)	Positive pressure self-contained breathing apparatus should be available for emergency use.	
VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (Gen.) X	OTHER
PROTECTIVE GLOVES	Rubber	
EYE PROTECTION	Safety goggles or glasses	
OTHER PROTECTIVE EQUIPMENT	Safety showers, eyebath	

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

D.O.T. Red Label, "Flammable Gas"

SPECIAL HANDLING RECOMMENDATIONS

Use only in a well-ventilated area. Never drop cylinders or allow them to strike each other violently. Avoid dragging or sliding cylinders, even for short distances. They should be moved by a suitable hand truck. Keep the valve protection cap in place until cylinder is secured and ready for use. Always insert a trap or check-valve in the line to prevent hazardous back-flow into the cylinder. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Never use a flame to detect leaks, use a soap water solution.

For additional handling recommendations consult the Air Products Specialty Gas Catalog Safety and Technical Information Section or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Protect against physical damage. Store cylinders in a cool, dry, well-ventilated area of noncombustible construction. Protect cylinders from excessive temperature rise by storing away from sources of heat. No part of a cylinder should be subjected to a temperature above 125°F (52°C). Store cylinders in an upright position and firmly secured. Segregate full and empty cylinders. Isolate from oxidizing materials.

For additional storage recommendations consult the Air Products Specialty Gas Catalog Safety and Technical Information Section or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

Isobutylene is noncorrosive to common structural materials. Systems employing isobutylene must be designed to handle the pressures involved.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Ground and bond all lines and equipment. Do not use around sparking motors or other nonexplosion-proof equipment. Vapor is heavier than air and may collect in low areas.

Air Products and Chemicals, Inc.
Box 538, Allentown, PA 18105
(215) 398-4287

Air Products

Specialty Gas Department

HEALTH HAZARD DATA

RECOMMENDED FIRST AID TREATMENT (Continued)

or soaked with tepid water (105—115°F, 41—46°C). DO NOT USE HOT WATER. If freezing is superficial and to minor extent, medical assistance may not be necessary; however, all other cases should be referred to a physician.

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ALPHAGAZ

Specialty Gas

Material Safety Data Sheet

	PRODUCT NAME Methane	
	TELEPHONE (415) 977-6500 **EMERGENCY RESPONSE INFORMATION ON PAGE 2**	
LIQUID AIR CORPORATION ALPHAGAZ DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	**TRADE NAME AND SYNONYMS** Methane	**CAS NUMBER** 74-82-8
	CHEMICAL NAME AND SYNONYMS Methane, Methyl Hydride, Marsh Gas	
ISSUE DATE AND REVISIONS OCTOBER 1, 1985 CORPORATE SAFETY DEPT.	**FORMULA** CH_4 **MOLECULAR WEIGHT** 16.01	**CHEMICAL FAMILY** Aliphatic Hydrocarbon

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Methane is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Inhalation: High concentrations of methane so as to exclude an adequate supply of oxygen to the lungs causes dizziness, deeper breathing due to air hunger, possible nausea and eventual unconsciousness.

Skin Contact: Contact with cryogenic liquid methane causes cryogenic "burns" or frostbite of dermal tissue.

TOXICOLOGICAL PROPERTIES

Methane is inactive biologically and essentially nontoxic; therefore, the major property is the exclusion of an adequate supply of oxygen to the lungs.

Frostbite effects are a change in color of the skin to gray or white possibly followed by blistering.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	Yes ☐ No ☒	I.A.R.C. Monographs	Yes ☐ No ☒	OSHA	Yes ☐ No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO METHANE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

Dermal Contact or Frostbite: Remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. (Continued on last page.)

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Forms explosive or flammable mixtures with most oxidizers (oxygen, chlorine, fluorine, etc.)

Is flammable over a wide range in air.

PHYSICAL DATA

BOILING POINT -258.74°F (-161.52°C)	**LIQUID DENSITY AT BOILING POINT** 26.383 lb/ft^3 (422.62 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C) Above the critical temperature of -116.7°F (-82.62°C)	**GAS DENSITY AT 70°F 1 atm** .041 lb/ft^3 (.657 kg/m^3)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen Coefficient = .035	**FREEZING POINT** -296.45°F (-182.47°C)
APPEARANCE AND ODOR Colorless, odorless gas, liquid is water white.	Specific gravity @70°F (Air = 1.0) is .55.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) -306°F (-188°C) Closed Cup	**AUTO IGNITION TEMPERATURE** 1076°F (580°C)	**FLAMMABLE LIMITS % BY VOLUME** LEL=5 UEL=15
EXTINGUISHING MEDIA Water, carbon dioxide, dry chemical		**ELECTRICAL CLASSIFICATION** Class 1, Group D

SPECIAL FIRE FIGHTING PROCEDURES

If possible, stop the flow of methane. Use water spray to cool surrounding containers.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Should flame be extinguished and flow of gas continue, increase ventilation to prevent flammable or explosible mixture formation.

