SOIL WASHING AND SOLIDIFICATION/STABILIZATION

WORK IMPLEMENTATION PLAN

DRAFT FINAL

Revision No. 0

June 2000

Prepared for:

McClellan Air Force Base
Environmental Management
Contract No. F04699-97-D-0021
Task Order No. 1008

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ADVANCED DRAFT FINAL

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This Soil Washing and Solidification/Stabilization Work Implementation Plan has been prepared as a part of the overall McClellan Air Force Base (AFB) remediation program. This document outlines the field activities required to conduct a treatability study assessing the viability(e.g.,cost and performance) of the two remediation technologies to clean designated contaminated soils at McClellan AFB. Non-VOC soils to be treated contain various heavy metals and/or semivolatile organic compounds.

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REPORT CERTIFICATION

The following report was prepared under the guidance of California Professional Engineers and meets or exceeds the applicable and relevant guidance documents pursuant to Contract No. F04699-97-D-0021, Task Order No. 1008.

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DISCLAIMER

This document has been prepared for the United States Air Force by URSG-Laidlaw, A Joint Venture (JV), to aid in the development of innovative technology under the Air Force Installation Restoration Program. Acceptance of this document in performance of the contract under which it is prepared does not mean the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

Background information, design bases, and other data have been furnished to the JV by McClellan Air Force Base or third parties, which the JV has used in preparing this document. The JV has relied on this information as furnished, and is not responsible for and has not confirmed its accuracy.

This document has been prepared based on assumptions made by the JV, which may substantially affect the conclusions and recommendations of this report. These assumptions, although thought to be reasonable and appropriate, may not prove true in the future. The JV's conclusions and recommendations are conditioned upon these assumptions.

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ABBREVIATIONS AND ACRONYMS

°F	Degrees Fahrenheit
μg/L	Micrograms per liter
μg/mL	Micrograms per milliliter
<	Less than
>	Greater than
≥	Greater than or equal to
°C	Degrees centigrade
μm	Micron
AA	Atomic absorption
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AIHA	American Industrial Hygiene Association
ALARA	As low as reasonably achievable
AOC	Area of concern
APHA	American Public Health Association
APR	Air-purifying respirator
ASTM	American Society of Testing and Materials
BESCORP	Brice Environmental Services Corporation
bgs	Below ground surface
BRAC	Base Realignment and Closure
CAA	Clean Air Act
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Act
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm^3	Cubic centimeters
CO	Contracting officer
COC	Chain-of-custody
CPR	Cardiopulmonary resuscitation
CRZ	Contaminant reduction zone
CS	Confirmed site
CWA	Clean Water Act
dBA	Decibels A scale
decon	Decontamination
DEFT	Decision error feasibility trials
DEHP	bis(2-Ethylhexyl)phthalate (di-ethylhexyl phthalate)
DHS	Department of Health Services
DI WET	Waste extract test with deionized water
DoD	Department of Defense
dpm	Disintegrations per minute

ABBREVIATIONS AND ACRONYMS (Cont'd)

DQO	Data quality objectives
DRI	Direct reading instrument
DTSC	Department of Toxic Substance Control
EE/CA	Engineering evaluation/cost analysis
EM	Environmental Management
EMS	Emergency medical services
EZ	Exclusion zone
FIFRA	Federal Insecticide, Fungicide, Rodenticide Act
FOC	Field operations coordinator
FPM	Field project manager
FS	Feasibility study
FSM	Field services manager
GC	Gas chromatograph
GC/FID	Gas chromatography/flame ionization detector
GC/MS	Gas chromatography/mass spectroscopy
GFAA	Graphite furnace atomic absorption
gpm	Gallons per minute
GW	Groundwater
H&S	Health and safety
H_2O	Water
HEPA	High efficiency particulate air
HSM	Health and safety manager
HSP	Health and Safety Plan
IAG	Interagency Agreement
IC	Investigative cluster
ICPES	Inductively coupled plasma atomic emission spectroscopy
ICP-MS	Inductively coupled plasma mass spectroscopy
ID	Identification
IDLH	Immediately dangerous to life or health
IPRG	Industrial preliminary remediation goal
IRP	Installation Restoration Program
JV	URSG-Laidlaw, a Joint Venture
kV	Kilovolts
LCS	Laboratory control standards
LDR	Land disposal restriction
LEL	Lower explosive limit
MCC	Motor control center
METRIC	McClellan Environmental Technology Remediation Implementation Contract
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
min	Minutes
mL	Milliliter
mm	Millimeter
MS	Matrix spikes
MSDS	Material Safety Data Sheets
NEC	National Electrical Code
NESC	National Electrical Safety Code
NETTS	National Environmental Technology Test Site

ABBREVIATIONS AND ACRONYMS (Cont'd)

MSD	Matrix spike duplicate
NAPL	Non-aqueous phase liquids
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NIOSH	National Institute of Occupational Safety and Health
nm	Nanometers
non-VOC	Non-volatile organic compound
NPL	National Priorities List
O&M	Operation and maintenance
OSC	Office Safety Coordinator
OSHA	Occupational Safety and Health Act
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
OVA	Organic vapor analyzer
OVM	Organic vapor monitor
PAH	Polynuclear aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, comparability, and completeness
Pb	Lead
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PE	Performance Evaluation
PE	Professional engineer
PELs	Permissible exposure limits
PID	Photoionization detector
PM	Project Manager
ppb	Parts per billion
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
PRL	Potential release location
PRP	Potentially responsible party
PVC	Polyvinyl chloride
QA	Quality assurance
QAC	Quality Assurance Coordinator
QAO	Quality assurance objectives
QAPP	Quality Assurance Project Plan
QC	Quality control
QLs	Quantitation limits
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
RICS	Remedial investigation characterization summary
ROD	Record of Decision
RPD	Relative percent difference

ABBREVIATIONS AND ACRONYMS (Cont'd)

RPRG	Residential preliminary remediation goal
RSD	Relative standard deviation
RSO	Radiation safety officer
RWQCB	Regional Water Quality Control Board
SAFR	Small Arms Firing Range
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SHSP	Site-Specific Health and Safety Plan
SMAQMD	Sacramento Metropolitan Air Quality Management District
SMS	Safety Management Standard
SOP	Standard operating procedure
SSC	Site safety coordinator
STEL	Short-term exposure limit
STLC	Soluble threshold limit concentration
STSP	Secondary treatment staging pile
SVOC	Semivolatile organic compound
SW	Solid waste
TAAR	Technology Application Analysis Report
TCLP	Toxic Characteristic Leaching Procedure
TPH-d	Total petroleum hydrocarbons as diesel
TPH-E	Total extractable petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TTLC	Total Threshold Limit Concentration
TWA	Time-weighted average
URSG	URS Greiner, Inc. - California
USC	United States Code
USCG	U.S. Coast Guard
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic compound
WET	Waste extraction test
WIP	Work Implementation Plan
XRF	X-ray fluorescence

1.0 INTRODUCTION AND BACKGROUND

This section of this Work Implementation Plan (WIP) introduces the soil washing and solidification/ stabilization study for *ex situ* soil treatment from sites that contain contaminants that are either semivolatile organic compounds (SVOCs) or metals. These are referred to as non-volatile organic compound (non-VOC) sites. This study is being conducted by URSG-Laidlaw, a Joint Venture (JV), with treatment subcontractors Surbec-ART (formerly ARCADIS Geraghty & Miller) and Brice Environmental Services Corporation (BESCORP), for McClellan Air Force Base (AFB). This section describes the technology need that was identified by McClellan AFB, a National Environmental Technology Test Site (NETTS), and discusses how the soil washing and solidification/ stabilization study is being conducted.

1.1 PROGRAM OVERVIEW

McClellan AFB has implemented an aggressive program to find more cost-effective environmental cleanup technologies. To this end, the Technology Integration Group is responsible for identifying and evaluating emerging or innovative remediation technologies. As part of the McClellan AFB remediation program, the Air Force Base Conversion Agency (AFBCA) funds evaluations of additional environmental treatment technology alternatives (*e.g.*, soil washing and solidification/ stabilization), other than those currently in use at McClellan AFB, which have the potential to reduce costs.

The Innovative Technology Program conducts demonstrations in support of the McClellan AFB Installation Restoration Program (IRP). The technologies evaluated by McClellan AFB at the NETTS location are chosen because they have the potential to reduce the life-cycle cost for the base cleanup.

McClellan AFB is one of four NETTS with established infrastructures and well-characterized contamination. McClellan AFB was designated as a NETTS in 1993. The goal of the NETTS program is to establish federal test locations at federal sites where governmental and private organizations can be invited to rigorously test and evaluate new environmental control and remediation technologies. The test program at each location is designed to obtain realistic environmental and economic information that may be applied nationwide to support the adoption and use of the more successful technologies. The NETTS program's ultimate goal is to accelerate to market the availability of these new technologies.

1.2 TECHNOLOGY NEED

McClellan AFB has identified the need to evaluate cost-effective alternative technologies for SVOCs and metals soil contamination remediation. Traditional approach to contaminated soils remediation is excavation and off-site disposal or containment, these expensive and liability-retaining alternatives. A technology to cost-effectively treat soil non-VOC contaminants on-base is needed.

Soil treatment technologies such as those to be performed in this soil washing and solidification/ stabilization study including soil classification, soil washing, asphalt emulsion batching, waste solidification/ stabilization, and fixation have been successfully implemented at numerous sites. Sites such as the Springfield Township Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, Aberdeen Proving Ground, Castle AFB, and Lackland AFB have successfully applied these technologies to similar conditions.

1.3 AMENDMENTS AND MODIFICATIONS

This section discusses how changes to the WIP will be addressed. When JV or McClellan AFB personnel observe changed conditions, they will notify the other party, discuss resolution of the issue, document the event and conditions, and resolve the issue. If the other party is not available, the event and condition will be documented, resolved, and discussed with the other party as soon as possible. Changes will be documented in a memorandum to McClellan AFB staff. For example, if a site initially selected for remediation is found to be inappropriate (*e.g.*, contaminants of concern are not present in the excavated area or unexpected conditions are encountered at the site), JV and McClellan AFB personnel would declare that site inappropriate. The JV then would shift the operations to the second priority site in that class. Should that site also be unacceptable, however, the Excavation Plan (Appendix E of this WIP), would be revised to address additional selected remediation site(s). It is recognized that reprioritizing a site may be required based on field-obtained information. Any such circumstances would be documented and presented as a deviation to the WIP in the Technology Application Analysis Report (TAAR).

1.4 PURPOSE AND OBJECTIVES

The study's purpose is to prepare the necessary documentation, evaluations, memoranda, and plans, following the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) 300, to conduct a treatability study assessing the viability (*e.g.*, cost and performance) of two innovative remediation technologies to clean non-VOC contaminated soils at McClellan AFB. The objectives of this soil washing and solidification/ stabilization study are to:

- Assess whether soil washing, in conjunction with solidification/ stabilization can substantially reduce the life-cycle costs to clean up certain non-VOC soil contamination sites at McClellan AFB. The study will also assess whether the projected time to clean up these sites can be substantially reduced.
- Conduct a treatability study of the technologies using soil from a minimum of three sites considered to be typical of soil contamination sites at McClellan AFB.
- Generate a scientifically defensible data set to assess the performance and cost of the technologies.
- Quantify the cost and performance of the technology, to include conceptual criteria that can be used to evaluate its applicability to other McClellan AFB sites.

2.0 SITE DESCRIPTION

This section provides a general description of the test site location, McClellan AFB. It includes the site location and a brief description of the history of the Air Force Base, as well as geologic and hydrogeologic summaries. The contamination at McClellan AFB is also described and potential cleanup goals are discussed.

2.1 SITE LOCATION AND HISTORY

McClellan AFB is located approximately seven miles northeast of downtown Sacramento, California (see Figure 2-1). The installation comprises nearly 3,000 acres and is bounded by the city of Sacramento to the west and southwest, the community of Antelope to the north, the unincorporated areas of Rio Linda to the northwest, and the community of North Highlands to the east.

McClellan AFB was established in 1936 as the Sacramento Air Depot. As part of its historical and recent mission, McClellan AFB has provided logistics support for aircraft, weapons systems, communications equipment, and commodity items as well as maintenance, supply, and contracting services. As part of 1995 Base Realignment and Closure (BRAC) activities, the decision was made to close McClellan AFB in 2001. Because of current and past missions, McClellan AFB has engaged in a variety of operations involving the use, storage, and disposal of hazardous materials including industrial solvents, caustic cleaners, electroplating chemicals, heavy metals, polychlorinated biphenyls (PCBs), low-level radioactive materials, and a variety of fuel oils and petroleum hydrocarbons.

McClellan AFB began addressing areas of groundwater contamination in 1979. As part of that program they delineated four areas (i.e., A, B, C and D) for remediation. In 1981, the Department of Defense (DoD) established its IRP, and McClellan AFB revised its comprehensive program. In 1987, McClellan AFB again revised its program when the site was added to the National Priority List (NPL), also known as the Superfund List. The Air Force, the United States Environmental Protection Agency (USEPA) and the California Department of Health Services (DHS) signed an Interagency Agreement (IAG) in 1989 for the cleanup of McClellan AFB. Operable units (OUs) encompassing known or potential sites (i.e., A1, A2, A3, B1, B2, C1, C2, D, E, F, G, and H) were identified in the IAG. In 1989, these areas were reorganized into OUs A through H, B1, C1 and GW (groundwater) that covered the entire base. The IAG was implemented in 1990. The IAG had been signed pursuant to CERCLA, Resource Conservation and Recovery Act (RCRA), National Environmental Policy Act, Defense Environmental Restoration Program, Executive Order 12580 and the California Health and Safety Code. The duties and responsibilities of the DHS were transferred to the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) in a subsequent reorganization. In March 2000, responsibility for Environmental Restoration functions at McClellan AFB were transferred to AFBCA.

2.2 GEOLOGY

McClellan AFB is centrally located within the Great Valley, a wedge-shaped accumulation of sediments, bounded on the west by the Coast Range and on the east by the Sierra Nevada. The Great Valley is approximately 400 miles long, from Redding in the north to Bakersfield in the south. The Sacramento River drains the northern portion of the valley, and the San Joaquin River drains the southern portion.

From the ground surface to a depth of 450 feet below ground surface (bgs), the subsurface of McClellan AFB consists of alluvial and fluvial sediments eroded from the Sierra Nevada and deposited over the last five million years. The range of soil types at the base is diverse, and includes coarse sands, fine sands, sandy silts, silty sands, and silts. At the depths of concern for this study (i.e., 0 to 25 feet bgs), soils include poorly sorted silty or clayey sands and sandy or clayey silts. Soils vary from location to location; however, predominant surficial soils (i.e., 0 to 5 bgs) contain fill, sand, silt, silty sand, and clay. Fluvial deposits have been found throughout OU A. Additional background geologic information is presented in the Preliminary Groundwater Operating Unit Remedial Investigation (Radian 1992) and in the various Remedial Investigation (RI) Characterization Summary Reports.

Generally, there is a limited amount of naturally-occurring oversize soils; however, in defined waste areas, particularly in former landfill sites, there is some oversize debris. Soil parameters for the selected sites will be determined initially through preoperational characterization and on an ongoing basis as part of the process control monitoring as discussed in Section 7.0.

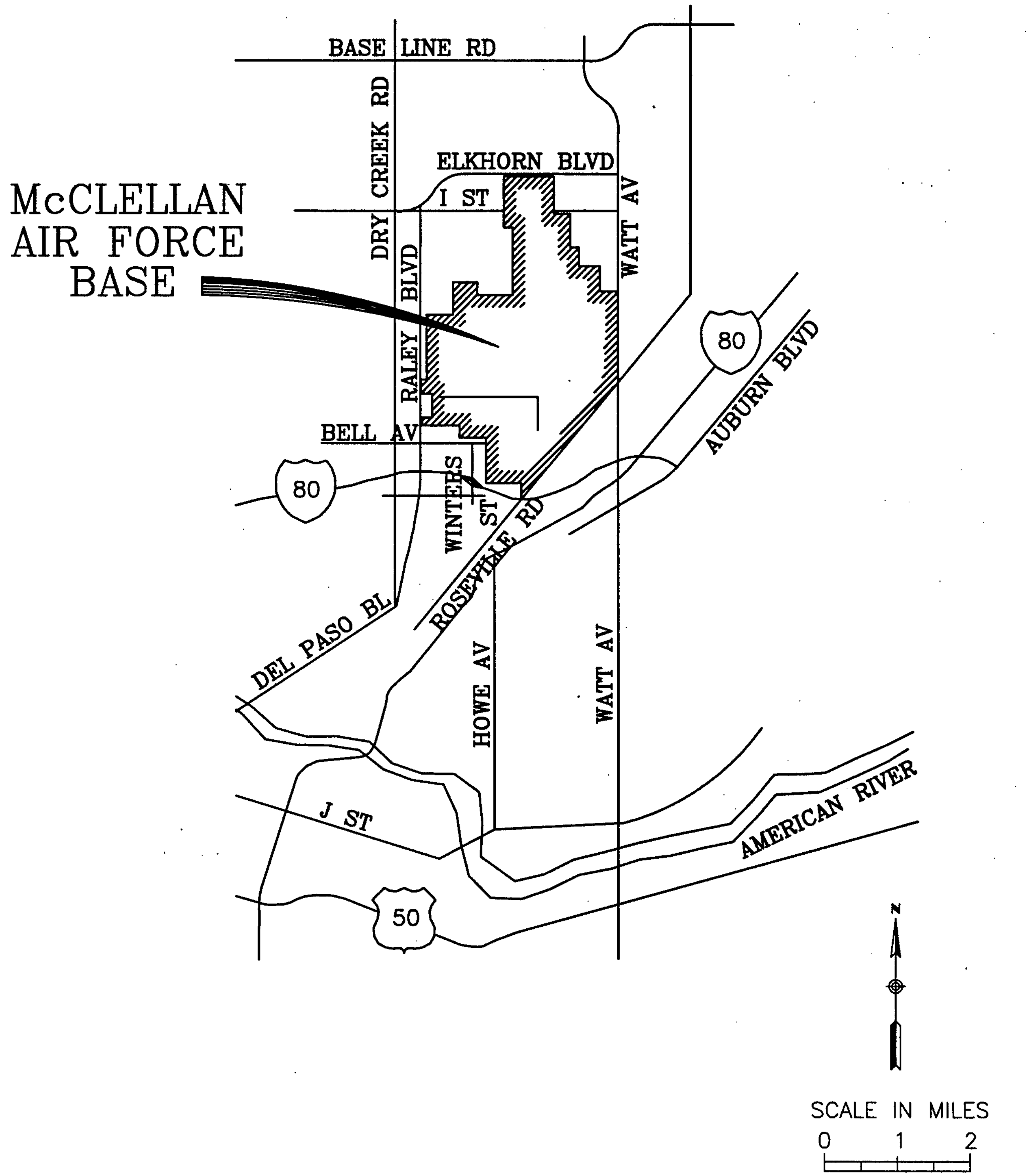

FIGURE 2–1

SITE LOCATION MAP
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

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M–AFB\PROCESS

2.3 HYDROGEOLOGY

Groundwater in the uppermost aquifer beneath McClellan AFB is encountered approximately 100 to 115 feet bgs. Groundwater flows generally to the south-southwest through the uppermost aquifer. Since this soil washing and solidification/ stabilization study is intended to provide only information on the applicability of soil remediation typically at depths less than 35 feet bgs, no further consideration of on-base hydrogeology is appropriate.

2.4 CONTAMINANT DISTRIBUTION

As previously mentioned, McClellan AFB has been subdivided, for environmental management purposes, into OUs. Each OU corresponds to a geographic area where specific industrial operations or waste management activities have taken place. Eleven OUs have been identified, designated as OU A through OU H, B1, C1, and GW. McClellan AFB has 319 "sites," *i.e.*, 319 areas that are tracked for contamination and cleanup under the jurisdiction of the Air Force. The term "site" generally means an area where contaminants have been released to the environment. Seventy-eight sites are included in the Non-VOC and Landfill Sites Feasibility Study (FS). The 78 sites in the non-VOC FS are contaminated with inorganics or SVOCs including polyaromatic hydrocarbons (PAHs), PCBs, pesticides, and dioxins/furans. Site types include landfills, washracks, underground storage tank (UST) sites, firing ranges, sludge pits, pipelines, creek beds, and others.