REACTIVITY DATA

STABILITY Unstable		**CONDITIONS TO AVOID**
Stable	X	

INCOMPATIBILITY (Materials to avoid)

Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS

None

HAZARDOUS POLYMERIZATION May Occur		**CONDITIONS TO AVOID**
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION
IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
Hood with forced ventilation	To prevent accumulation above the LFL.	
	MECHANICAL (Gen.) In accordance with electrical codes.	**OTHER**

PROTECTIVE GLOVES
Plastic or rubber

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower, eyewash "fountain"

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION (Note: For cryogenic liquid methane, see last page.)
DOT Shipping Name: Methane DOT Hazard Class: Flammable Gas
DOT Shipping Label: Flammable Gas ID No.: UN 1971

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS
Methane is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Earth-ground and bond all lines and equipment associated with the methane system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ADDITIONAL DATA

RECOMMENDED FIRST AID TREATMENT: (Continued)

A physician should see the patient promptly if the cryogenic "burn" has resulted in blisterning of the dermal surface or deep tissue freezing.

SPECIAL LABELING INFORMATION: (Continued)

For cryogenic liquid methane:

DOT Shipping Name: Methane, refrigerated liquid
DOT Shipping Label: Flammable gas
DOT Hazard Class: Flammable gas
I.D. No.: UN 1972

American Burdick & Jackson
Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

METHANOL

emergency telephone no. 312/973-3600 (American Scientific Products)
chemtrec telephone no. 800/424-9300
information telephone no. 616/726-3171 (American Burdick & Jackson)

I. Identification

chemical name Methanol — molecular weight 32.04
chemical family Alcohol — formula CH_4O
synonyms Carbinol, Methyl Alcohol, Wood Alcohol
DOT proper shipping name Methyl Alcohol or Methanol
DOT hazard class Flammable Liquid
DOT identification no. UN1230 — CAS no. 67-56-1

II. Physical and Chemical Data

boiling point, 760mm Hg. 64.7°C — freezing point -97.7°C — evaporation rate (BuAc=1) ca 5
vapor pressure at 20°C 97 mm Hg — vapor density (air = 1) 1.11 — solubility in water @ 20°C complete
% volatiles by volume ca 100 — specific gravity (H_2O = 1) @ 20°C 0.792 — stability Stable
hazardous polymerization Not expected to occur.
appearance and odor A clear, colorless liquid with a slight alcoholic odor.
conditions to avoid Heat, sparks, open flame, open containers, and poor ventilation.

materials to avoid Strong oxidizing agents and reactive metals which will displace hydrogen.

hazardous decomposition products Incomplete combustion can generate carbon monoxide and other toxic vapors such as formaldehyde.

III. Fire and Explosion Hazard Data

flash point, (test method) 12°C (Tag closed cup) — auto ignition temperature 385°C
flammable limits in air % by volume: lower limit 6.0 — upper limit 36.5
unusual fire and explosion hazards May burn with an invisible flame. Mixtures with water as low as 21% by volume are still flammable (flash point below 37.8°C). Under some circumstances can corrode certain metals, including aluminum and zinc, and generate hydrogen gas.
extinguishing media Carbon dioxide, dry chemical, alcohol foam, water mist or fog.
special fire fighting procedures Wear full protective clothing and self-contained breathing apparatus. Heat will build pressure and may rupture closed storage containers. Keep fire-exposed containers cool with water spray.

IV. Hazardous Components

	%	TLV	CAS no.
Methanol	ca 100	200 ppm	67-56-1

American Burdick & Jackson Subsidiary of American Hospital Supply Corporation 1953 South Harvey Street Muskegon MI 49442

V. Health Hazards

Occupational Exposure Limits

OSHA	8-hour PEL	-	200 ppm
	Ceiling	-	not listed
	Peak	-	not listed
ACGIH	TLV-TWA	-	200 ppm
	TLV-STEL (15-min)	-	250 ppm
NIOSH	TLV-TWA	-	200 ppm
	TLV-C	-	800 ppm

Concentration Immediately Dangerous to Health

OSHA/NIOSH	25,000 ppm

Odor Threshold

NSC & OHS	10 ppm
NIOSH	2000 ppm

Carcinogenic, Mutagenic, Teratogenic Data

Positive mutagen (RTEC)

Primary Routes of Entry

Methanol may exert its effects through inhalation, skin absorption, and ingestion.