Since final cleanup goals have not yet been established in a Record of Decision (ROD) for McClellan AFB, the USEPA Region IX preliminary remediation goals (PRGs), both residential (RPRG) and industrial (IPRG) (USEPA 1998b), are used as the main cleanup goals for this study. The treated soil will also be compared to background for naturally-occurring compounds or non-detect, to designated levels that will impact groundwater quality, and to hazardous criteria. See Figure 2-3 for materials classification. The overall volume for all non-VOC sites potentially requiring treatment is approximately 900,000 cubic yards, to meet RPRGs, and 800,000 cubic yards to reach IPRGs (CH2M Hill 1999a). For this study, approximately 2,400 cubic yards of non-VOC contaminated soils are to be treated.

In support of this study, McClellan AFB has selected ten potential sites for testing. The candidate sites were chosen to reflect typical non-VOC sites present at McClellan AFB. The candidate sites are segregated into three major groups: landfills, SVOC spill sites, and sites having only metals contamination. Table 2-1 summarizes location, contaminants of concern, and site prioritization. Figure 2-2 illustrates the site locations. Sites are divided into general categories and prioritized separately.

Table 2-1

BACKGROUND INFORMATION AND PRIORITIZATION OF CANDIDATE SITES

Ranking	Site Designation	Site Location	Materials Handled/ Site Activities	Operation Dates	Contaminants of Concern	Comments
Landfill Sites						
1	CS 013	OU C IC 19	Plastic, paper, burned material, fuels and solvents disposed in disposal pit/ solid waste landfill; formerly housed aboveground fuel storage tank	1949 - 1974	Sb, Cd, Pb, Mn, Cr, Ni, Cu, TPH-d, PCB-1260, DEHP, naphthalene, dioxin, pentachlorophenol, n- nitrosodiphenylamine, 2,6-dinitrotoluene, 4-chloroaniline, chlordane, 4-methylphenol, n- nitrosodi-n-propylamine, 1,4-dichlorobenzene	1.2 acres; mainly undeveloped grassland; gravel road runs through southern portion
2	CS 011	OU C IC 19	Disposal pit/landfill/burn pit; open excavation, fire training area (fuel and oils discharged to ground and ignited); contaminated soils holding area	1949 – 1974 1965 – 1966 (open) 1977 – 1987 (fire training) 1987 – 1993 (soils holding)	Sb, Cd, Pb, Tl, Cr, As, TPH-d, PCB, DEHP, 1,2-dichlorobenzene, 1,3-dichlorobenzene, naphthalene, 1,4-dichlorobenzene, fluoranthene, dibenzofuran, pentachlorophenol, fluorene, n-nitrosodiphenylamine, 2,4-dimethylphenol, pyrene	0.74 acre, partially paved; adjacent area is flat, unpaved grassland, gravel road
3	CS 069	OU C1	Burial pit, burn debris pits landfill	1950's – early 1960's	Pb, Cr, Cu, Cd, TPH-d, 1,4-dichlorobenzene, PCB, dioxin, radium-226	1.02 acre; grass-covered, unimproved; easy access, close to treatment area; industrial wastewater line runs east-west through the site
4	CS 012	OU C IC 19	Disposal pit/landfill/burn pit; fire training area (fuel and oils discharged to ground and ignited); contaminated soils holding area	1949 – 1974 1977 – 1987 (fire training) 1987 – 1993 (soils holding)	Sb, Cd, Pb, Mn, Hg, Tl, Cr, As, TPH-d, PCB, DEHP, chrysene, naphthalene, fluoranthene, dibenzofuran, n-nitrosodiphenylamine, dibenzo(a,h)anthracene, acenaphthalene, dioxin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene	1.34 acres; difficult to access
5	CS 043	OU C IC 17	Inactive disposal pit and solid waste landfill; wastes included solvents, demolition debris and solid industrial wastes	1940's – 1957	Cr, Pb, Al, Ni, Sb, Cu, PCB-1260, TPH-d, DEHP, 1,4-dichlorobenzene, 4-methlyphenol, "NAPL," 1,2-dichlorobenzene, Ra-226	0.48 acre; partially covered in asphalt, some grass cover, western portion is part of fenced area. Due to the presence of Ra-226, this site is not recommended for this treatability study.

Table 2-1 (Cont'd)

BACKGROUND INFORMATION AND PRIORITIZATION OF CANDIDATE SITES

Ranking	Site Designation	Site Location	Materials Handled/ Site Activities	Operation Dates	Contaminants of Concern	Comments
SVOC Spill Sites						
1	PRL S-006 Non VOC EE/CA site	OU A IC 32	Old sanitary waste treatment facility; later converted into industrial wastewater treatment plant No. 1; contaminated backfill; some hot spots	1930's – 1954 (sanitary) 1954 – 1972 (industrial)	benzo(a)pyrene, benzo(a)anthracene and benzo(b)fluoranthene, Pb (Pb, As, PAHs above background)	McClellan AFB preferred "SVOCs and metals" site, due to EE/CA designation. 0.35 acre; buildings mostly demolished in 1994; most of site is bare
2	AOC G-3	OU G	Aircraft maintenance apron, including fuel dumps, repaving	1959 – 1999	benzo(a)pyrene, benzo(a)anthracene and benzo(b)fluoranthene VOC contamination, but not requiring remediation	McClellan AFB preferred "SVOCs only" site 13.78 acres; apron is paved with concrete; unpaved areas adjacent to apron and in undeveloped area north of apron; difficult access
Metals Only Sites						
1	PRL S-004 Non VOC EE/CA site	OU A IC 36	Storage area for unknown materials and former lube oil storage building (demolished)	1943 - 1972	Pb to be remediated (TPH-d, SVOCs present, but do not require remediation, per source report noted below)	McClellan AFB preferred "metals only" site due to EE/CA designation. 0.68 acre; currently unused, overgrown grassland
2	Waste Pile	OU B IC 7	Storage of dirt from various excavation sites	1950's – 1960's	Pb, Cd, Cr	0.15 acre, dirt contains unspecified chemicals, rubble and concrete slabs
3	Small Arms Firing Range	OU C, OU D, IC 21	Small arms firing range - spent ammunition	1957 - 1999	Pb, Cu, Sb	0.67 acres, grass-covered soil berm at northeastern end with concrete backstop; piles made up of ammunition debris.

Source: CH2M Hill, Appendix D, Non-VOC and Landfill Sites Feasibility Study Report, Working Copy, April 1999

Al	aluminum	Hg	mercury	VOC	volatile organic compounds
As	arsenic	Mn	manganese	TPH-d	total petroleum hydrocarbons as diesel
Cd	cadmium	Sb	antimony	PCB	polychlorinated biphenyls
Cr	chromium	Tl	thallium	NAPL	non-aqueous phase liquid – not further identified in above-referenced report
Cu	copper	Ra	radium	PAH	Polynuclear aromatic hydrocarbons
Ni	nickel	DEHP	bis(2-ethylhexyl) phthalate	SVOCs	semivolatile organic compounds
Pb	lead	EE/CA	Engineering Evaluation/Cost Analysis	CS	Confirmed site
OU	Operable unit	IC	Investigative cluster	PRL	Potential release location
AOC	Area of concern				

DIRECTIONS TO BELL AVENUE GATE:

Exit Non-VOC Study Treatment Pad area on adjacent road. Travel west to Patrol Road. Turn left (south) and proceed to Dean Street. Turn left (east) on Dean Street, then right (south) on Kilzer Avenue, and exit base at Bell Avenue gate.

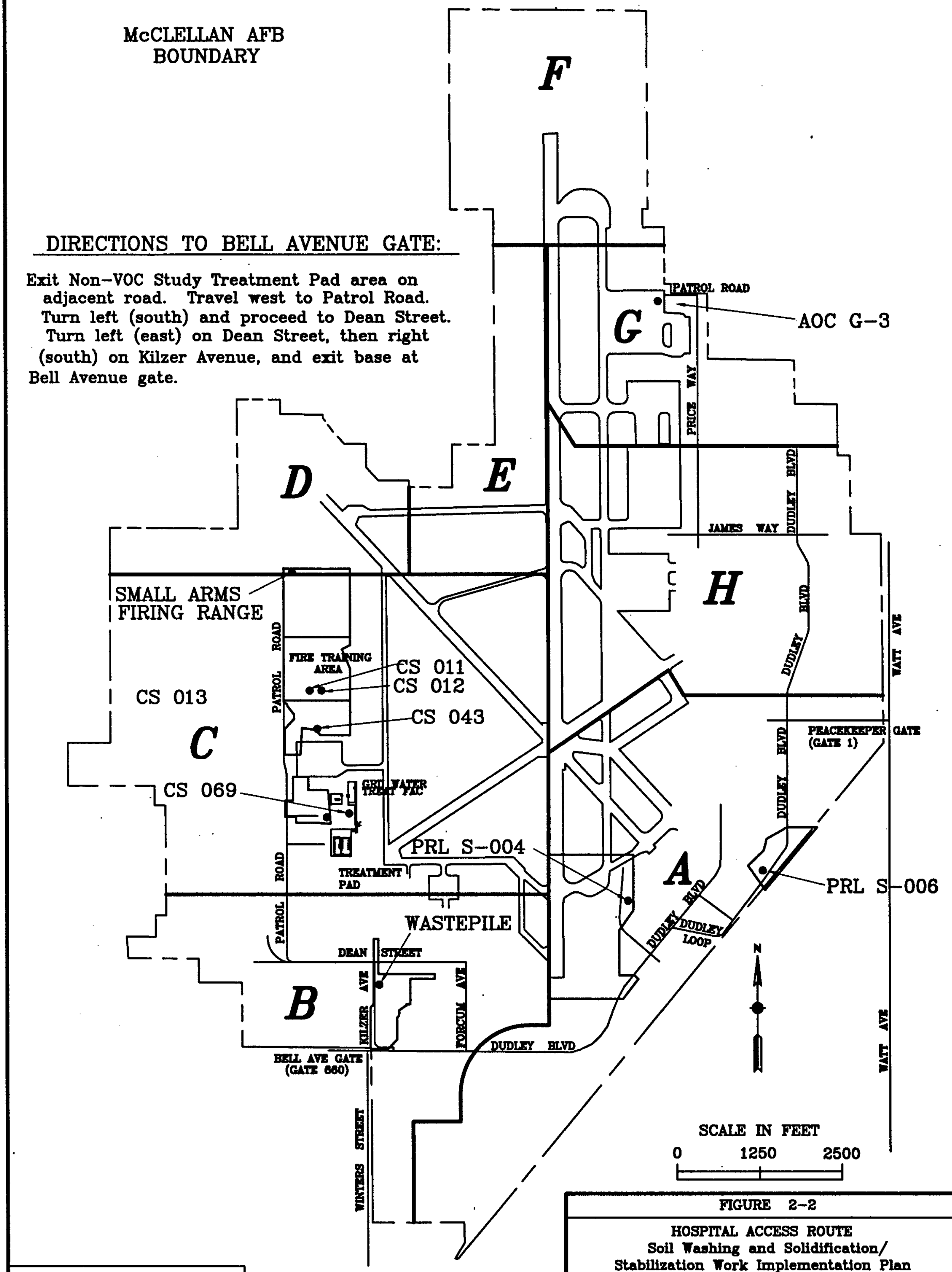

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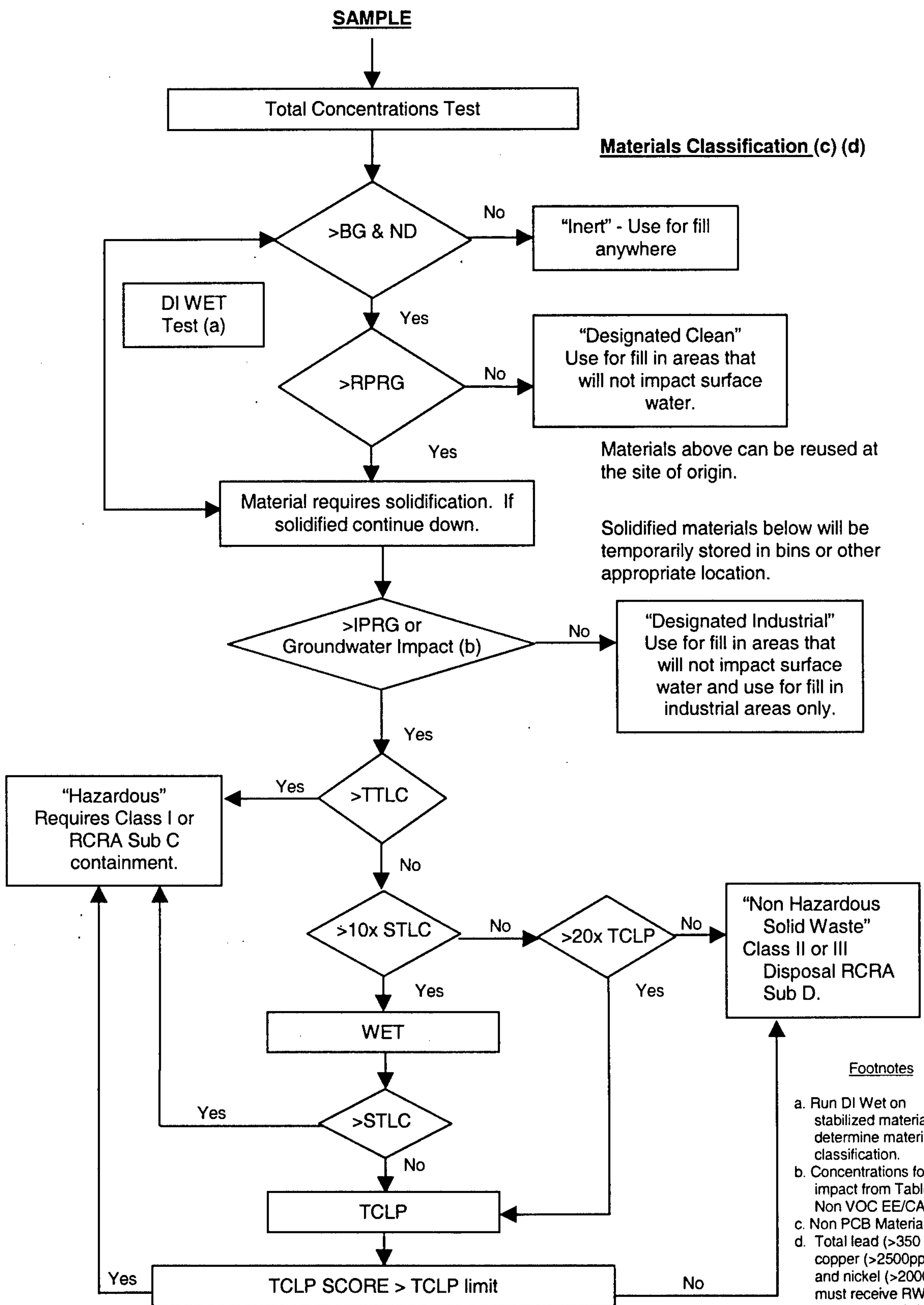
FIGURE 2-2

HOSPITAL ACCESS ROUTE
Soil Washing and Solidification/ Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento. CA

T:\ENV.\MCCAFBSOILWASHING\TAMARA\FIG2-2.DWG (ETB)



Footnotes

a. Run DI Wet on stabilized material to determine material classification.
b. Concentrations for GW impact from Table 2-1 Non VOC EE/CA
c. Non PCB Material
d. Total lead (>350 ppm), copper (>2500ppm), and nickel (>2000 ppm) must receive RWQCB approval (H&S Code 25157.8)

BG = Background
ND = Non Detect

Figure 2-3
MATERIAL CLASSIFICATION(c)(d)

Prioritization criteria considered include:

Overall Non-VOC Program representativeness. Ten sites have been initially selected for consideration. These sites are generally considered as typical or representative of Non-VOC Program sites. The sites include landfills, metals-contaminated waste piles, and sites with shallow SVOC contamination from aircraft maintenance operations. The ten sites are:

- Potential Release Location (PRL) S-6 (lead/SVOCs)
- PRL S-4 (lead)
- AOC G-3 (SVOCs)
- Waste pile (metals)
- Small Arms Firing Range (SAFR) (lead and copper)
- Confirmed site (CS) 43 (metals/SVOCs)
- CS 11 (metals/SVOCs)
- CS 12 (metals/SVOCs)
- CS 13 (metals/SVOCs)
- CS 69 (metals/SVOCs)

Site Characteristics. These characteristics include location, ease of excavation, contaminants of concern, and past and current site use. The goal of prioritization is to select for treatment at least one landfill, one SVOC spill site, and one metals-contaminated site. Additionally, if appropriate, treatment will be performed at least one site that requires only SVOC treatment, and one that requires a combination of SVOCs and metals remediation. A site having multiple chemicals of concern has been ranked higher than one having fewer. In general, a site having difficult access is ranked lower than one having easy access.

Risk/Expedited Cleanup Requirements. Two selected sites, PRL S-006 and PRL S-004, have been given higher priority because of their status as proposed engineering evaluation/cost analysis (EE/CA) sites. These areas have high reuse potential and expedited remediation is therefore desirable. These sites are discussed in more detailed in the site-specific non-VOC EE/CA (CH2M Hill 1999c).

The top-ranked site from each group will be evaluated in accordance with Subsection 5.1.1 to confirm that the soils are amenable to soil washing. In the event that the site is rejected based upon on-base observations and field testing, the next highest ranked site will be evaluated. Additional information regarding specific material selection is discussed in the Excavation Plan (Appendix E).

2.4.1 Contaminants of Concern

Contaminants of concern differ between sites. Three sites will initially be selected from non-VOC areas of defined OUs, as discussed above. In general, contaminants include metals such as antimony, nickel, chromium, cadmium, lead and semi-metallics such as arsenic. Sites that contain SVOCs predominantly contain benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, naphthalene, chlordane, bis(2-ethylhexyl) phthalate (DEHP), pentachlorophenol, n-nitrosodiphenylamine, 4-chloroaniline, 4-methylphenol, n-nitrosodi-n-propylamine, 1,4-dichlorobenzene, and dioxins. Site soils also contain VOCs, total petroleum hydrocarbons (TPH), and non-VOCs such as PCBs, pesticides, radionuclides, and dinitrotoluene.

Table 2-2 presents the non-VOC contaminants of concern measured in site soils. Due to the uncertainty of both future land use and cleanup standards to be specified in the non-VOC RODs, contaminants having soil concentrations that exceed the PRGs are considered to be contaminants of concern for this study. Several constituents including pyrene and fluorene are present in soils, but below RPRGs. They have been included in Table 2-2 to indicate their presence. However, use of italics indicates that they are not expected to be chemicals of concern at the listed site. Additionally, although not within the scope of this study, there may be VOCs present in some of the soils being treated (i.e., landfills). Although the efficiency of this treatment demonstration is not being determined for VOC removal, residuals and products from treatment of landfill soils will be analyzed for VOCs as necessary and compared to RPRGs to verify their disposition as designated clean. This is discussed further in Section 7.0. Landfills will also be screened for radioactive materials as noted in Section 9.

2.4.2 Target Cleanup Goals

Since cleanup goals have not been established for McClellan AFB soils, USEPA Region IX RPRGs will be used for target cleanup goals for this study. The RPRGs have been found to be less than concentrations that would impact groundwater quality. (See Table 2-1, Preliminary Cleanup Goals, in the PRLS-033 non-VOC EE/CA, CH2M Hill 1999c). The naturally-occurring constituent concentrations will also be compared to their background concentrations (EE/CA Table 2-1, CH2M Hill 1999c) to ensure protection of surface water. The final cleanup levels for non-VOC sites will be determined in a non-VOC ROD. The purpose of this study is to determine the cost and performance of soil washing and solidification/stabilization to treat soils received from non-VOC sites at McClellan AFB. As this study does not address the final clean up of any of these sites. These target cleanup goals will be used to evaluate the results of the treatability study to identify material that could be designated as "clean," and potentially used as backfill. To determine if treated soil could be designated as clean, the chemical analytical result for each contaminant will be compared to the RPRG. If all contaminants are below their RPRGs, the treated soil will be considered suitable for backfill in designated areas (see Figure 2-3).

Treated soils that do not meet RPRGs will also be evaluated against IPRGs. Depending upon the final site cleanup goals, to be established in a ROD, soils meeting IPRGs may later be deemed "clean for use in industrial areas away from surface water bodies."

Table 2-2
CONTAMINANTS OF CONCERN

Site Designation	Site Location	Depth (ft bgs)	Contaminants Present	Maximum Concentrations (mg/kg)	EPA Region IX PRGs, Residential Scenario (mg/kg)	EPA Region IX PRGs, Industrial Scenario (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
CS 069	OU C1	12.75	chromium	1,500	210	450	2,500	5.0	5.0
		12.75	lead	3,900	130	1,000	1,000	5.0	5.0
		12.75	copper	20,000	2,800	70,000	2,500	25	-
		13.00	cadmium	410	9	930	100	1.0	1.0
		10.25	1,4-dichlorobenzene	14	3	7.3	-	-	7.5
		12.75	dioxin	0.08	0.0000038	0.00003	0.01*	0.001*	-
		12.75	PCBs	1.60	0.2	1.3	50	5	-
		12.75	TPH-d	3,200	100**	-	-	-	-
CS 013	OU C, IC 19	8.50	1,4-dichlorobenzene	120	3	7.3	-	-	7.5
		9.50	2,6-dinitrotoluene	1,700	55	1,100	-	-	-
		6.50	chlordane	720	1.6	12	-	-	-
		5.00	chromium	2,100	210	450	2,500	5.0	5.0
		5.50	DEHP	18,000	32	210	-	-	-
		25.00	dioxin	0.000092	0.0000038	0.00003	0.01*	0.001*	-
		5.50	lead	3,700	130	1,000	1,000	5.0	5.0
		8.00	n-nitrosodiphenylamine	22,000	91	610	-	-	-
		9.50	naphthalene	310	55	190	-	-	-
		9.50	pentachlorophenol	340	2.5	15	17	1.7	100
		8.00 – 14	PCBs	1,800	0.2	1.3	50	5	-
		5.00 – 7	cadmium	210	9	930	100	1.0	1.0
		9.50 – 10	4-chloroanaline	270	-	-	-	-	-
		9.50 – 10	*pyrene*	150	1,500	26,000	-	-	-
		8.50- 10	n-nitrosodi-n-propylamine	950	0.063	0.43	-	-	-
		8.50 – 10	4-methylphenol	950	270	5,300	-	-	-
		5.50 – 10.5	antimony	35	30	750	500	15	-
		5.50 – 10.5	nickel	210	150	37,000	2,000	20	-
		5.50 – 10.5	copper	5,300	2,800	70,000	2,500	25	-
		18.50 - 21	manganese	3,300	3,100	45,000	-	-	-

Table 2-2

CONTAMINANTS OF CONCERN (Cont'd)

Site Designation	Site Location	Depth (ft bgs)	Contaminants Present	Maximum Concentrations (mg/kg)	EPA Region IX PRGs, Residential Scenario (mg/kg)	EPA Region IX PRGs, Industrial Scenario (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
CS 011	OU C, IC 19	11.00 – 14.5	1,4-dichlorobenzene	4,200	3	7.3	-	-	7.5
		15.50 – 24	arsenic	27	0.38	3	500	5.0	5.0
		6 – 7.5	DEHP	86,000	32	210	-	-	-
		15.50 – 24	dibenzofuran	260	210	3,200	-	-	-
		15.50 – 24	fluoranthene	2,900	2,000	37,000	-	-	-
		15.50 – 24	2,4-dimethylphenol	2,000			-	-	-
		15.50 – 24	lead	4,400	130	1,000	1,000	5.0	5.0
		15.50 – 24	*fluorene*	240	1,800	22,000	-	-	-
		15.50 – 24	*mercury*	15	22	560	20	0.2	0.2
		11.00 – 14.5	naphthalene	440	55	190	-	-	-
		11.00 – 14.5	1,2-dichlorobenzene	6,000	370	370	-	-	-
		15.50 – 24	*pyrene*	240	1,500	26,000	-	-	-
		34.50 – 35	n-nitrosodiphenylamine	190	91	610	-	-	-
		11.00 – 14.5	1,3-dichlorobenzene	1,900	41	140	-	-	-
		11.00 – 14.5	pentachlorophenol	470	2.5	15	17	1.7	100
		11.00 – 14.5	antimony	160	30	750	500	15	-
		11.00 – 14.5	thallium	61	5.2	130	700	7.0	-
		11.00 – 14.5	chromium	320	210	450	2,500	5.0	5.0
		18.5 – 20	PCBs	1.00	0.2	1.3	50	5	-
		18.5 – 20	copper	4,000	2,800	70,000	2,500	25	-
		18.5 - 20	cadmium	91	9	930	100	1.0	1.0
CS 012	OU C, IC 19	9.50 – 25	DEHP	10,000	32	210	-	-	-
		16.00 – 18.5	lead	3,800	130	1,000	1,000	5.0	5.0
		34.5 – 35	n-nitrosodiphenylamine	590	91	610	-	-	-
		9.50 – 25	dibenzo(a,h)anthracene	1,200	0.056	0.36	-	-	-
		9.50 – 25	antimony	210	30	750	500	5.0	-
		9.50 – 25	thallium	51	5.2	130	700	7.0	-
		9.80 – 25	2,4-dinitrotoluene	200	110	2,100	-	-	0.13
		9.50 – 25	acenaphthalene	3,200	2,600	28,000	-	-	-
		9.50 – 25	dibenzofuran	3,500	210	3,200	-	-	-
		9.50 – 25	naphthalene	1,200	55	190	-	-	-
		9.50 – 25	2,6-dinitrotoluene	420	55	1,100	-	-	-
		9.50 – 25	*anthracene*	5,900	14,000	220,000	-	-	-
		9.50 – 25	chrysene	12,000	6.1	360	-	-	-
		9.50 – 25	benzo(a)anthracene	13,000	0.56	3.6	-	-	-
		9.50 – 25	fluoranthene	28,000	2,000	37,000	-	-	-

Table 2-2

CONTAMINANTS OF CONCERN (Cont'd)

Site Designation	Site Location	Depth (ft bgs)	Contaminants Present	Maximum Concentrations (mg/kg)	EPA Region IX PRGs, Residential Scenario (mg/kg)	EPA Region IX PRGs, Industrial Scenario (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
		5.00 – 6.5	PCBs	1.60	0.2	1.3	50	5.0	-
		16.00 – 18.5	cadmium	130	9	930	100	1.0	1.0
		18.00 – 20	mercury	22	22	560	20	0.2	0.2
		18.00 – 20	manganese	4,100	3,100	45,000	-	-	-
		16.00 – 18.5	arsenic	25	0.38	3	500	5.0	5.0
		16.00 – 18.5	chromium	230	210	450	2,500	1.0	5.0
		1.00 – 2	benzo(a)pyrene	96	0.056	0.36	-	-	-
		1.00 - 2	*pyrene*	160	1,500	26,000	-	-	-
		9.5 - 25	TPH -d	10,500	100**	-	-	-	-
CS 043	OU C, IC 17	10	PCB-1260	0.77	0.02	1.3	50	5	
		10	Radium-226* (pCi/g)	5.05	-	-			
		10	antimony	160	30	750	500	15	-
		10	lead	4,300	130	1,000	1,000	5.0	5.0
		10	copper	9,900	2,800	70,000	2,500	25	-
		10	chromium	870	210	450	2,500	5.0	5.0
		10	aluminum	78,000	75,000	100,000			
		10	nickel	600	150	37,000	2,000	20	
		10	TPH-d	4,500	100**	-	-	-	-
		10 - 14.5	DEHP	6.5	32	210	-	-	-
		1.5 – 7.5	1,4-dichlorobenzene	4.4	3	7.3	-	-	-
		1.5 – 7.5	4-methylphenol	3.1	270	5,300	-	-	-
		1.5 – 7.5	1,2-dichlorobenzene	21	370	370	-	-	-
PRL S-006 Non-VOC EE/CA site	OU A, IC 32	0	benzo(a)pyrene	3.38	0.056	0.36	-	-	-
		0	benzo(b)fluoranthene	4.54	0.56	3.6	-	-	-
		0	benzo(a)anthracene	2.64	0.56	3.6	-	-	-
		1.5	lead	166	130	1,000	1,000	5.0	5.0
AOC G-3	OU G	0.00	benzo(a)pyrene	1.40	0.056	0.36	-	-	-
		0.00	benzo(a)anthracene	1.00	0.56	3.6	-	-	-
		0.00	benzo(b)fluoranthene	2.60	0.56	3.6	-	-	-
PRL S-004 Non-VOC EE/CA site	OU A, IC 36	0.00	lead	760	130	1,000	1,000	5.0	5.0
		0.00	TPH-d	1,200	100**	-	-	-	-
Waste pile	OU B, IC 7	0.50	chromium	1,000	210	450	2,500	5.0	5.0
		0.50	cadmium	88	9	930	100	1.0	1.0
		0.50	lead	470	130	1,000	1,000	5.0	5.0

Table 2-2

CONTAMINANTS OF CONCERN (Cont'd)

Site Designation	Site Location	Depth (ft bgs)	Contaminants Present	Maximum Concentrations (mg/kg)	EPA Region IX PRGs, Residential Scenario (mg/kg)	EPA Region IX PRGs, Industrial Scenario (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
Small Arms Firing Range	OU C	0.00	lead	71,000	130	1,000	1,000	5.0	5.0
	OU D	3.00	antimony	39	30	750	500	15	-
	IC 21	0.00	copper	4,100	2,800	70,000	2,500	25	-

Source: CH2M Hill, Appendix B, Non-VOC and Landfill Sites Feasibility Study Report, Working Copy, April 1999, except for CS 043 data, from IC 17 Final RICS, January 1998.
Use of italics indicates chemical is present at levels below RPRG (i.e., they are not chemicals of concern at the listed site)
Where appropriate (i.e., lead, cadmium, nickel), California modified PRGs are incorporated on this table.

mg/kg	Milligram per kilogram	ft bgs	Feet below ground surface	PRGs	Preliminary Remediation Goals
PCB	Polychlorinated biphenyls	OU	Operable unit	SA	Study area
IC	Investigative cluster	DEHP	bis-(2-Ethylhexyl)phthalate	CS	Confirmed site
EPA	U.S. Environmental Protection Agency	PRL	Potential release location	EE/CA	Engineering evaluation/cost analysis
-	Not applicable	TPH-d	Total petroleum hydrocarbons as diesel	SVOCs	Semivolatile organic compounds
pCi/g	picoCuries per gram	mg/L	milligrams per liter	TCLP	Toxicity Characteristic Leaching Procedure
STLC	Soluble Threshold Limit Concentration	TTLC	Total Threshold Limit Concentration	WET	Waste Extraction Test
*	Values for 2,3,7,8-tetrachlorodibenzo-p-dioxin	**	Values provided for TPH-d are based on the Tri-Regional Guidelines protective of groundwater quality		

3.0 TECHNOLOGY DESCRIPTION

3.1 PRINCIPLES OF TECHNOLOGY

Soil washing combines water-based treatment units that use physical and chemical means to remove particulate contaminants and transfer adsorbed contaminants into a small soil mass that can be stabilized while rendering a large soil mass uncontaminated. Solidification/ stabilization treatment commonly involves excavating contaminated soil and mixing it with chemical additives (i.e., reagents), and using complex chemical reactions to improve physical properties and reduce contaminant toxicity and mobility. This section describes those operations.

3.1.1 General Description

The diverse range of feedstock expected in this study will be managed through characterization in the field by the project team, coupled with the ability to divert feed streams to the appropriate arrangement of treatment units. This will be accomplished using four base treatment modules:

- A prescreening module to remove debris and gross oversize material while preparing a "standard" plant feed;
- A physical separation module to remove oversize material and separate sands from fines;
- A sand treatment module to remove contaminants to be concentrated in the fines; and
- A fines treatment module to allow dewatering, stabilization, or further treatment of this fraction.

The system is arranged such that the appropriate modules will be used for each of the distinct soils tested. A process flow diagram for the system is depicted on Figure 3-1. The overall system has a basic throughput capacity of 20 tons per hour, with the primary system-limiting operation being the fines dewatering subsystem. All water is recycled in the system and thus results in no discharge during operations. The soil washing is a net water consumer. Exact contaminant soil concentrations are not known. As such, prior to processing, soil from selected excavation areas will be sampled and analyzed. Additionally, a mass balance for each soil tested will be prepared, and included in the TAAR at the end of the field treatability study.

3.1.1.1 Soil Washing

Soil washing is primarily a water-based volume-reduction technology that uses physical processes to separate fine soils from coarser soils. Contamination is often concentrated on the fine soils so that the coarse fraction may be below target contaminant levels. The contaminants are generally adsorbed onto particle surfaces and, because of the much larger surface area of the fine particle sizes, the majority of the contaminants are often associated with the fines. Soil washing also can be enhanced by the addition of chemicals that aid in the dispersion of the particles or chemical removal of contaminants from soils. The soil washing process to be undertaken in this study is a combination of water-based treatment units that are modified in their configuration based upon the physical soil characteristics, the distribution and concentration of contaminants in each key soil fraction, and the nature of the contaminants encountered.

As such, soil washing is practiced in two related modes:

- One which relies primarily on physical separation of target contaminants in the coarse fractions transferring the contaminants to a smaller mass of fine particles; and
- One which relies on target contaminant solubilization into washwater, which can be further treated and then reused.

For the study target contaminants (i.e., metals and SVOCs), the physical separation arrangement of soil washing should provide the highest benefit, due to the relative insolubility of the target contaminants in water, and the high propensity for contaminant concentration in the finer-grained particles.

In the physical separation mode, the contaminant distribution in the soil matrix is the key factor by which the various treatment unit operations are arranged and employed. Subsection 3.1.2 contains detailed unit process descriptions. A particle size distribution curve, used to quantify and evaluate the soil matrix, is constructed by wet sieving representative samples. Materials retained on each of nine successively finer sieves are dried, the mass determined, and the results plotted. The process is conducted in accordance with American Society of Testing and Materials (ASTM) Standard Method 422D. For soil washing systems, three gross fractions are frequently discussed:

- The oversize (soils and debris with average particle sizes larger than 2 millimeters [mm]).
- Sands (with particles sizes less than 2mm and as small as 0.038mm); and
- Fines (with particle sizes less than the smallest defined sand diameter).

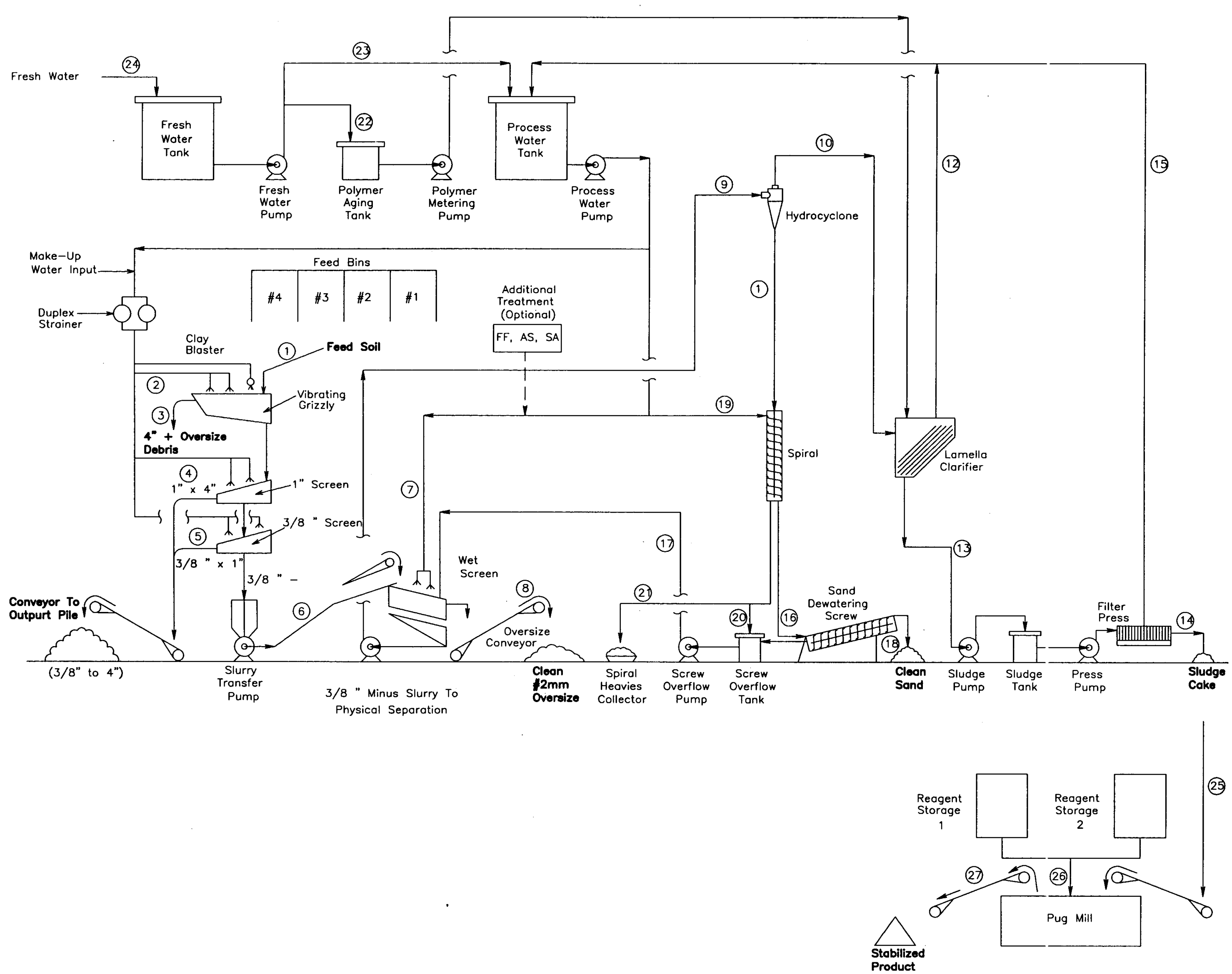
For the project, the candidate feed soil volumes have not been specifically defined. The range of soil types at the base is diverse, and includes clays, clayey silts, coarse sands, fine sands, sandy silts, silty sands, and silts. Generally, there is a limited amount of naturally-occurring oversize soils. In defined waste areas, however, particularly in former landfill sites, there is a significant amount of oversize debris. Because of the generalized nature of the soil definition, it is assumed that soils selected for the demonstration study will range from 5 to 25 percent oversize, 35 to 60 percent sands, and 15 to 60 percent fines. The integrated soil treatment system will have the inherent capability to handle this range of feeds.

3.1.1.2 Solidification/ Stabilization

Solidification/ stabilization treatment commonly involves excavating contaminated soil and mixing it with chemical additives (i.e., reagents), and using complex chemical reactions to improve physical properties and reduce contaminant toxicity and mobility. The process can be used as a secondary or stand-alone treatment option. Mixing is accomplished using earth-moving equipment; treatment systems, including conveyors and pug mills; concrete batch plants; or grout-mixing equipment. The treated material is typically stockpiled for confirmation testing prior to disposal.

A variety of techniques are available, including organic polymer addition, glassification, asphalt encapsulation, and the addition of numerous proprietary reagents; but, most wastes are treated with lime, fly-ash, cement kiln dust, cement, or combinations of these materials. The technology is used to treat inorganic wastes, heavy metals, and oil wastes. The technology has also been shown to treat PCBs and some SVOC.

Stabilization refers to those techniques that reduce the hazard potential of a waste by converting the contaminants into their least soluble, mobile, or toxic form. The physical nature and handling characteristics of the waste are not necessarily changed by stabilization (Conner 1990). The goal of a stabilization process is to solidify the waste feed stream and to make insoluble, immobilize, encapsulate,



IDENTIFICATION OF FLOW STREAMS

1. Feed Soil, unscreened
2. Grizzly Spray Bar Water
3. Grizzly Screen Gross Oversize
4. Double-Deck Screen, Top Screen Oversize
5. Double-Deck Screen, Lower Screen Oversize
6. Double-Deck Screen, Slurry Undersize
7. Vibrating Wet Screen Spray Bar Water
8. Wet Screen Oversize
9. Wet Screen Undersize Slurry
10. Hydrocyclone Overflow
11. Hydrocyclone Underflow
12. Lamella Clarifier Overflow
13. Lamella Clarifier Thickened Solids Underflow
14. Filter Press Sludge Cake
15. Filter Press Dewatering Liquids
16. Spiral Concentrator Sand Product
17. Coarse Product Recycle Water
18. Dewatered Sand Product
19. Spiral Concentrator Make-Up Water
20. Spiral Concentrator Recycle Water
21. Spiral Concentrator Concentrate
22. Polymer Make-Up Water
23. Process Water Make-Up
24. Fresh Water Make-Up
25. Sludge Cake Requiring Stabilization
26. Selected Reagent Dosage
27. Stabilized Sludge Cake Product

FIGURE 3-1

PROCESS FLOW DIAGRAM
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

URS Greiner, Inc. - Laidlaw

S:\TAMARA\McCLELLAN\CADFILE\FIG3-1.DWG (ETB) destroy, sorb, or to otherwise produce solids that are nonhazardous, or less hazardous, than the original waste stream. Most current commercial stabilization processes are quite simple and utilize standard mechanical equipment. The study system consists of an assembly of mixers, chemical storage and reagent feeding devices, pumps, conveyors, and support equipment.