Industrial Exposure: Route of Exposure/Signs and Symptoms

Inhalation: Exposure can cause drowsiness and intoxication, headache, visual disturbance leading to blindness, coughing and shortness of breath, collapse and death at high concentrations.

Eye Contact: Liquid can cause moderate burning, watering, swelling, and redness; high vapor concentration (greater than 2000 ppm) may cause same symptoms.

Skin Contact: This substance may be absorbed through intact skin and produce toxic effects. Extensive, repeated and/or prolonged skin contact can cause burning, itching, redness, or blisters.

Ingestion: Causes burning of the gastrointestinal tract and toxic effects. Swallowing more than 2 ounces of methanol can cause death.

Effects of Overexposure

Mild poisoning is characterized by fatigue, nausea, headache, and delayed visual blurring. Moderate intoxication results in severe depression. Temporary or permanent blindness may follow in 2-6 days. In severe poisoning, symptoms progress to rapid, shallow respiration, cyanosis, coma, hypotension, dilated pupils, and visual disturbance. Death may result from respiratory failure.

Medical Condition Aggravated by Exposure

Preclude from exposure those individuals with diseases of eyes, liver, kidneys, and lungs.

Emergency First Aid

Inhalation: Immediately remove to fresh air. If not breathing, administer mouth-to-mouth rescue breathing. If there is no pulse administer cardiopulmonary resuscitation (CPR). Contact physician immediately.

Eye Contact: Rinse with copious amounts of water for at least 15 minutes. Get emergency medical assistance.

Skin Contact: Flush thoroughly for at least 15 minutes. Wash affected skin with soap and water. Remove contaminated clothing and shoes. Wash clothing before re-use, and discard contaminated shoes. Get emergency medical assistance.

Ingestion: Call local Poison Control Center for assistance. Contact physician immediately. Never induce vomiting or give anything by mouth to a victim unconscious or having convulsions.

Note to Physician

In case of ingestion or massive inhalation, observe victim as an inpatient because slow metabolism causes a latent period of 24 hours between exposure and acidosis and blindness.

VI. Safety Measures and Equipment

Ventilation: Adequate ventilation is required to protect personnel from exposure to chemical vapors exceeding the PEL and to minimize fire hazards. The choice of ventilation equipment, either local or general, will depend on the conditions of use, quantity of material, and other operating parameters.

Respiratory: Use approved respirator equipment. Follow NIOSH and equipment manufacturer's recommendations to determine appropriate equipment (air-purifying, air-supplied, or self-contained breathing apparatus).

Eyes: Safety glasses are considered minimum protection. Goggles or face shield may be necessary depending on quantity of material and conditions of use.

Skin: Protective gloves and clothing are recommended. The choice of material must be based on chemical resistance and other user requirements. Generally, neoprene or rubber offers acceptable chemical resistance. Individuals who are acutely and specifically sensitive to methanol may require additional protective equipment.

Storage: Methanol should be protected from temperature extremes and direct sunlight. Proper storage of methanol must be determined based on other materials stored and their hazards and potential chemical incompatibility. In general, methanol should be stored in an acceptably protected and secure flammable liquid storage room.

Other: Emergency eye wash fountains and safety showers should be available in the vicinity of any potential exposure. Ground and bond metal containers to minimize static sparks.

VII. Spill and Disposal Data

Spill Control: Protect from ignition. Wear protective clothing and use approved respirator equipment. Absorb spilled material in an absorbent recommended for solvent spills and remove to a safe location for disposal by approved methods. If released to the environment, comply with all regulatory notification requirements.

Waste Disposal: Dispose of methanol as an EPA hazardous waste. Hazardous waste numbers: U154 (Ignitable); D001 (Ignitable).

Revision Date: 1/85

KEY

ca	Approximately	STEL	Short Term Exposure Level
na	Not applicable	TLV	Threshold Limit Value
C	Ceiling	TWA	Time Weighted Average
PEL	Permissable Exposure Level	BuAc	Butyl Acetate

NSC National Safety Council ("Fundamentals of Industrial Hygiene", 1983)
OHS Occupational Health Services ("Hazardline")