In this project, a mechanical conveyor will transfer the waste stream to the mixing component of the stabilization unit, where the waste is mixed with selected reagents. The reagents will be selected from a combination of Portland cement, cement kiln dust, and silicate additives. Depending upon the waste stream's nature, the mixing time will range from approximately 1 to 15 minutes. Additional water may also be required during the mixing. After mixing, the solids will be removed from the mixer by an installed screw mechanism, and moved by conveyor to a designated holding and sampling location.

The effectiveness of stabilization will be determined by the resultant leachability of the stabilized product, as measured by the modified deionized water waste extraction test (DI WET). Products meeting required standards, as outlined in Section 2.0, Table 2-2 and Figure 2-3, could be used as construction-grade product, such as backfill or roadway subbase.

3.1.2 Detailed Soil Washing Process Description

The following is a description of the soil washing process.

3.1.2.1 Prescreening

The prescreening module, the treatment system's first module, washes and removes debris and natural oversize material larger than 4 inches from the soil and prepares a feed soil for further treatment. It includes flow streams #2 and #3, shown on Figure 3-1. The prescreening system consists of a vibrating grizzly screen feeder connected to a vibrating screen that will be fed with a front-end loader. The grizzly screen is a fixed bar screen with the expected maximum size of 4 inches. Material smaller than 4 inches is conveyed to the vibrating screen for further separation. The screen sizes on the vibrating screen can be adjusted in the field to range from 3/8 to 2 inches. The wet screen size selection will be made using sieving data obtained by ASTM standard method 422D.

The material passing through the wet screen will be pumped to the physical separation treatment unit by slurry transfer pump, piping, and distribution plate. The determination of whether to move the created feed pile to the physical separation module or directly to solidification/ stabilization will be made in the field, as discussed in detail in Subsection 4.4.2.

3.1.2.2 Physical Separation

The physical separation module is designed to efficiently and precisely separate the soil matrix into three manageable streams: coarse sands, sands, and fines. This module includes flow streams #4, #5, and #6, depicted on Figure 3-1. The contaminants of concern at McClellan AFB have a propensity to migrate to and concentrate in selected soil matrix fractions, commonly, the fine-grained particles. Even when all feed soil fractions (i.e., the gravel, the sand, and the fines) are contaminated, treatment can be more easily performed when the treatment is directed at the individual fractions.

The physical separation plant consists of a wet screen composed of a double-deck, vibrating screen with installed high-pressure spray bars, and easily interchangeable screens (i.e., #7 and #8). The screen decks can vary from 1mm to 3/8-inch depending upon the specific occurrence of the gravel fraction. Wet screen deck oversize is taken off the top of the screen and is staged outside the plant. The undersize material, consisting of the sand and fines, is collected in the screen sump and is pumped to the next sub-stage of the physical separation plant.

Agglomeration problems can be encountered at this step in the process. The process feed material, when it consists of certain soil/moisture mixtures, can be difficult to handle and can tend to bind and form clay balls and clay logs upon handling. Proper material handling methods, feed preparation techniques, and in the worst case, suspension of the feed in a feed slurry can manage this problem. The clay blaster, a high volume/high pressure oscillating water jet scrubber mounted on a vibrating grizzly, is provided to reduce this problem. Its primary role is to power-wash oversize rocks and debris. It also aids in deagglomeration, and making the first size cut on the grizzly bars, while slurrying "minus" material for introduction into the plant. It works well at removing silts and clay fines from boulders and cobbles. This process may be modified pending the results of the preliminary treatment study described in Appendix F.

The next stage is the hydrocyclone section (i.e., #9) where the sand (i.e., #11) is separated from the fines (i.e., #10). The separation point, or cut-point, can be adjusted in the field by interchanging the vortex finder, the body, and the spigot angle on the supplied Mozley hydrocyclones. The slurry is pumped to the hydrocyclones under pressure; sand is discharged in the underflow and water and fines in the overflow. The sand and fines separation efficiency is measured by the concept of misplacement. Efficient separation means that there will be little or no fines in the sand stream and little or no sand in the fines stream. The installed subsystem is anticipated to have a misplacement efficiency of greater than 95 percent.

Once the coarse sand has been removed and staged and the sand and fines are separated, the product fractions can be analyzed to determine whether the treatment standard has been attained. If the products meet the standards, no further treatment is required and the products can be reused or recycled. If the products do not meet the treatment standard, they will be treated further.

3.1.2.3 Sand Treatment

If the sand meets the treatment standard upon physical separation, it will be dewatered and staged. If the sand does not meet the treatment standard, it will be subjected to further treatment using attritioning, density separation, specialty surfactant treatment, and/or froth flotation.

Agglomeration can occur in the underflow of the hydrocyclone separation step. Agglomerated fine-grained soils can form a mass of similar density to separated sand particles. The agglomerated material, looking like sand, but really fines, will be deagglomerated using attrition scrubbers as necessary to force the agglomerated mass to its true particle size. Attritioning is a mining subset of grinding. Attritioning, in this context, is the high intensity abrasion of the particles in the separated sand fraction against themselves to ensure that the resultant particles are sand and not an agglomeration of fines. Attritioning can be useful since often the agglomerated fines in the sand are concentrated contaminants that can cause the sand fraction to appear to be contaminated. Attritioning can break up these agglomerates, and when used with separation to remove the resultant secondary fines, the sand can be found to be clean in accordance with the treatment standards.

Density separation equipment will be installed to remove particles with densities different from sand from the sand fraction. These particles typically include particulate lead or light, naturally-occurring organic materials like grasses and root material. These lighter/heavier density contributors can also jeopardize the sand quality. Separation is accomplished due to differences in the feed material components' specific gravity (designated by streams #11 in, #16 out, on Figure 3-1). Four double-start Humphreys® spirals will be installed for this purpose. Humphreys® spirals are used in a wet separation process and provide gravity concentration treatment for particle sizes between 3.0 mm and 0.05 mm. A feed material stream is fed onto a downwardly sloping surface the spiral, where it flows under gravity. The higher specific gravity particles settle near the stream's bottom while the light materials accumulate near the top.

Froth flotation is a mining process often referred to as ore beneficiation. Flotation utilizes a selected surfactant with a particular propensity for the identified contaminants. Groups of surfactants are available for a wide range of constituents and are grouped by metal, organics, combinations of metals and organics, and so on. Contaminants in the sand are usually residing in a free particulate form, are lightly bound, or are even partially coating the sand particles. The selected surfactant can reduce the surface tension of the bound constituents and in both the bound and particulate occurrences, render the constituents hydrophobic. The froth flotation cell uses a series of mechanical aerators through which the sand stream already contacted with the selected surfactant, is passed. Air bubbles catch the hydrophobic micelle tail of the surfactant and float the surfactants to the surface where they can be removed and combined with the fines stream concentrate.

Attritioning, density separation, and froth flotation can be used independently or together depending upon the actual contaminant situation. Whether to use any or all of these unit operations will be based upon the analytical quality of the sand product after physical separation. Regardless of the combination of the treatment unit operations for the sand fraction, the sand product will be staged for further treatment or for reuse or recycling, as described in Subsection 4.4.1.

The choice of sand treatment unit operations will be based on how the contaminants appear in the sand fraction: free particulates, weakly bound surficial contact or coatings, or agglomerated fines with a net density to appear as sand. This will be determined both visually and chemically in the field lab.

- If the contaminant of concern occurs as a particulate, density separation using the installed spiral concentrators will be chosen;
- If the target contaminant is in a weakly bound or coating mode, the use of surfactants can be considered in the context of froth flotation;
- If the contaminants are agglomerated, attritioning will be used to force particles to their natural particle size fraction; or
- If all three stated conditions occur, then treatment unit operations will be combined.

3.1.2.4 Product and Residual Management

Fines fraction management will depend upon the soil matrix's physical characteristics, and the contaminant nature and concentration.

- If the soil matrix indicates that physical separation is practical, the fines stream will be dewatered with a mobile plate and frame filter press and staged for analysis;
- If the analyses indicate that the fines stream meets the relevant treatment standard, the product will be staged; or
- If physical separation is not required, based upon the high occurrence of fine-grained particles in the feed, or because the fines stream does not meet the treatment standards, additional treatment will be required. The treatment planned for this fraction includes solidification/ stabilization.

Stabilization has been described in Subsection 3.1.1.2. For the demonstration project, a commercial, 50-ton-per-hour pugmill (stream #25 in, #27 out) will be used for the mixing unit. The dewatered or screened feed will be introduced into the pugmill by a feed hopper/conveyor system fed by a front-end loader. A simple field treatability study will be conducted to determine the most effective stabilization reagent(s) for use and the reagent dose to be applied, as discussed in Appendix F. Appropriate dosing and reagent feeding equipment will be provided. The reagent and feed are mixed in the pugmill and held for the specified retention time. The mixed product is discharged by conveyor and staged for analysis. The stabilization will improve the feed leaching characteristics and may allow the use of the material as designated backfill on-site.

One stabilization option under consideration is an asphalt emulsion process, which can produce an asphaltic material that could have potential recycling value. The criteria to determine amenability to asphalt emulsion are detailed in Subsection 4.4.1 and Appendix F. By adding appropriate oversize material and asphaltic emulsions into the pugmill, a cold-mix asphalt or asphalt-stabilized base material can be produced.

Regardless of the treatment applied, the fractions will be dewatered and staged for analysis. It is important to recognize that some portions of test feeds may not be amenable to treatment by any soil washing or stabilization method. These untreatable waste streams may require direct disposal. This finding is important for the demonstration and for ultimate site remediation. The process as described above will produce the products and residuals summarized on Table 3-1.

Table 3-1

SOIL FRACTIONS

Source	Physical Quality
Prescreen Grizzly Oversize	≥4 inch Debris
Prescreen Wet Screen	>3/8 inch to 4 inch Debris
Physical Separation Wet Screen Oversize	>2mm ≤3/8 inch to 2 inch Gravel
Physical Separation or Treated Sand	>Hydrocyclone cut-point ≤2mm sand
Physical Separation or Treated Fines	<Hydrocyclone cut-point sludge cake
Physical Separation or Treated Fines	<Hydrocyclone cut-point stabilized soil
Physical Separation or Treated Fines	<Hydrocyclone cut-point fines incorporated into an asphalt product

≥	Greater than or equal to
<	Less than
mm	Millimeter
>	Greater than

3.2 WASTE AND MEDIA APPLICABILITY

Soil washing, in conjunction with solidification/ stabilization, appears to be applicable to the soil matrix and contaminants at these non-VOC sites. Table 2-2 lists the contaminants of concern for these sites. The arrangement of treatment unit operations may be affected by site-specific soils. Some soils, such as those with exceptionally high fine-particle mass (i.e., greater than 50 percent passing through a 200-mesh sieve) are not amenable to physical separation. Some material will contain free products from spills, leaks, or process upsets. Some may already meet the specified treatment standards upon excavation and will need no further treatment unless lower treatment standards are established in a ROD. Determination of soil characteristics will be made in the field prior to excavation as outlined in Subsection 4.4.1. To determine this treatment technology's applicability to McClellan's site-specific conditions, a treatment study will be conducted as outlined in Appendix F.

3.3 ADVANTAGES AND DISADVANTAGES/LIMITATIONS

The demonstration soil treatment, which includes prescreening, physical separation, and further treatment when needed, has advantages and disadvantages. The advantages include:

- The soil treatment remedy has the potential to significantly reduce the volume of soils defined as hazardous or designated, which improves the opportunity to reuse soil products and minimizes the disposal of residuals off-site;
- The reduction (or elimination) of off-site disposal reduces or eliminates the long-term liability of the government in being named as a potentially responsible party (PRP) at the selected disposal facility;
- Costs to perform volume reduction and residual management may potentially be significantly less than full off-site disposal. Initial estimates range from $100 to $150 per cubic yard;
- Since the soil treatment remedy can be performed on-site, transportation safety and traffic issues are minimal compared to long-distance transportation to a hazardous waste landfill; and
- Treatment on-site would preclude most costs of off-site waste transport, treatment, and disposal.

There are also disadvantages/limitations to the soil treatment remedy, which include:

- The soil treatment process is sensitive to the nature of the feed matrix to the extent that the process treatment rate will change with the changing nature of the feeds. For example, increased clay content will slow the process, and
- Not all contaminant concentrations can be treated to applicable treatment requirements. Some contaminants are so concentrated, *e.g.,* saturated soil, that the required removal efficiency cannot be achieved.

3.4 DEVELOPMENT STATUS

The project's development status is discussed in Section 12.0. Soil treatment technologies such as those to be performed in this soil washing and solidification/ stabilization study including soil classification, soil washing, asphalt emulsion batching, waste solidification/stabilization, and fixation have been successfully implemented at numerous sites. Sites such as the Springfield Township Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, Aberdeen Proving Ground, Castle AFB, and Lackland AFB have successfully applied these technologies to similar conditions.

4.0 OBJECTIVES

This section sets forth the objectives of the project, presents a test plan to test for the objectives, and describes how the technology parameters will be evaluated. It also includes a description of how the data collected during the test period will be evaluated.

4.1 GENERAL OVERVIEW

The overall purpose of this project is to conduct a treatability study to assess the viability of soil washing, in conjunction with solidification/ stabilization, to treat non-VOC soil contamination in a diverse range of feed streams from up to ten prioritized locations at McClellan AFB. The process will consist of soil washing, solidification/ stabilization, and possibly asphalt emulsion batching.

4.2 DESCRIPTION OF TECHNOLOGY PROCESS

A modular soil treatment system will be used for the demonstration project at McClellan AFB. The system incorporates soil washing and residual treatment as an integrated system to handle the diverse range of McClellan AFB soils. A more detailed process description is included in Section 3.0.

4.3 STATEMENT OF TREATABILITY STUDY OBJECTIVES

The soil washing and solidification/ stabilization study objectives are:

- Assess whether soil washing, in conjunction with solidification/ stabilization can substantially reduce the life-cycle costs to clean up non-VOC contaminated sites at McClellan AFB that exhibit soil characteristics that are amenable to physical separation. The study will also assess whether the projected time to clean up these sites can be substantially reduced.
- Conduct a treatability study using soil from a minimum of three, representative non-VOC soil contamination sites at McClellan AFB. For study purposes, RPRGs will be used to determine whether soil is "designated clean" for disposal in areas that would not impact surface water quality. For all major contaminants of concern, the RPRGs have been demonstrated to be protective of groundwater quality.
- Generate a scientifically defensible data set to assess the performance and cost of the technologies.
- Quantify the cost and performance of the technology, to include conceptual criteria that can be used to evaluate its full-scale applicability to other McClellan AFB sites.

4.4 TEST PLAN

The test plan describes the field tasks that will be performed for the soil washing/stabilization project.

4.4.1 Field Tasks

The test plan is based on a 12-week field treatability study. The specific field tasks are outlined below:

Field Task 1, Site Preparation. Site preparation requirements, such as size, containment, access, and utilities are discussed in Subsection 5.2.1, Site Preparation. While the site requirements are for the pilot-scale demonstration, the size, location, and infrastructure are suitable for future use for full-scale soil washing and solidification/ stabilization systems. A soil treatment pad will be constructed at the facility to provide a suitable location for treatment and storage of soils.

Field Task 2, Equipment Mobilization. The planned treatment system will provide process flexibility for a wide range of feed soils. The plant has three general modes of operation: physical separation, physical-chemical treatment, and screening plus stabilization. The mode to be used on a specific feed source will be chosen based upon the nature of the physical soil matrix and the contaminant occurrence and relative concentration. All process equipment will be mobilized to McClellan AFB. Utility connections will be established, treatment equipment will be assembled, and initial equipment readiness checking will be completed following assembly.

Field Task 3, Testing (Treatability Study Operations). The treatability system will be operated and necessary data collected. Section 3.0 contains more detailed information on the technology. The operations will consist of several subtasks, including:

- Preliminary treatment study. To ensure the proper equipment is mobilized to address the agglomeration issue and to screen the sites, a preliminary treatment study will be conducted. The work plan for this study is included in Appendix F. An initial site walk will be conducted to determine accessibility. Sampling locations are shown in Appendix E. They are based on RI information and contaminant distribution maps provided in the Non-VOC EE/CAs. This information will be used to select preliminary treatment study sites and sampling locations, which will be marked with stakes.

  Following the site walk over, the selected sites will be sampled as described in Appendix F. Based on the RI and Non-VOC EE/CAs information, the required excavation depth will be determined. If the contamination is shallow, hand tools will be used to collect the sample; if the contamination is deep a backhoe will be used. Preliminary treatment study samples will be appropriately labeled and processed as described in Appendix F. The results will be summarized in a letter report to McClellan AFB and detailed on the TAAR. The health and safety plan (Section 9.0) will be used for this preliminary study and for all site excavation.

- Soil excavation and transport to the treatment system. Based on the preliminary treatment study findings, a minimum of 3 sites will be selected for the full-scale treatment study. Excavation and material handling will be conducted in accordance with the Excavation Plan and Site Management Plan in Appendices E and C, respectively. Information in the RI and Non-VOC EE/CAs will be used to selectively excavate contaminated soil that is suitable for soil washing. Contaminated soil unsuitable for soil washing will be transported directly to the stabilization unit. Dust suppression techniques described in Appendix C will be used to control dust during excavation and transport. The excavated material will be staged on the soil treatment pad shown on Figure 5-2, as described in the Site Management Plan, Appendix C.

  Temporary construction fencing will be placed around the excavation area until the site is restored. The determination of clean closure will need to be based on cleanup levels established in a ROD.

- Soil washing, sorting and screening. Soil washing is a water-based combination of treatment unit operations using physical and chemical processing. Four basic treatment modules will be available, including a prescreening module, a physical separation module, a sand treatment module, and a fines treatment module. Depending on the soil to be treated, all or some of the modules may be used. The following criteria will be used to determine the treatment mode; the data from the preliminary treatment study will form the basis for the selection:

- For feed soils with a soil mass of less than 40 percent in the fines fraction (i.e., less than 200 mesh) and no contaminants in the oversize or sand fractions, but with contamination in the fines fraction, the physical separation mode will be used. The separated fines fraction will be further analyzed. If the fines are less than the treatment standard, the fraction will be dewatered. If the fines fraction is greater than the treatment standard, the fines fraction alone will be stabilized.
- For feed soils with a soil mass of less than 40 percent in the fines fraction (less than 200 mesh) and in which the sand fraction and the fines fraction exceed the treatment standards, the physical/chemical treatment mode will be used. This method will incorporate density separation, attrition, scrubbing, and chemical treatment as necessary to render the sand fraction clean, and further concentrate contaminants in the fines. The separated fines fraction will be further analyzed. If the fines meet the treatment standard, the fraction will be dewatered. If the fines fraction exceed the treatment standard, the fines fraction alone will be stabilized. If the sand cannot be treated such that it can attain the treatment standards, the sand will be combined with fines not meeting standards for stabilization.
- If the feed soils have a soil mass that exceeds 40 percent in the fines fraction (less than 200 mesh), the feed soils will be processed using the stabilization mode. Oversize soils will be removed using mechanical screening, and the physical separation component of the plant will be bypassed, directing the mechanical screening undersize to the pug mill for stabilization or incorporation into an asphaltic product.

• Solidification/ stabilization. Solidification/ stabilization refers to those techniques that reduce the hazard potential of a waste by converting the contaminants into their least soluble, mobile, or toxic form. The physical nature and handling characteristics of the waste are not necessarily changed by stabilization. The system consists of an assembly of mixers, chemical storage and reagent feeding devices, pumps, conveyors, and support equipment.

The rationale for deciding which solidification/ stabilization alternative will be used is based upon real-time field data that will define the nature of the soil matrix to be stabilized and both the total concentration and soluble concentration of the target contaminants. The soil matrix will be evaluated based upon the soil physical characteristics as determined at the field laboratory. Generally, the feed materials to be stabilized will consist of fine-grained particles. The fines may result from high fines feed soils from the selected sites or from the fines product resulting from the physical separation step from the processing plant.

The number of contaminants to be stabilized, and their respective concentrations, must be considered in conjunction with the soil matrix. These two factors are key to determining the reagent and reagent dosage required to chemically bind the target contaminants to render them non-hazardous. Portland cement will be the reagent of choice, with secondary enhancement from selected silica additives, if necessary. A stabilization bench-scale treatment study will be conducted in the field lab to confirm the mix parameters. This study will quantify the soil matrix of concern by sieving and will quantify the species and concentration of contaminants. Portland cement will be used as the default reagent and the dosage for chemical immobilization determined. When selected, the proper reagent, at the proper dosage, will be added to the pug mill with the target soils to achieve the stabilized product.

An alternative process being considered is asphalt emulsion batching. The waste is converted to a non-hazardous, construction material that meets conventional engineering design and materials standards for roadway bases, light traffic pavements, landfill caps, berms, and levees, while mitigating a concern over the fate of encapsulated contaminants. The primary rationale for the determination of asphalt batching as the process alternative will depend upon the same parameters as described in the solidification/ stabilization option with the exception of the evaluation of the ability to bind the target contaminants in the asphalt product matrix. This determination requires a focused bench-scale study performed in the field laboratory. The study will evaluate the nature of the target soil matrix, the species and concentrations of the target contaminants, and the development of a mix formula for production. The standard mix ingredients will include the contaminated soil, clean and sized aggregate, a selected oil emulsion, and possibly a Portland cement additive. This mix will be prepared and tested to determine if an asphalt product of acceptable specifications can be prepared.

- Sampling and analysis. The effectiveness of soil washing with and without solidification/ stabilization will be measured by comparing the final total concentration of constituents of concern in the soil with their respective RPRGs and background concentrations. Soils having all constituents of concern below the RPRGs may be used as fill at any location away from surface water bodies, or stored in a McClellan AFB-designated "clean soil" pile. In addition, the leachability of the contaminants in the soil will be determined using the DI WET method. If concentrations are less than the RPRGs, the material has a potential reuse as backfill or roadway subbase. If concentrations exceed the IPRG or designated levels for impact to groundwater, the USEPA toxicity characteristic leaching procedure (TCLP) and the California WET will be used to characterize the soil for disposal (see Figure 2-3).

Field Task 4, Equipment Demobilization. The treatment equipment from McClellan AFB will be demobilized and removed off-site upon completion of the study.

4.4.2 Treatment Logic Diagram

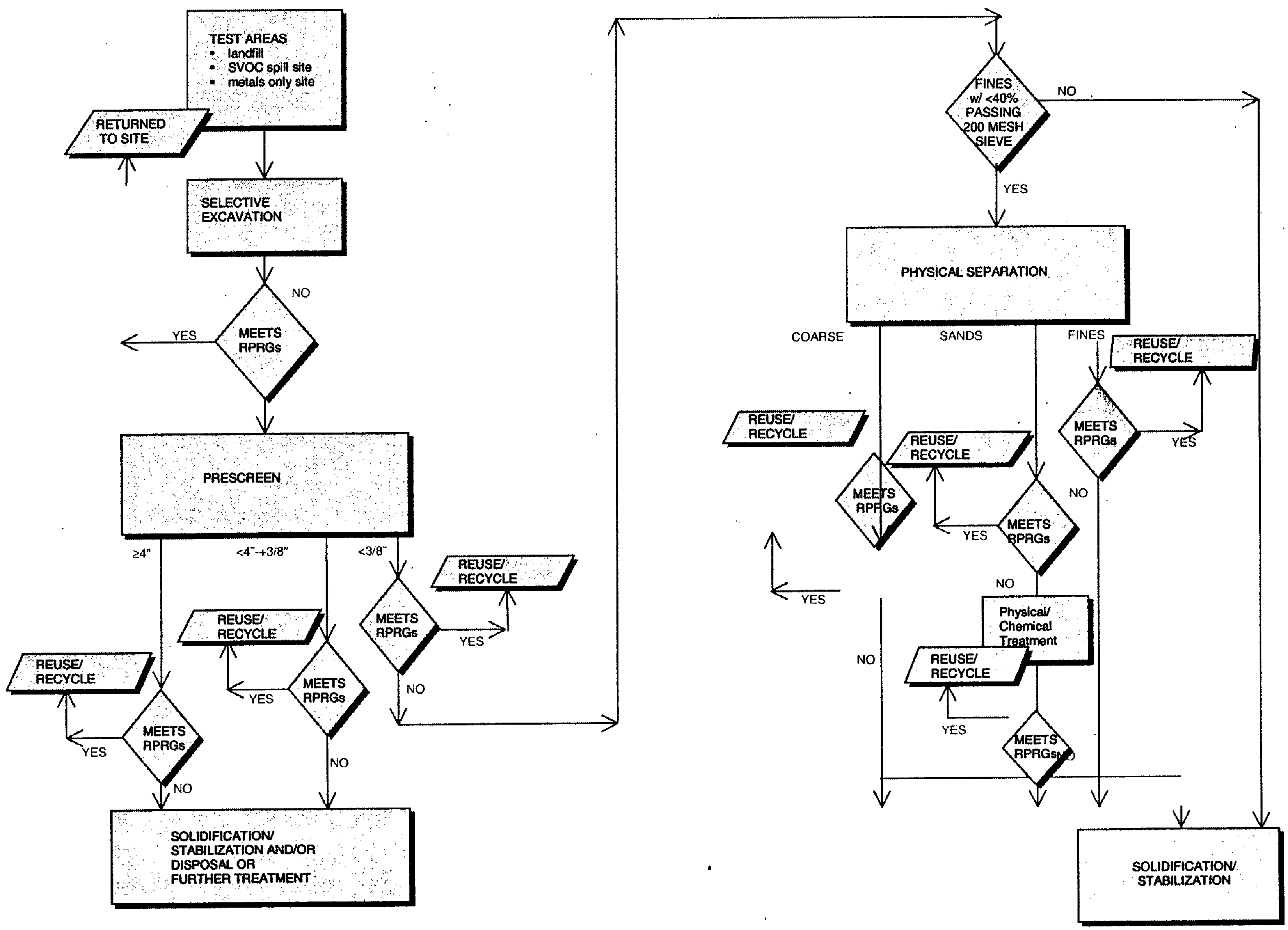
Because of the widely diverse feed soils expected, a treatment logic system has been defined and is shown on Figure 4-1. Four major decision points can be identified:

1. *Prescreening*. A minimum of three piles will be individually field tested to confirm the operational parameters. Parameters should include, but not be limited to, particle size distribution, degree of agglomeration, contaminant concentration, and soil fraction distribution. This information is essential to the selection of the treatment process. The prescreening module will be consistently used on all assembled piles to remove debris and particles larger than 4 inches in diameter. Prescreening will segregate materials as follows:

    - Larger than 4 inches (oversize debris).
    - In the range of less than 4 inches to 3/8 inches (cobbles/gravel and coarse sand).
    - Less than 3/8 inches (fine sand).

    The two larger sizes will be staged in piles and tested, while the less-than-3/8-inches material may be forwarded for further treatment. The treatment for the less-than-3/8-inches material will depend on the soil's physical conditions. If the soil is reasonably well distributed, the physical separation module will further separate it. This decision will be made in the field by wet sieving at the field laboratory. The soil physical characteristics significantly affect the treatment capacity of downstream modules. In other words, a larger fraction of fines will slow the rate at which the material can be processed. Thus, to balance feeds and to provide proper treatment feed, volumes/masses will be adjusted based upon the conditions of the soil matrix from each of the designated source areas.

Figure 4-1
TREATMENT LOGIC DIAGRAM



2. *Physical Separation*. Physical separation will be used on those feed streams with less than 40 percent passing the 200 mesh (0.075mm) sieve. This cut point has been selected, based upon previous studies, because at levels higher than this, physical separation will not contribute any significant volume reduction in a cost-effective manner. In this module, the feed stream is separated into coarser-grained and finer-grained fractions. Each fraction (the coarser [sand] fraction and the finer [fines] fraction) will be analyzed, and decisions made regarding the requirement for further treatment.

   - *Sand Treatment*. Sand that does not meet the treatment standard will be further treated using treatment steps provided as part of the demonstration plant. The treatment steps will include attrition scrubbing, density separation, and froth flotation.
   - *Fines Treatment*. Fines that do not meet the treatment standards will also be further treated. Based upon the matrix and contaminant concentrations, the fines will either be stabilized or incorporated into an asphaltic product. The determination of which of these additional treatment steps to employ will be made in the field utilizing the mobile field laboratory.

4.5 TECHNOLOGY PARAMETERS EVALUATION

This study is designed to assess whether soil washing, in conjunction with solidification/ stabilization, can substantially reduce the life-cycle costs to clean up certain non-VOC soil contamination sites at McClellan AFB. To accomplish that objective, the JV will generate a scientifically defensible data set to assess the performance and cost of the technologies.

Performance evaluation data include product grain-size distribution and stability, as well as treatment cost. Chemical and geologic data will be used to determine the most effective general process configuration. If feed soil is well distributed, with approximately 10 to 20 percent greater than 2mm and 10 to 20 percent less than 0.063mm, then a physical separation mode is indicated. This configuration also represents the highest performing and lowest cost arrangement. If the feed has more than 40 percent of the soil mass less than 0.063mm, then a stabilization/asphalt arrangement is indicated. This will result in a slightly more complicated and slightly more costly process. When a well distributed soil is encountered, but all fractions are contaminated, then a physical/chemical process will be used, resulting in a more difficult and costly scenario.

Performance evaluation parameters, which demonstrate the capabilities of the soil washing and solidification/ stabilization study, include chemical concentrations (compared to PRGs and background) and the leachability of the treated products/residuals. The performance evaluation parameters, which demonstrate real-world operating characteristics in handling variations in feed concentrations, are the system operating up time, polymer or surfactant usage rates, and electricity usage rate. This information is recorded on the operator log sheets.

Capital and operating costs for conventional treatment will be determined using existing data available from similar systems currently in operation at other sites. Part of this evaluation addresses whether soil washing, in conjunction with solidification/ stabilization, can substantially reduce the life-cycle costs to clean up certain non-VOC soil contamination sites at McClellan AFB. The technical and economic analysis will be documented in the TAAR.

4.6 DATA ANALYSIS AND INTERPRETATION

The sample and analysis plan (Section 7.0) provides for the collection of data that will be used to determine treatment efficiency in terms of effluent concentrations (*i.e.*, parts per billion [ppb] or parts per million [ppm]) and percent and mass of contaminants removed. Treatment efficiency in percent will be calculated using the following equation:

$$\frac{\text{Influent concentration - Effluent concentration}}{\text{Influent concentration}} \times 100\%$$

The data will be collected in such a manner that each set of data contains paired influent and effluent values. Further multiple sets will be collected at regular intervals for each site soil to monitor treatment efficiency. Treated soil samples will be collected for the duration of the demonstration, and will be grouped according to the operating conditions at the time of their collection. A paired t-test or other valid statistical procedure may be used to evaluate to overall effectiveness of the technology (i.e., determine if the inlet and outlet concentration reductions are consistent over the duration of the test and for the range of concentrations and constituents). The 95% upper confidence level for the average outlet concentration for each COC will also be calculated to provide an upper bound on the concentration that can be expected in treated soils from multiple sites. The UCL will also be compared with the PRGs to help assess the effectiveness of the technology.

The influent and effluent data for each source material will then be plotted versus time and operating conditions. These plots will graphically show any gradual changes in the data over the course of the demonstration. The contaminant concentrations, other analytical results, flows, and operating log sheets will be used to calculate contaminant mass entering and leaving the system, as well as accumulation and destruction within the system.

The final step will be to use the field test process and cost data to determine optimal operating parameters (soil and chemical feed rates, power, etc.), to determine equipment sizing for different treatment feed rates, and to price (capital and operating costs) full-scale application at McClellan AFB sites. These costs will be compared to those associated with conventional technologies (i.e., off-site disposal). Data quality objectives (DQOs) for the demonstration are discussed in Subsection 8.4.1.

5.0 FIELD ACTIVITIES

This section describes the field activities that will be performed to fulfill the soil washing and solidification/ stabilization study objectives presented in Section 4.0. Field activities are described in seven subsections:

- Preoperation Characterization. Characterization activities performed before treatability system installation and operation.
- Treatability System Installation.
- System Operation. Operational procedures during both the system startup and operation phase.
- Post-Operation Characterization. Characterization activities performed after operating the treatability plant.
- Material Storage. Management of materials to be used during the demonstration.
- Residuals Management. Management of waste generated during the demonstration.
- Demobilization and Site Restoration. The procedures for leaving the site in an acceptable condition after completing the demonstration.

5.1 PREOPERATION CHARACTERIZATION

The objective of this phase is to obtain additional site-specific information and identify excavation locations, areas, and depths. An Excavation Plan, based upon criteria for prioritizing sites (discussed in Subsection 2.4), is included in Appendix E. Site-specific details have been incorporated, where available; however, on-base inspections prior to commencing operations and new RI data may override some initial information presented in the Excavation Plan.

5.1.1 Preliminary Treatment Study

The JV and McClellan AFB management team will conduct a field walkover of the candidate sites, visually verifying the prioritization of sites as listed on Table 2-1 of this WIP. The purpose of the walkover inspection will be to verify the general nature and condition of the site, the access limitations, the nature of the soil matrix, and to better understand the expected contaminants and concentrations. At the time of the walkover, the JV will select several discrete locations at the candidate site where real-time samples will be collected by backhoe at appropriate depths. Areas are shown on the excavation plans in Appendix E.

Once the samples have been collected, they will be appropriately labeled, transferred to the preliminary treatment study, and processed as described in Appendix F. The health and safety plan described in Section 9 will be used for sample collection and any site excavation.

5.1.2 Site Selection

Sites to be considered for the soil washing and solidification/ stabilization study, their predominant contaminants, and ranking have been discussed in Section 2.0. Based on the preliminary treatment study findings, sites most amenable to soil washing and with easiest access for excavation will be prioritized. The remaining sites will be considered as contingencies in the event that McClellan AFB wishes to expand the treatability study.

5.1.3 Excavation

Excavation and staging of the candidate feed soils will be conducted as described in the Excavation Plan and Soils Management Plan, Appendices E and C, respectively. It is intended that the excavation and staging task will take place 2 to 4 weeks prior to the demonstration project. The excavated material will be transported via dump truck to the primary treatment soil staging area and segregated by site.

5.1.4 Feed Selection

The excavated soils will be transported and staged at the designated feed soil storage areas within the treatment pad. When staged, the JV will collect representative samples from each of the designated piles and perform a second round, field expedient sieving study to better quantify the nature of the soil matrix to be treated.

5.2 SYSTEM INSTALLATION

The treatability study field operations will be conducted on a paved process pad southeast of the former hangar (Building 704), as shown on Figure 5-1. McClellan AFB has selected this location. The treatment pad thickness may be 4 inches of asphalt concrete over 6 inches of Class 2 aggregate base material, with approximate dimensions of 250 feet x 250 feet. In addition, the existing ponds to the north of the process pad will be used as a Secondary Treatment Staging Pile (STSP) for interim storage of dewatered residuals requiring ultimate disposal. In the event that the renovation of this storage area is not completed in time, roll-off bins will be used to store the residuals during the study.

All treatment operations and short-term storage areas will be located adjacent to the process area on the paved and curbed pad. Dewatered residuals for ultimate disposal will be temporarily stockpiled on the process pad, within a fines/residuals designated compartment until they are cleared for placement in the STSP. Figures 5-1 and 5-2 present the site plan and process pad layout.

5.2.1 Site Preparation

A soil treatment pad may be constructed as shown on Figure 5-1 and 5-2. An existing water hydrant will be modified for use as input and makeup water for the soil washing system. The Air Force and the Sacramento Metropolitan Utility District (SMUD) is providing an electrical transformer to meet the power requirements of the studies. The project access roads will be consistent to reflect the conceptual layout in the 35 percent design (CH2M HILL). Residuals may be containerized at the treatment pad area for temporary storage, if the volume is sufficiently small. This may be a viable alternative to storage in the ponds, should the ponds be unavailable for use during this study.

As part of site preparation, the JV will establish temporary facilities and controls, mobilize and assemble equipment, and connect to existing utilities, which will be provided by McClellan AFB, within the process area.

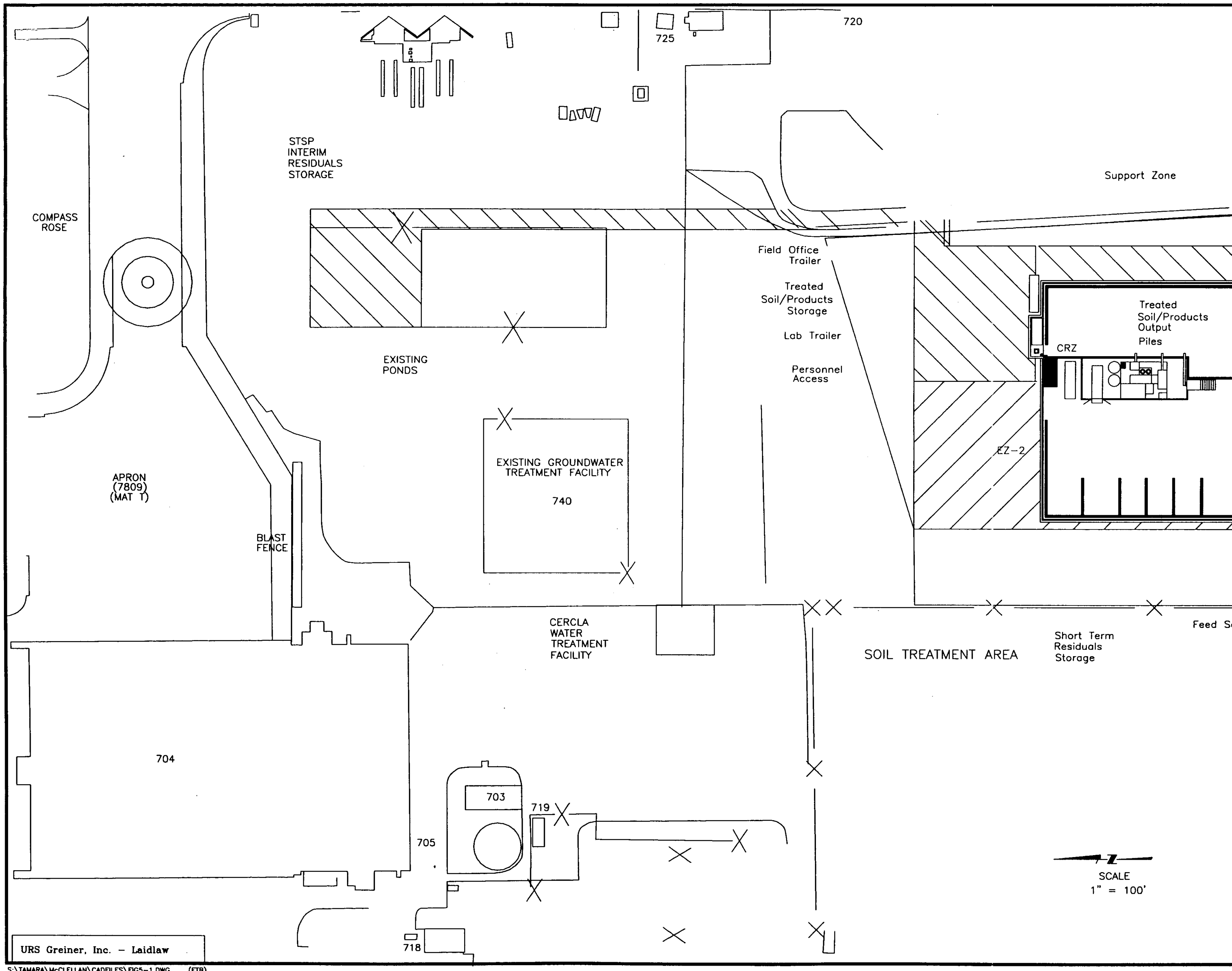


FIGURE 5-1

SITE PLAN
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

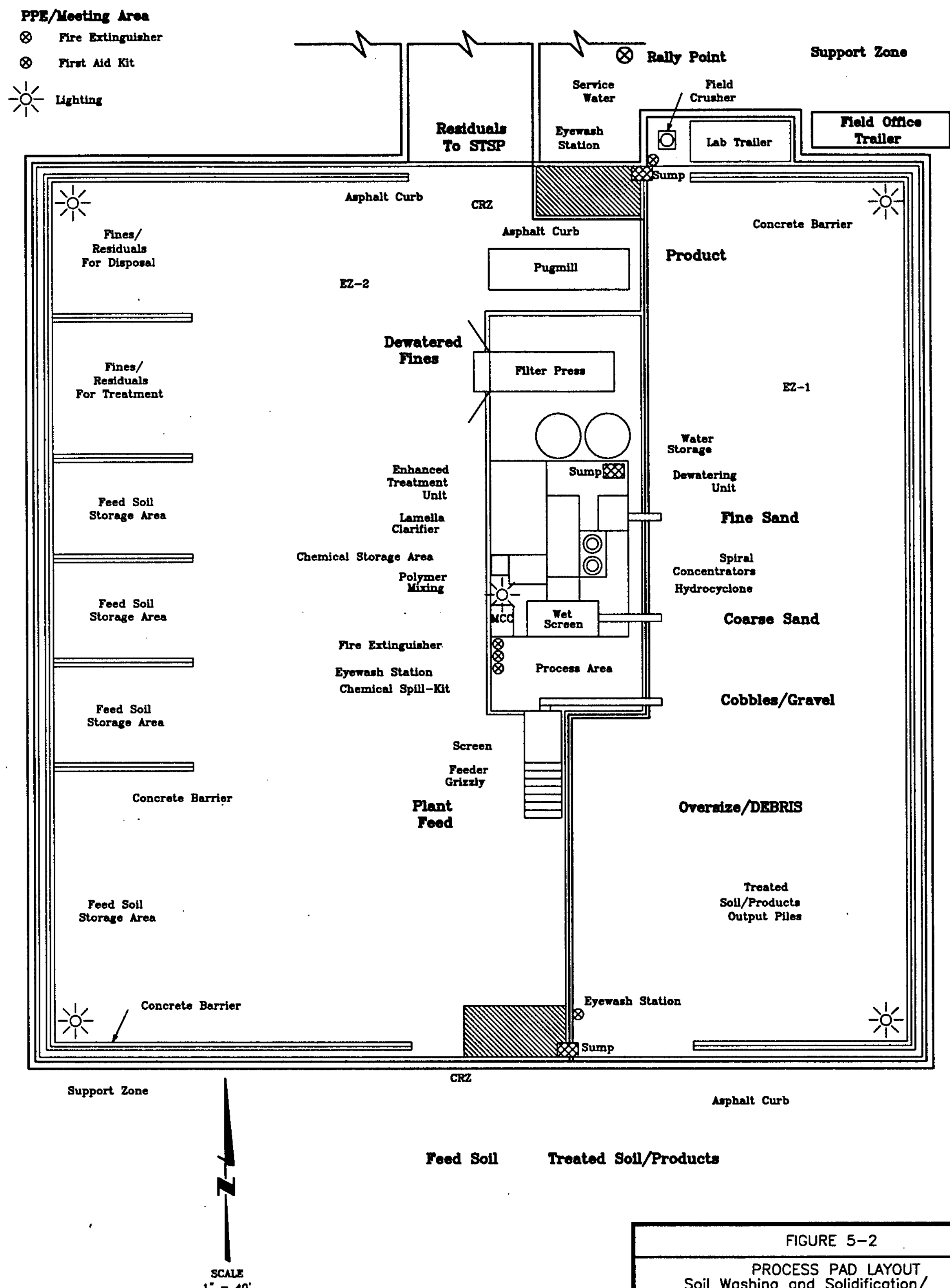


FIGURE 5-2

PROCESS PAD LAYOUT
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

URS Greiner, Inc. – Laidlaw

5.2.1.1 Process Pad

The process pad will be encircled with an asphalt roll-curb approximately 6-inches in height. Three sumps suitable for installation of automated sump pumps will be installed as shown on Figure 5-2 to collect and reuse any rainwater, spilled process water, or maintenance/wash down water. The process pad will be divided into three (3) distinct areas:

- Feed soil/residual storage
- Soil process area
- Treated soil/product storage

Asphalt roll-curbs will be used to separate the processing and storage areas. Once on-site, the JV will establish and delineate a decontamination area as detailed in Section 9.0. Concrete (Jersey) barriers will be used to delineate individual storage areas, and provide backstops for material handling operations. Once on-site, the material handling/equipment routes within these areas will be established and delineated. Since the project will require extensive testing to validate treatment performance, the treated soil staging area will be larger than the incoming feed soil staging area. The details of the material storage pad are illustrated in Figure 5-2, and discussed in further detail in Subsection 5.4.

5.2.1.2 Temporary Facilities and Controls

As required, specific work areas will be delineated, including the exclusion zone (EZ), the contaminant reduction zone (CRZ), and the support zone. Prior to site activities, these areas will be identified in the field and illustrated on maps posted within the field lab trailer and made available to all site visitors.

5.2.1.3 Field Laboratory

To expedite project completion and to optimize process performance, a mobile treatability laboratory (lab) will also be deployed at the site. This lab will be supplied with the required physical and chemical test equipment to perform real-time treatability/process control analyses. The lab tests to be performed in the lab trailer will consist of physical and chemical analyses related to feed selection and preparation, process control, and product and residual preliminary/interim results. The field lab will be a self-supporting facility that provides quick turnaround times to support field decisions and project control. While the laboratory will not be USEPA certified, it will provide data that has been shown to have a high correlation with certified laboratory off-site results. The on-site lab will be used for system optimization. Any quantitative evaluation of system performance will be based on data from the USEPA certified off-site lab.

Sample Preparation. Soil samples will be prepared at the field lab for further physical and chemical analyses. The sample preparation will consist of crushing and grinding designated samples to fineness. The crushing will be performed with a pedestal-mounted jaw crusher that will be used for selected oversize fractions. The crushed oversize and the sand fractions will be ground to fineness (approximately 400 mesh) utilizing an installed Angstrom grinder. Samples will be homogenized using an installed coning and quartering device. The prepared samples will be placed in plastic coupon containers while awaiting analysis.

Physical Analysis. The lab trailer will be equipped with a complete shaker/sieve unit to permit wet sieving for the determination of soil particle size. The shaker/sieve is supported by an electric oven for drying of retained soil, and by weigh scales for curve production.

Chemical Analyses. The field lab may be capable of performing organic and inorganic analyses. Inorganics may be quantified using x-ray fluorescence (XRF) techniques using the Spectrace 8000 machine. The unit will be calibrated using known standards in typical field soil matrices. Organics will be analyzed using gas chromatography for selected contaminants. Field lab results will be confirmed using the results from definitive analyses described in Section 7.0. For both organics and inorganics, a wide range of constituents can be detected, but not all suspected parameters. If some constituents are not quantifiable by field techniques, they will be confirmed, as necessary, with off-site analyses. Screening for radiological contamination is described in Section 9.5.4.

5.2.2 Infrastructure Requirements

In addition to process pad and storage areas, other major infrastructure requirements include 3-phase power and a water source for process make-up water.

5.2.2.1 Electrical Requirements

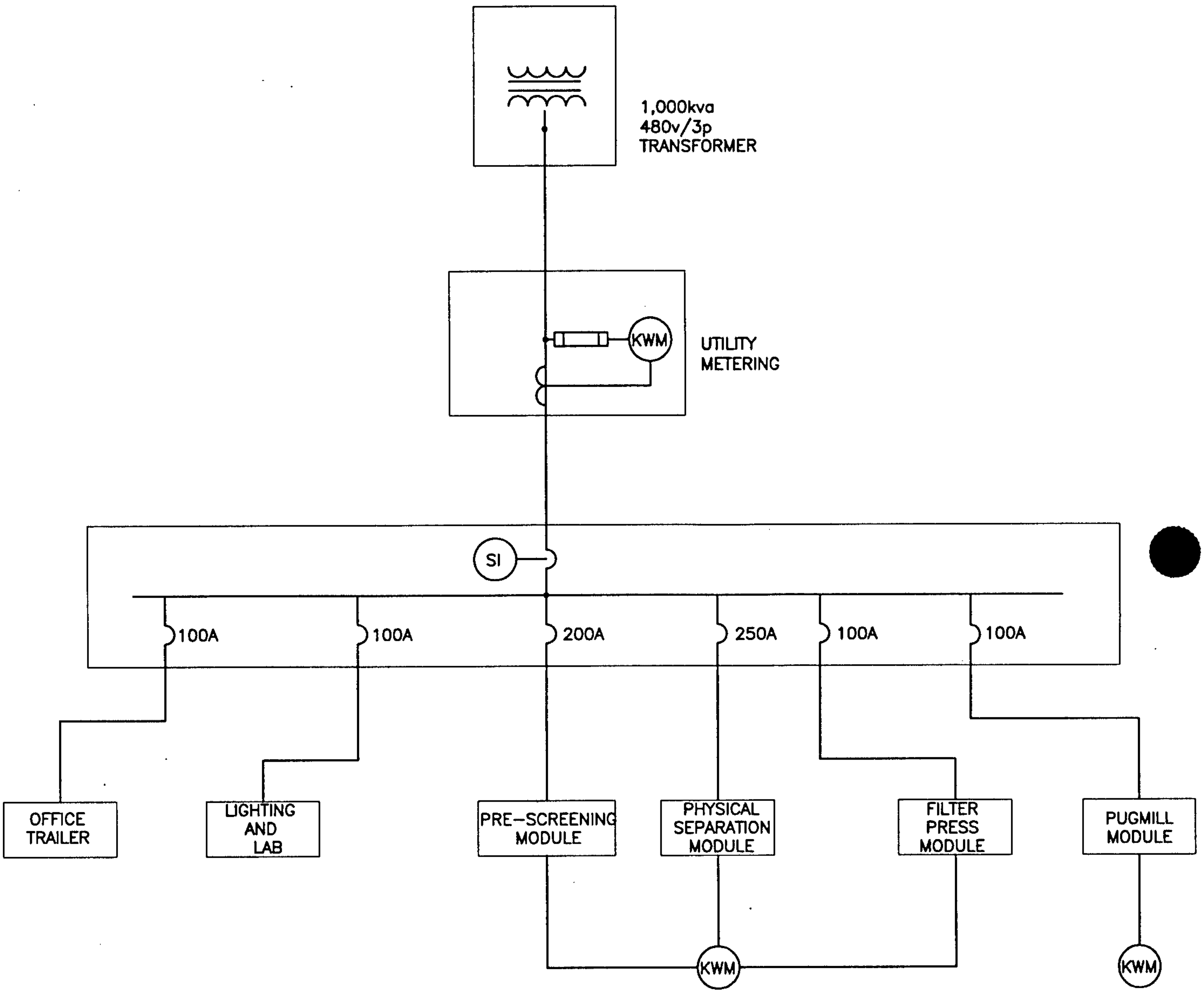
The majority of the process equipment uses electric drives. These are fed from a central power distribution motor control center (MCC) that is integral to the process plant. A dedicated circuit breaker and motor controller that is properly grounded control each drive. Power will be distributed from the MCC to each powered unit using appropriately sized and rated power cords and to each trailer via 4-inch conduit. An electrical one-line diagram for this system can be found on Figure 5-3. The power cords will be bundled and run in dedicated utility corridors to minimize slip-trip-and-fall hazards. The utility corridors will be isolated from equipment traffic areas. If utilities must cross traffic areas, appropriate ramps/barricades will be used.

A single power feed will be run from the MCC to the service disconnect provided by McClellan AFB to the process area. The power requirement is 440 volt three phase, with a total load capacity of 1,000 amps. The JV will make the connection between the treatability system's primary MCC and the existing service disconnect as part of the mobilization task. Security lighting will be provided at each corner of the process pad and at the MCC. Electrical meter readings for the soil washing unit will be noted between sizes and on a daily basis. The cause of any unusual fluctuations in the current usage rate will also be noted in the field log book. These readings will be used to determine the cost for power using current SMUD rates.

5.2.2.2 Water Requirements

The soil washing process is a net water user. As such, make-up water is required throughout the process. The JV will provide water storage/recycle water tanks. Approximately 30,000 gallons of water is required for initial plant charging, with about 8,000 gallons per shift (freshwater at 10 to 20 gallons per minute [gpm]) as process make-up. Water service will be provided to the process pad at the eyewash locations shown on Figure 5-2. Each will be equipped with a hose bib and back-flow preventer.

The process water system consists of a battery of self-contained pumps integral to the plant. At project completion, the process water will be used for plant decontamination, and subsequently collected and containerized. The JV will characterize the wastewater stream to develop and recommend treatment options. The results of this evaluation will be documented in the TAAR. Approximately 25,000 gallons of wastewater will be collected, sampled, and treated appropriately.



KVA	KILOVOLT-AMP
V	VOLTS
P	PHASE
KWM	KILOWATT METER
SI	SAFETY INTERLOCK

Figure 5-3

ELECTRICAL ONE-LINE DIAGRAM
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McClellan AFB, Sacramento, CA

T:/ENVIRONMENTAL/MARSHA/McClellan/FIG5-3.DIAG.DWG (ETB)

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5.2.3 Equipment Receipt and Inspection

Prior to field activities, the JV will conduct an orientation meeting for all project personnel and relevant subcontractors. The site orientation meeting will:

- Establish protocols for entering and exiting the work area
- Review overall site activities and details of each specific site task
- Review the health and safety plan
- Identify specific safety concerns

Process equipment will arrive by flatbed tractor-trailers and be unloaded and staged with either an appropriately sized crane, or other on-site equipment. It will be inspected to determine if shipping damage occurred. Each piece will be inventoried, with repairs, if any, noted. The equipment will be staged adjacent to the process area for subsequent assembly or repairs.

5.2.4 Equipment Assembly

The plant will be mobilized sequentially by unit operations module. The modules will be placed with an appropriately sized crane, forklift, or front-end loader. Each module will have inter-module components hard piped and hard-wired, and the modules will be staged per the process flow diagram, Figure 3-1. Once placed and secured, the power cords from each unit operation will be connected to the MCC with plug-in connectors, and process and make-up water hoses run from module to module as required using flexible hose with quick disconnect hose fittings throughout. Prior to system start-up, any damaged components will be repaired per the manufacturer's recommendations. A spare parts inventory and mobile mechanics truck/machine shop will be maintained on-site to expedite repair and maintenance.

5.2.5 System Inspection and Testing

As each module is set, it will receive an evaluation as summarized on Table 5-1.

Table 5-1

MODULE EVALUATION CRITERIA

Test Item	Requirement	Acceptance Criteria
Tanks	Water-tight	No visible leaks
Level sensors	Appropriate level settings	Trip at preset levels
Piping	Water-tight	No visible leaks Within manufacturer's specifications
Pumps	Leak-free Correct rotation	No visible leaks Within manufacturer's specifications
Conveyors	Correct rotation Operate in design range	Within manufacturer's specifications
Jigs	Water-tight Correct rotation Operate in design range	No visible leaks Within manufacturer's specifications
Mechanical Equipment	Correct rotation Operate in design range	Within manufacturer's specifications
Safety Equipment	Functional	No visible damage Within manufacturer's specifications

If a unit operation fails to meet acceptance criteria, it will be repaired or adjusted and retested. Once all unit operations have been successfully tested, the system will be tested as a whole, using criteria summarized on Table 5-2. Because the exact equipment to be used has not yet been determined, set points are not available.

Table 5-2

SYSTEM EVALUATION CRITERIA

Test Item	Requirement	Acceptance Criteria
Piping Systems	Leak and pressure test	No visible leaks
Process Arrangement	Conformance to process flow diagram	Matches process flow diagram
Pumps	Leak-free Operate in design range	No visible leaks Meets manufacturer's specifications
Safety Services	Test/adjust shutoffs, level adjustments, pressure relief valves	Per manufacturer's specifications
Mechanical Equipment	Test system on/off rotation, direction	No binding, per manufacturer's specifications

If the system fails the check, the appropriate repairs or adjustments will be made. When the system checks meet the manufacturer's requirements, system start-up will commence.

5.2.6 Preliminary Testing

To confirm operational acceptance, the system will initially be run with clean water. If all unit operations run water, the unit will subsequently be run with clean site soil, obtained from a "clean" soil pile as directed by McClellan AFB personnel. All unit operations will be monitored for performance within their design specification. If performance outside of design specification is noted, the deficient unit will be repaired, adjusted, or replaced. Once 30 to 40 tons of clean sand or soil have successfully been processed, the unit will be commissioned for processing impacted soils. At this time, contaminated soil will be run to confirm process effectiveness. The process will be field adjusted, as required, to meet performance requirements, and processing will commence.

5.3 SYSTEM OPERATION

The diverse range of feeds will be managed in the field based upon visual observation and prescreening of the material. The flexibility of the treatment system allows the feed stream to be diverted to the appropriate arrangement of treatment units. This will be accomplished using four basic treatment modules to include:

1) A prescreening module to remove debris and gross oversize while preparing a standard plant feed.
2) A physical separation module that will remove process oversize and separate sands from fines.
3) A sand treatment module that will remove contaminants to be re-concentrated in the fines.
4) A fines treatment module to dewater, stabilize, or further treat this fraction.

5.3.1 Plant Start-Up

Prior to daily plant start-up, the plant manager or lead operator will perform a walk-through inspection. All equipment and piping will be visually inspected for damage, misalignment, obstructions, or leaks. Any deficiencies noted will be corrected, if necessary, prior to plant start-up.

The plant start-up sequence will be such that all valves are open prior to starting any pumps. Water supply pumps will be started first, followed immediately by transfer slurry pumps, beginning with the slurry pump on the prescreening module, and working downstream to the filtrate pump. Flow rates will be adjusted, if necessary, to balance the water flows in and out of each unit operation.

Once the plant has reached steady state water balance, the mechanical conveying equipment will be started in sequence, beginning with product output conveyors and working back to the grizzly. Once all mechanical equipment is operational, plant feed can commence.

5.3.2 Feeding

The plant will be fed using a rubber tire loader equipped with a calibrated bucket scale. To minimize the potential for cross contamination, one loader will be assigned to feed soil, process support, and residual handling. This loader will remain in exclusion zone 2 (EZ-2), which consists of the feed soil storage pad, process area, residual storage area, and the haul road to the STSP (if residuals are removed to the STSP).

Material will be transported from the feed soil storage area to the process area using a dedicated loader as described above. Prior to accepting material from the feed soil stockpile, the loader operator will jiggle the bucket to ensure all previous soil has been discharged. The bucket scale will then be zeroed per the manufacturer recommendations, and filled with a load of feed soil from the feed soil stockpile. The operator will transport the material to the vicinity of the grizzly feeder, level the bucket, and measure and record the weight of material in the bucket. Each loader will have a logbook to record the operator of record, day, date, time of placement, and the bucket weight. Additional information to be recorded includes bucket counts, run number, and feed soil source. Dust will be controlled using the dust control procedures described in Appendix C.

The entire feed soil storage pad, process area, and residual storage area are one EZ, eliminating the need for decontamination of the dedicated loader operating within this area. If the loader needs to leave this EZ, it has to be decontaminated as described in Appendix D, Equipment Decontamination Plan.

5.3.3 Prescreening

The prescreening step is the first step in the soil washing process. Here, the feed soil is loaded and metered into the plant, debris and oversize are removed, and the soil is deagglomerated and slurried to facilitate further separation and treatment. The prescreening process is a self-contained skid and consists of the following components:

- Vibrating grizzly feeder
- Vibrating screen
- Stacking conveyor
- Slurry transfer system

The following text describes these in more detail.

5.3.3.1 Vibrating Grizzly Feeder

The vibrating grizzly feeder receives material for treatment from a front-end loader. It consists of a grizzly bar screen and high pressure spray nozzles positioned over a feed chute. The grizzly bar screen and high pressure nozzles deagglomerate the feed soil, remove oversize and debris, and advance the plant feed to a feed chute where it is metered onto the vibrating screen.

The initial grizzly bar spacing will be set at 4 inches. Material larger than 4 inches exits the grizzly via a stacking chute, and is stockpiled on the process pad adjacent to the grizzly feeder. Wash water and material smaller than 4 inches passes through the grizzly bars into a feed chute, where it is metered onto the vibrating screen deck. The grizzly bar spacing and feed rate are field adjustable to optimize cut points and will be adjusted as required during field operations.

During operations, the flow rates from the spray bars will be maintained. A noticeable reduction in water flow indicates that the inline strainers need to be cleaned. This is accomplished by isolating a strainer via a 3-way valve, removing the basket, and clearing the debris. Operation can continue using the parallel strainer. When the strainer is cleaned, it is reinserted and closed, and left on standby until the second strainer needs cleaning. At that time, the 3-way valve is reversed and the process reversed to clean the first strainer.

If agglomerates or light organics are not effectively separated, the angle of inclination can be adjusted to increase retention time.

5.3.3.2 Vibrating Screen

The vibrating screen is equipped with two screen decks and spray bars to separate larger stones from sand and fines, which require further separation or treatment. The vibrating screen receives the underflow from the vibrating grizzly feeder. The top screen size will initially be set at 1 inch, and the bottom screen size at 3/8 inch. Material that passes through the grizzly, but is larger than 1 inch, exits the top screen deck onto the stacking conveyor for stockpiling on the process pad. The process water and material smaller than 1 inch advances to the 3/8-inch bottom screen deck. Material that passes through the 1-inch screen, but is larger than 3/8-inch, exits the bottom screen deck onto the stacking conveyor for stockpiling on the process pad. The process water and material smaller than 3/8-inch advances to a slurry transfer system where it is pumped to the physical separation unit.

As with the grizzly, the spray bar flow rates are monitored. Since both the grizzly and screen spray bars receive water via the same pump/strainer set-up, the strainer cleaning process is the same. In addition, flow rates to individual spray bars can be throttled to concentrate water on areas requiring additional scrubbing.

The screen size for both decks can be changed in the field to optimize cut points, and will be adjusted, if required, during field operations. Also, the screens will be inspected on a daily basis for "pegging," and cleaned if the fabric becomes plugged.

5.3.3.3 Stacking Conveyor

The stacking conveyor receives dewatered material from both decks of the vibrating screen and conveys the material to a stockpile outside of the process area to await subsequent analysis. The stacking conveyor will be monitored to ensure proper tracking, with pulley adjustments made if the belt wanders off-center.

5.3.3.4 Slurry Transfer System

The slurry transfer system consists of a slurry pump and integral sump. The sump receives the underflow consisting of the process water and material smaller than 3/8-inch from the bottom deck of the vibrating screen. This slurry stream is directed to a high capacity slurry pump, where it is pumped through flexible slurry hose to the physical separation unit for subsequent processing.

5.3.4 Physical Separation

5.3.4.1 Slurry Feed from Prescreening

The feed prescreening system will remove oversize material larger than 3/8 inch; the resultant slurry will be pumped from the prescreening module to the physical separation system and delivered by flexible piping to a distribution header. The slurry distribution header will be mounted above the wet screen and will deliver the slurry in a manner that allows reasonable distribution of the feed on the screen and provides adequate on-screen residence time. The plant operator will frequently check the distribution and adjust the header as necessary to provide proper retention time.

5.3.4.2 Wet Screen, Oversize, and Slurry Handling

The slurry delivered to the wet screen is further classified on this unit. The wet screen is a low-head vibrating screen that can be operated with either single or double decks (installed screens) and enhanced by high-pressure spray bars. The screen itself can be either woven wire or polypropylene material depending upon the feed physical characteristics. The purpose of the wet screen is to remove oversize material primarily consisting of gravel in the range of larger than 1 to 2mm but smaller than the feed size, nominally controlled at 3/8 inch. The wet screen operation consists of the operation of the vibrating motor, the control of the slurry distribution on the top screen deck, and the visual management of the produced oversize to assess misplacement in the oversize fraction. If soil particles smaller than 1 to 2mm are present in the product, the operator will determine whether to increase residence time on the screen, reduce slurry feed depth on the screen, or increase water flow from the spray bars. The operator will also control the process oversize pile, delivered to the designated location by conveyor. Under the wet screen deck(s) is a sump that collects the slurry formed by the undersize soil (fraction less than 1 to 2mm) and the water delivered by the spray bars. This sump provides a temporary buffer between the produced slurry and the transfer location from which the slurry is pumped to the next unit operation. The screen/spray bar maintenance is as described for the grizzly/screen units.

5.3.4.3 Hydrocyclone Separation

The slurry pump pumps the slurry from the wet screen sump to the hydrocyclone separation module. The purpose of the hydrocyclone is to precisely separate the sand and the fines particles at specifically designated cut points. The hydrocyclones have no moving parts and are specifically manufactured to be abrasion resistant for these exact separations. The hydrocyclones are designed and manufactured by Mozley Ltd. (UK) and have been proven in a wide range of soil applications. The slurry is pumped under known pressure and controlled dry solids concentration to the inlet port of the hydrocyclone. The slurry stream then encounters a vortex finder that induces flow spin with high centrifugal force. The force throws heavy particles to the outside of the body while lighter particles move to the inside. Sand is then discharged from the underflow of the unit and water and fines in the overflow. The units can be field adjusted and controlled by the operator by changing the body, vortex finder, and apex valve of the hydrocyclone. Upon separation, a sand stream, mostly free of fines, and a fines stream free of sand can be further processed.

The hydrocyclone is equipped with a pressure gauge, which will be monitored to ensure that the hydrocyclone is functioning within the proper operating range. The flow rates can be adjusted with pinch valves to maintain correct pressure. A large pressure drop, or stoppage in the sand underflow, generally indicates a line blockage, which may require system shutdown and line purging.

5.3.4.4 Operation of Spiral Concentrator

From the underflow of the hydrocyclone, the separated sand stream is now directed to a module consisting of four double-start heavy spiral concentrators. The sand slurry from the hydrocyclone underflow is directed, by gravity, to the top of the spiral module. As the slurry flows down the spirals, heavy particles (heavies) move to the inside of the spiral and light particles (lights) to the outside. For this project, heavies are expected to include lead (Pb) particulate materials from firing ranges, and lights are expected to consist of natural organic materials like grasses and roots. Particulate materials may also be expected in the landfill soils. The middling fraction will be the sand. The heavies and lights will be directed for collection by the operator, who visually identifies fraction formation and adjusts cutter knives at the base of the spirals.

5.3.4.5 Sand Dewatering Screw

The sand (middling) fraction from the spirals is also directed by gravity to an inclined screw classifier or, synonymously, the sand dewatering screw. The screw advances the sand fraction for discharge at the upper end of the unit and allows water and misplaced fines to be collected and recycled. The unit operation requires checking of the screw motor, and monitoring the sand moisture content and the solids concentration of the recovered water. The sand, discharged from the end of the screw, is then staged for sampling and analysis.

5.3.4.6 Enhanced Sand Treatment

If the sand product described above does not meet the specified treatment standards, additional treatment, on a batch-wise basis, will be provided to determine if the sand product quality can be upgraded. The specific upgrades to be used will be determined by the contaminant concentration and the relationship of the specific contaminants to the soil matrix. The enhanced treatment must be flexible. The treatment will include attritioning, use of specialty surfactants, and froth flotation. Other enhancements can be used if unusual contaminant conditions are observed.

5.3.5 Fines Treatment

5.3.5.1 Hydrocyclone Overflow

The hydrocyclone overflow, consisting of fines and water, is directed to the clarifier for clarification by gravity. The system operator collects periodic samples of this stream and performs jar-settling tests with the addition of select polymers. A description of a typical jar test is included in Appendix F. The polymers act to coagulate fines particles to form larger agglomerates that increase mass and aid settling. The operator prepares and properly doses the polymer into this stream before introduction into the clarifier.

A list of proposed reagents cannot be provided until the more definitive treatability study is performed at the time of soil excavation. The bench-scale treatment study will make proposed separations and will produce samples that can be tested for the selection of the proper surfactants, polymers, or filter aids, as necessary. Several hundred unique products are available. The reagents will be selected by actual testing to select and then optimize the proper choice. In each case, however, the chemicals to be used are non-hazardous, biodegradable, and have approved manufacturer Material Safety Data Sheets (MSDSs). The chemical selection documentation and the verification of efficacy and safety will be confirmed and approved prior to use.

5.3.5.2 Lamella Clarifier

The lamella clarifier is an inclined plate clarifier with cone thickener, overflow weirs, and thickener mixers. The fines and water stream are separated in the lamella. Solids settle to the cone thickener and water overflows the weirs to be collected and staged for recycling. The solids are thickened and then transferred by sludge pump to the filter press. A thickener mixer maintains the thickened solids in a condition that allows pumping and avoids over-compaction and blockage. The operator can measure the torque on the mixer shaft and the level of solids in the thickener to control the operation.

The lamella clarifier is initially started-up by filling the unit with process water. As the unit is filled, water overflows the overflow weir and is collected in the recycle water tank. When feed is initiated to the plant and soil slurry is separated in the hydrocyclones, the hydrocyclones' overflow is directed by gravity to the top of the lamella. The fine particles are coagulated by the use of the selected polymer, a denser/larger mass is formed, and the particles settle into the clarifier cone. The unit is put in operation by starting the coagulant polymer-dosing pump, checking polymer flow and delivery into the unit influent, and starting the lamella thickener rake motor. This rake keeps the settled and thickened solids suspended so that the sludge transfer pump can transfer them to the filter press.

5.3.5.3 Filter Press Operation

The thickened solids from the lamella clarifier are transferred by sludge pump to the plate and frame filter press for dewatering. A full-time operator controls the plate and frame filter press, which is operated in batch mode. Samples of the thickened sludge are collected periodically by the operator and tested to determine the need for, and required concentration of prefiltration aids. If necessary, the operator doses the feed with the selected chemicals to improve the quality of the product sludge cake. The thickened solids are pumped to the unit and are directed to a series of plates. The transfer pump pressure forces the water through the membrane filter, retaining the solids on the membrane. When the pressure reaches a predetermined set point, transfer of solids is stopped, the plates are separated, and the collected solids are dropped onto a sludge cake collection pan. Once the solids are removed, the plates are again connected and the next cycle begins. The collected sludge cake is staged for sampling and analysis.

The sludge pump mounted at the base of the lamella is started and placed in operation. At start-up, the sludge pump receives thickened solids and pumps them under pressure to the filter press. The filter press is essentially a static device that loads delivered solids onto installed membranes until a design pressure is attained. The pressure is set according to the results of the bench-scale treatment study based upon the soil matrix. When the pressure set point is reached, the sludge pump transfer is interrupted, and the filter press plates are unbolted. The accumulated solids are removed into under-unit sludge bins, the plates cleaned, put back together, and re-bolted. The sludge pump is restarted, and the process begins again.

5.3.5.4 Coagulation and Prefiltration Polymer Preparation and Use

The chemical handling systems for clarification and prefiltration are provided with the treatment plant. These systems allow local preparation, mixing, and feeding of chemicals in a flexible manner, adjusted to the nature of the feeds to be treated. The plant process engineer oversees the preparation and use of these chemicals to determine selection, concentration, and dosages.

5.3.5.5 Water Management System

It is the plan for the integrated treatment system that all water be recycled. Since it is expected that the feed moisture will be relatively low, and the residual moisture in the sludge cake is about 40 to 50 percent, there is a loss of water bound in the sludge cake. Thus, there is a need to continually add water to the system. The recycle water, originating from the lamella overflow and from the filter press, is collected, pumped to a recycle water storage tank, and pumped back to the screening section of the plant.

The process engineer collects routine samples from the recycle water tanks to monitor the water quality. First, it is important that contaminants not build-up in the recycle water to the extent that they could "pre-contaminate" the feed. The process engineer will routinely analyze these samples to control this issue. It is the experience of the team that this does not occur with the expected contaminants at McClellan AFB. Although this has never occurred, if it does occur, the team will make a decision to remove the unacceptable water from the recycle loop or treat the recycle water to appropriate levels. Secondly, the process engineer will check the recycle water for any potential interference with the selected plant chemistry, specifically the surfactants or polymers in use. If interference is detected, the process engineer will either adjust the plant chemistry or consider treatment of the recycle stream.

Typically, the process water contains only traces of contaminants at low ppm or ppb levels that do not significantly impact the performance of the washing process or the quality of the washed products. If contaminant levels build up to levels such that the water would contribute more than approximately 10 percent of the contaminant load to the washed product, additional water treatment would be integrated into the soil washing process to control contaminant levels in the process water.

Before processing soils from a different site, the water will be analyzed for contaminants of concern from the previous site. Process water will be sampled from the process water holding tank that receives the clarifier overflow and filter press filtrate. If contaminant levels in the water would contribute a contaminant load of more than approximately 10 percent to the washed soils based on the new site standard, the water will be treated, disposed, or refreshed prior to processing the soils from a new site. If the process water contributes a contaminant load to the washed soil of less than 10 percent of the new site standard, the water will be considered "clean" and acceptable for reuse.

Routine water samples will be collected for monitoring and evaluation of water quality after processing 50 percent and 100 percent of the soil from each site. Thus, a total of six water samples will be collected for analysis for the project (assuming treatment of three sites' soils).

5.3.6 Solidification/ Stabilization

5.3.6.1 Feed Selection

The sludge cake produced by the plate and frame filter press is subjected to routine analysis for both total and extractable constituents. Sludge cake that meets specified standards will not require further treatment. For the sludge cake that does not meet the standards, the cake will be stabilized with the intent of meeting non-hazardous requirements. Staged sludge cake that is hazardous will be forwarded for stabilization.

5.3.6.2 Reagent Selection and Dosage Determination

The process engineer will run bench-scale treatment tests at the project site to assess the sludge cake characteristics and to select the reagent, water requirements, and mixing required to achieve the treatment requirements, as described in Appendix F, Field Test Procedure – Sludge Dewatering. The plant manager and operators will then implement these selections.

5.3.6.3 Reagent and Makeup Water Feed

The primary reagents identified are various combinations of Portland cement and water, or the material may be incorporated into asphalt. The materials will be staged at the site for use as needed and makeup water pumped from process water storage tanks.

5.3.6.4 Pugmill Operation

The pug mill is a heavy-duty soil-mixing device that will be used to stabilize selected soils. The pugmill operation is started-up by turning on the feed conveyor motor, which transports the selected feed soils into the unit. The pugmill is started by energizing the mixing motor system and by checking the reagent-dosing feeder for level and starting the reagent-dosing feeder. Once these units are started, the product discharge conveyor is started and the unit is ready to accept feed.

5.3.6.5 Stabilized Product Management

The stabilized product will be staged for sampling and analysis in accordance with this plan, as described in Subsection 7.3. Stabilized material that is not suitable for backfill will be staged in bins for later treatment or disposal. Materials classification is discussed in Section 2 and Figure 2-3.

5.3.7 Plant Shutdown

At the end of each shift, or other non-emergency shutdowns, the feed will be shut off and the rest of the plant allowed to run until all process solids, excluding working beds, have been discharged. Beginning with the grizzly, the unit operations will be shut off in the reverse sequence of their startup and end with the dewatering unit. Polymer dosing will also end at this time. Once the plant is free of solids, the water supply pumps will be shut off first, followed by the process/slurry pump, working from the grizzly unit to the dewatering unit.

The working bed is the annular space between moving parts in equipment (*e.g.,* auger and sides in sand screw, bowl in centrifuge). This space, which holds a given amount of solids, is filled when the equipment is initially charged with solids. These solids stay in place after plant feed is shut down, and the plant only runs on water. The only way to remove this material is to go through a decontamination (decon) procedure, which may or may not require partial equipment disassembly. In a controlled shutdown, the plant is run on just water until all free solids are expelled. The annular material or working bed will not discharge as noted above. Hence, when no more solids are discharged, the plant can be shut down.

In the event of an emergency, shutdown would be accomplished by use of one of the master plant switches. This type of shutdown is extremely disruptive, as it does not allow process equalization prior to shutdown.

5.4 SYSTEM OPTIMIZATION

5.4.1 Data Evaluation

The performance data to be collected, and reviewed daily, include, but are not limited to:

- The soil matrix and contaminant mix of the source (feed) soils currently being treated.
- The effective processing rate currently being experienced.

- The physical and chemical nature of each of the products and residuals currently being generated. The daily chemical information will be obtained from real-time qualitative results.
- The details regarding any plant upsets or unusual situations.

The JV will evaluate this information in detail to identify trends, potential problems, and areas targeted for improvement. The results of this evaluation will be translated into an action plan for implementation in the next day's run(s). The actions could include modification of the feed, feed composition, processing throughput rates, or detailed adjustments to specific unit operations. The intention will be to improve the products, obtain improved volume reduction efficiency, and to reduce both study costs and projected costs for full-scale implementation.

5.4.2 Feed Management

Using information gathered from the sieving studies described in Subsection 3.1.1.1, the JV will continuously evaluate the most effective handling and feeding of the selected source material. The initial concept is that each of the selected sites will be handled and treated as discrete runs. Flexibility may be provided, however, to improve the feed characteristics by mixing source areas to optimize feed quality and thus improve treatment results

5.4.3 Feed Selection

Initial feed soil selection is based on data generated during the initial field soil characterization (Subsection 3.1.1.1) and selected as described in Subsection 5.1.4. If the characteristics of the feed material change beyond the process plant tolerances during ongoing field activities, the amenability of the feed soil for the treatment process will be reassessed. For areas with soils deemed unsuitable for processing, excavation will cease, and another site will be selected for processing. The ultimate disposition of all soils will be noted in the TAAR.

5.4.4 Feed Soil Staging

Feed soil will be stockpiled in discrete piles, designated by area of excavation, on the feed soil storage pad. Each pile will be covered with a polytarp overnight, or when the pile is not being used. Since this is the only point at which the materials are dry, it is the only point at which dust may be generated. Water mist application will be used for dust control as required.

5.4.5 Material Handling Equipment and Routing

The primary equipment used for material handling is rubber tire front-end loaders. To minimize the potential for cross contamination, one loader will be assigned to feed soil, process support, and residual handling in EZ-2. This loader will remain in EZ-2, which consists of the feed soil storage pad, process area, and residual storage area.

A second loader will be dedicated to treated material/product handling, and will remain in the treated soil/product storage pad, EZ-1 and support zone area. Each loader will be outfitted with a bucket scale/totalizer to determine processing rates, and record total feed soil processed, and totals for each output stream/product, as outlined in Subsection 5.3.2. Secondary material handling of palletized supplies/equipment will be accomplished with an appropriately-sized fork lift or loader equipped with lifting forks. Dust will be controlled as described in the Dust Control Plan in Appendix C.

Concrete barriers as described in Subsection 5.2.1.1 will outline material storage areas. Feed soil haul units will access the feed storage area through the south gate, and deposit the feed soil on the feed soil storage pad. If they can dump without entering the feed soil storage pad EZ, exterior truck decontamination will not be required. If they must access the feed soil storage pad, the truck exterior will be inspected to determine if it must be decontaminated as described in Appendix D, prior to leaving the storage pad area. Prior to accessing the treated soil storage pad, feed soil haul units must undergo truck decontamination.

Material will be transported from the feed soil storage pad to the process area using a dedicated loader, as described above. The entire feed soil storage pad, process area, residual storage area, and STSP are one EZ, eliminating the need for decontamination of the dedicated loader operating within this area. If the loader needs to leave this EZ, it will be decontaminated as described in Appendix D.

A dedicated EZ-1 loader will provide equipment support in the support zone, ferry treated soil/products from plant output piles adjacent to the process area to the treated soil/product storage area, and transport material requiring subsequent treatment back to the process area. If the loader in EZ-1 transports material requiring subsequent treatment back to the process area, then it would need decon prior to handling "clean" soils again.

5.4.6 Transfer to Subsequent Treatment

The transfer methods used to advance materials to subsequent treatment are a function of the material being transferred, and the requirements of the subsequent operation. Loaders are used to transfer materials that are dewatered, tested, and found to require additional treatment or disposal subsequent to dewatering. Slurry pumps are used to advance slurry streams that are known to require additional treatment such as attritioning or surfactants prior to dewatering. Slurry streams requiring stabilization/disposal or asphalt incorporation are first dewatered, then handled as noted above for dewatered materials. Table 5-3 outlines the methods used for each situation.

Table 5-3

MATERIAL TRANSFER METHODS

Material/Stream	Treatment Requirement	Transfer Method
Debris/Oversize	Stabilization/Disposal Additional Washing/surfactants	Loader/Mechanical handling Loader/Mechanical handling
Cobbles/Gravel	Additional washing/surfactants Stabilization/disposal Asphalt incorporation Crushing (by others)	Loader to plant feed or conveyor to scrubber unit Loader to stabilization unit or STSP Loader to treatment unit Loader to crushing operation
Sand (dewatered)	Additional soil washing (attrition/surfactants) Stabilization/disposal Asphalt Incorporation	Loader to plant feed; see Sand (slurry) Loader to stabilization unit or STSP Loader to treatment unit
Sand (slurry)	Additional soil washing (attrition/surfactants) Stabilization/disposal Asphalt incorporation	Slurry pump/hose Dewater; see Sand (dewatered) Dewater; see Sand (dewatered)
Fines/Residuals (dewatered)	Additional soil washing (attrition/surfactants) Stabilization/Disposal Asphalt Incorporation	Loader to plant feed; see Fines/Residuals (slurry) Loader to stabilization unit or STSP Loader to treatment unit
Fines/Residuals (slurry)	Additional soil washing (attrition/surfactants) Stabilization/disposal Asphalt incorporation	Slurry pump/hose Dewater; See Fines/Residuals (dewatered) Dewater; See Fines/Residuals (dewatered)

STSP Secondary Treatment Staging Pile

5.4.7 Treated Soil/Product Staging

Treated soil will exit the process plant onto plant output piles via chutes or conveyors. Treated soil/products will be transported via dedicated loader from the plant output piles adjacent to the process area to the treated soil storage area on a daily basis. Treated soil/products will be discretely stockpiled by output stream for each day's run. Since the piles are treated, covering with a polytarp is not required. Dust controls may be needed on windy days to avoid dust nuisance. Samples for confirmatory analysis will be collected from the piles as detailed in Section 7.0.

5.4.8 Stockpile Management and Tracking

Soils will be tracked from initial stockpiling on the feed soil process pad through final treatment or disposal. Each feed soil pile will be identified with a pink pin flag and pink marking paint and labeled with the area and date of excavation. Feed soil piles deemed unsuitable for treatment will be further identified with a blue pin flag and blue marking paint and labeled "NO GO."

Each treated soil/product pile will be identified with a yellow pin flag and yellow marking paint containing the stream name/number, date processed, and total pile weight and feed stock identification (ID) number. Treated soil/product piles meeting the appropriate analytical requirements will be further identified with a green pin flag and marking paint of the same color and labeled "PASSED," and left for subsequent disposition by McClellan AFB after project completion. If analytical results indicate additional treatment or disposal is required, the material in that pile will be further identified with a red pin flag and red marking paint and labeled "RE-TREAT" or "DISPOSE," respectively. These piles will subsequently be transferred back to the process area or temporarily stored as outlined in Subsection 5.6.2. Report forms to be used for daily operations are presented as Figures 5-4 through 5-8.

The piles will be inspected on a daily basis and the markings will be refreshed/replaced as needed. In addition, care will be taken in equipment routing and material handling to avoid disturbing/obscuring markings on stockpiles. The material log will be updated on a daily basis to provide a cross reference.

5.4.8.1 Feedstock I.D. Form, EZ-2 Feed Operator's Daily Log and EZ-1 Loader Operator's Daily Log

Each loader operator will maintain a logbook to record the operator of record, day, date, and time of load placement. Additional information to be recorded includes bucket counts, bucket weights, and totalizer readout for each feed/output stream per shift or run. The operators will zero the bucket scale/totalizers at the beginning of each shift, when changing feed sources or output streams, or when starting a new process run. Figure 5-4 presents the Feedstock I.D. form. Figures 5-5 and 5-6 are the EZ-2 Feed Operator's Daily Log and EZ-1 Loader Operator's Daily Log.

5.4.8.2 Daily Operations Report

The plant manager/site superintendent will compile information from the Daily Field Log into daily summary totals per feed/output stream. Additional information includes plant/site personnel, weather, and highlights of plant performance. In addition, it will include a summary of analytical samples collected per shift, material deemed unsuitable for treatment, and material transferred for additional treatment or disposal. Figure 5-7 presents the Daily Operations Report.

5.4.8.3 Material Disposition Log

The project manager will compile the Material Disposition Log, which is a compilation of the Plant Operator Reports. In addition, confirmatory analytical results will be included, along with a record of any subsequent treatment or disposal for each feed/output stream. Figure 5-8 presents the Material Disposition Log.

5.5 MATERIAL STORAGE

5.5.1 Potable Water

McClellan AFB will provide potable water to the treatment system contractors. No storage is anticipated, except for the process water tanks.

5.5.2 Process Water/Wastewater

Two 5,000-gallon capacity water storage tanks will be used at the treatment pad. Approximately 30,000 gallons of water is required for initial plant charging, with about 8,000 gallons per shift (freshwater at 10 to 20 gpm) as process make-up. The treatment process is a net water consumer, and therefore, no wastewater is anticipated to be generated. However, at the end of the project there will be approximately 25,000 gallons of process wastewater which will be sampled and managed appropriately.

Spills will be collected in the sump(s) and pumped back into process. Relatively speaking, spills should not contain appreciable amounts of solids as they drop out of suspension as soon as they hit the ground; shoveling the solids is generally easier than pumping them as it takes much more water to move them across an open surface than it does to push them through a pipe. Fines and organics are dealt with by reintroducing the material upstream of the plant water treatment consisting of settling coagulation, flocculation and filtration.

Process water spills and storm water will be collected in the process pad sump and routed to the process water tank for treatment and recycle, or use for decontamination. Alternatively, the water may be collected and transferred to the CERCLA water treatment plant, or other appropriate location.

5.5.3 Sediment and Soil

Several soil storage areas have been incorporated in the design of the treatment pad. These areas include feed soils and treated soils. Details regarding these storage areas are provided earlier in this section.

5.5.4 Solid Waste

Solid waste generated in this treatment process, such as towels, rags, etc. that are used for cleaning off treatability system parts, etc., will be stored at the treatment pad in double-lined plastic garbage bags. When the bags are full, the bags will be disposed as solid waste in a waste receptacle on base. If contaminated with raw wet soil, the personal protective equipment (PPE) waste will be washed off or brushed, followed by cutting off the arms and legs and containerization by JV personnel. These materials will then be transferred by another McClellan AFB contractor to an appropriate facility, as directed by McClellan AFB.

Figure 5-4

Feedstock I.D. Form

Feed Stock I.D. # ______

Supervisor ______
Date ______

As-excavated ☐

Excavation location ______
Range BGS ______
Comp. Sample I.D. # ______
Soil type ______
Contaminants of concern ______

Blended ☐

Excavation / material type ______
Percentage ______
Sample I.D. # ______
Soil type ______
Contaminants of concern ______

Excavation / material type ______
Percentage ______
Sample I.D. # ______
Soil type ______
Contaminants of concern ______

Excavation / material type ______
Percentage ______
Sample I.D. # ______
Soil type ______
Contaminants of concern ______

Figure 5-5

EZ-2 Feed Loader Operator's Daily Log

Feed Stock I.D.# ______________________

Operator ____________

Date ______

Feed stock		
Load #	**Weight / Vol.**	**Time**

Feed stock		
Load #	**Weight / Vol.**	**Time**

Run / Shift

Start time	
Stop time	
Total Wt. / Vol.	

Figure 5-6

EZ-1 Loader Operator's Daily Log

Feed Stock I.D. # ____________________

Operator ____________________

Date ______________

4 minus to 3/8		
Count	**Weight / Vol.**	**Time**

3/8 to 2mm		
Count	**Weight / Vol.**	**Time**

Sand		
Count	**Weight / Vol.**	**Time**

Stabilized product		
Count	**Weight / Vol.**	**Time**

Run / Shift

Start time	
Stop time	

Total Wt. / Vol.

4- to 3/8	
3/8 to 2mm	
Sand	
Stabilized product	

Figure 5-7

Daily Operations Report

Supervisor ______________

Date ________

Site conditions ________

Site Personnel

Run / Shift

Start time	
Stop time	

Feed stock I.D. # ________

Daily Totals

Feed stock	
4+ oversize	
4- to 3/8	
3/8 to 2mm	
Spiral heavies	
Sand	
Sludge cake	
Stabilized product	

Consumables

Polymer	
surfactant	
cement	

Utilities

Water	
electricity	

Samples

Location	I.D.#	Time	TAT

Material Disposition:

Notes:

Figure 5-8

Material Disposition Log

Feed Stock I.D. # [ ]

Supervisor ____________

Date ________

Material Type ____________

Material Wt. / Vol. ______

Sample I.D.# [ ]

Pass [ ] **Fail** [ ] Fail Criteria ____________

Disposition

____

____

____

Material Type ____________

Material Wt. / Vol. ______

Sample I.D.# [ ]

Pass [ ] **Fail** [ ] Fail Criteria ____________

Disposition

____

____

____

Material Type ____________

Material Wt. / Vol. ______

Sample I.D.# [ ]

Pass [ ] **Fail** [ ] Fail Criteria ____________

Disposition

____

____

____

Material Type ____________

Material Wt. / Vol. ______

Sample I.D.# [ ]

Pass [ ] **Fail** [ ] Fail Criteria ____________

Disposition

____

____

____

5.5.5 Process Chemicals

Process chemicals, such as polymers or surfactants, will be stored within a secondary containment area near the Lamella clarifier. The storage area is on the treatment pad, within the curbed process pad.

5.6 RESIDUALS MANAGEMENT

Residuals requiring additional treatment or ultimate disposal are anticipated in addition to the treated soil/products detailed in Subsection 5.4.5. Some residuals will be known to require ultimate disposal prior to processing specific soils, while others will be identified through confirmatory analysis. The following strategy outlines the approach to safely and effectively deal with process residuals.

5.6.1 Residuals Strategy

The basis of the residuals strategy is to anticipate where the residuals will originate and have a plan in place to deal with them prior to commencing operations. For this project, all residuals will be dewatered prior to exiting the plant to simplify material handling and storage requirements as well as to enhance process area housekeeping. All residuals requiring disposal will be placed in the STSP to the north of the process area. Residuals may be containerized (*e.g.* covered roll-off bins or drums) for temporary storage, if the volume is sufficiently small. This may be a viable alternative should the STSP not be accessible during performance of this study. The material will then be further classified to determine if it can be used as backfill or what type of containment would be required (see Figure 2-3).

5.6.2 Temporary Storage of Residuals

Residuals known to require ultimate disposal will be temporarily staged in process output piles or bins until they are transferred to the STSP using the dedicated EZ-2 loader.

Residuals that may require additional treatment/incorporation into products, as well as residuals that may potentially meet treatment goals, will be transferred from the process output piles to the dedicated residuals storage area as detailed in Figure 5-1. As with treated soil/products, they will be flagged with the requisite material handling/tracking information recorded as detailed in Subsection 5.4.8. These piles will be covered with polytarps as described in Subsection 5.4.7. The anticipated physical properties of process residuals and disposition are outlined on Table 5-4.

5.6.3 Use of Existing Ponds

To facilitate site operations, the existing concrete ponds to the north of the process area will be used for staging residuals, if available. They will be part of the feed soil/process area (EZ-2), and will be made contiguous via a dedicated access road, which will be provided by McClellan AFB contractors. Through this configuration, the loader servicing EZ-2 activities can access the ponds without having to decontaminate equipment, and without risk of accidentally spilling residuals on the ground outside the EZ limits. Soil that cannot be treated to the treatment standards will be staged for further treatment.

Table 5-4

PROCESS RESIDUALS AND DISPOSITION

Source	Physical Quality	Chemical Quality	Disposition
Prescreened Grizzly Oversize	≥4 inch Debris	Clean	Reuse/Recycle or Local Landfill
Prescreen Trommel Oversize	>3/8 to 4 inch Debris	Clean	Reuse/Recycle
Wet Screened Oversize	>2mm to 3/8 inch Gravel	Clean	Reuse/Recycle
Physically Separated for Further Treated Sand	>Hydrocyclone Cut-Point <2mm Sand	Clean	Reuse/Recycle
Physically Separated for Further Treated Fines	<Hydrocyclone Cut-Point Sludge Cake	Concentrated Residual Non-Hazardous	Stabilize and Non-Hazardous Disposal
Physically Separated for Further Treated Fines	<Hydrocyclone Cut-Point Stabilized Soil	Hazardous	Stabilize and Contain
Physically Separated for Further Treated Fines	<Hydrocyclone Cut-Point Fines incorporated into an asphalt or construction-grade product	Non-Hazardous	Reuse/Recycle or Contain

≥ Greater than or equal to
< Less than
> Greater than
mm Millimeter

5.7 DEMOBILIZATION AND SITE RESTORATION

Upon process completion, the system will be drained and all residual solids removed and staged with contaminated residuals in dedicated storage areas. The system will then be flushed with clean water, decontaminated/disassembled, and demobilized from the site.

5.7.1 Plant Decontamination and Disassembly

Prior to final plant shutdown, the plant will be allowed to run on just water until all free solids are discharged. The plant will then be drained and residual solids removed. All residual solids will be staged in the process area for subsequent placement in the STSP, or if sufficiently small quantity, transferred to a roll-off bin or drum and managed as investigation derived waste.

The plant may be partially disassembled to facilitate residual solids removal. Once the residual solids have been removed, the plant will be decontaminated with treated process water using a high-pressure nozzle. Initially, the exterior and readily accessible interior sections will be washed. Following the water wash, the plant will be disassembled and staged on the process pad, where it will undergo a final wash. Interior surfaces will be washed first followed by the exterior surfaces, with work progressing from top to bottom.

Spent decon water will be collected in the process pad sump, and pumped to the plant wastewater recycling and distribution unit for treatment, and reuse in the decon process. If required, a final rinse using hydrant water will be completed. Once decontamination has been completed, all spent water will be collected and transferred to the existing CERCLA water treatment plant, or other appropriate location.

5.7.2 Plant Inspection

Following decon/disassembly, the plant will undergo a visual inspection. Process equipment will be deemed suitable for demobilization if it is visually free of site soil or contaminants. Pieces with soil or contamination will undergo additional decontamination as previously described, until it is visually free of soil/contaminants, at which time it will be marked "ok."

5.7.3 Plant Demobilization

Once units have passed inspection, they will be loaded using appropriately sized cranes, forklifts, or other suitable lifting equipment. The process equipment will be loaded on flatbed trailers, and shipped off-site. Decontamination/demobilization will be documented in the TAAR.

6.0 PERMITTING AND REGULATORY COMPLIANCE

This section describes all applicable or relevant and appropriate regulatory requirements related to activities discussed in Section 5.0. These requirements include acquisition of permits and compliance with regulations. The necessary permitting and compliance issues are described below.

6.1 RELEVANT PERMIT REQUIREMENTS

As detailed below, no permits are required for this demonstration. However, it is the base's policy to comply with the substantive, applicable federal, state, and local regulations for which permits would normally be required. Operations subject to such regulations are discussed below. Furthermore, the waiver of the permitting process does not apply to off-site operations, including the transport of materials or products to the site or off-site. Any activities that will occur off-site are subject to the appropriate permitting procedures.

6.1.1 Hazardous Material Storage

The treatability study does not require hazardous materials to support its operation. Some surfactants and polymers, as well as fuel and lubricating oils may be used in the operations. However, site soils undergoing treatment are generally hazardous materials and are handled as such. During the treatability study, all soils will be tested for hazardous characteristics and staged accordingly within the treatment area prior to and during treatment and in the STSP or "clean soil" sites after treatment.

Clause H-500 of the McClellan Environmental Technology Remediation Implementation Contract (METRIC) identifies specific requirements regarding the storage and use of hazardous materials on McClellan AFB. Among these requirements are to:

- Update the list of hazardous materials identified in the "Certification Regarding Identification of Hazardous Materials in the Performance of On-Base Services" (Certification).
- Update or provide additional MSDS for each item on the Certification list.
- Submit a "Contractor Hazardous Material Report" (report) for each Certification list item brought onto McClellan AFB.
- Update the report monthly until the hazardous material is removed from McClellan AFB.
- Affix a hazardous material warning label to all such materials.
- Conduct and document employee hazard communication training before beginning work.

6.1.2 Land Disposal Restrictions

Land disposal restrictions (LDRs) apply to hazardous waste generators, including cleanup waste generators. Products to be "used in a manner constituting disposal" will undergo testing as detailed in Section 7.0, to ensure they meet the relevant LDRs for the contaminants of concern.

6.1.3 Atmospheric Discharge

No separate permits are required for atmospheric discharge during the demonstration period. Atmospheric discharges from the system may include dust from handling soils; however, stockpiled and feed soils will be wetted, if necessary to reduce dust, and the overall treatment process is performed on wet soils, so no dust is anticipated to be generated during treatment operations. Since McClellan AFB is an NPL site, the system will not require any air permits from the Sacramento Metropolitan Air Quality Management District (SMAQMD) of the California Air Resources Board (CARB). Section 9.7 further describes air monitoring for this project.

6.1.4 Wastewater Discharge

No separate permits are required for wastewater discharge, as the system is a water consumer and will not produce wastewater. At study completion, any remaining process water will be collected, tested, and treated appropriately.

6.1.5 Waste Storage, Treatment, and Disposal

Wastes generated during the operational phase of the demonstration will include used PPE and other solid waste (paper towels, rags, etc.) from system operation, and diluted Alconox® solution from decontamination activities. The procedures set forth in the Hazardous Waste Management Plan (SM-ALC-MCAFB Instruction 32-2, 1996) will be followed. SM-ALC/EMPC and the contracting officer will be notified of the type and quantity of hazardous waste expected to be generated. Hazardous waste will be managed as specified in Chapter 4 of the McClellan AFB Hazardous Waste Management Plan (SM-SLC-MCAFB Instruction 32-2, 1996). No separate permits are required for waste generated during the treatability study.

6.1.5.1 Used Personal Protective Equipment and Other Solid Waste from Operations

Used PPE, with no adhering wet soils and the arms and legs cut out, and towels, rags, etc. that are used for cleaning off treatability system parts, etc. will be stored in double-lined plastic garbage bags. When the bags are full, the bags will be disposed as solid waste in a waste receptacle on base. If PPE is contaminated with raw wet soil, the soil will be rinsed or brushed off, the arms and legs cut off, and the PPE waste containerized by JV personnel. These materials will be transferred by another McClellan AFB contractor to an appropriate facility, as directed by McClellan AFB.

6.1.5.2 Alconox® Solution

Dilute Alconox® solution from cleaning and decontamination activities will be stored in a 55-gallon drum (1A/2 - full removable head steel drum) on-site in compliance with Subsection 2.3.1 of the Hazardous Waste Management Plan (SM-ALC-MCAFB Instruction 32-2, 1996). When the drum is full, McClellan AFB will package the waste for pick-up. The waste will be labeled, tested, and classified by JV personnel, then transferred by another McClellan AFB contractor to an appropriate facility, as directed by McClellan AFB.

6.1.6 General Operation

General system operation will require no special or additional permits and will be in compliance with all local, state, and federal codes and regulations.

6.2 REGULATORY COMPLIANCE

In addition to fulfilling the requirements in Subsection 6.1, the implementation and operation of the technology demonstration must comply with other federal, state, and local regulations, including, but not limited to:

- CERCLA and the NCP require the implementation of a remedial solution that provides short and long-term effectiveness and permanence, reducing toxicity, mobility or volume through treatment in a cost-effective manner acceptable to federal, state, local personnel, and the local community. CERCLA states: "Remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants as a principal element, are to be preferred over remedial actions not involving such treatment. The off-site transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practical treatment technologies are available." CERCLA also specifies specific requirements to handle and dispose of hazardous wastes generated during clean up activities. These requirements may take precedence over other waste regulations and would need to be assessed for each specific site for which the technology was implemented. No federal, state, or local permits are required for on-site response actions, including treatability studies, conducted under Sections 104, 106, 120, 121, and 122 of CERCLA.

- RCRA, as amended, 42 United States Code (USC) 901, *et seq.* and Title 22 California Code of Regulations (CCR). Wastes generated during the soil washing and solidification/ stabilization study system operation will be compared to RCRA and Title 22 CCR hazardous waste concentrations to determine containment requirements. It is possible that treatment systems required for full-scale implementation of the thermal desorption strategy may generate RCRA hazardous waste (*e.g.*, organic process liquids). The specific RCRA wastes to be generated would vary from site-to-site due to local regulations and, therefore, must be considered individually for each site.

- Clean Water Act (CWA). The CWA requires compliance with the applicable requirements of the discharge permit issued to the facility by the county. No wastewater will be discharged from this treatment process during normal operations. Following operation, residual water within the system may be sent to the on-base CERCLA treatment plant for disposal.

- Safe Drinking Water Act as amended, 42 USC 3300f, *et seq.* Since no water will be produced in this treatment scheme, the regulation will not be applicable to the demonstration.

- Clean Air Act as amended, Title 42 USC 3401, *et seq.* Limits the emission of both "criteria" (ozone and its precursors oxides of nitrogen and reactive organic compounds, as well as sulfur dioxide and particulate matter less that 2.5 microns in diameter) and "non-criteria" or hazardous air pollutants. The atmospheric emissions expected are carbon dioxide and particulates. Carbon dioxide is not regulated. Particulates will be minimized by dust suppression during excavation. During the treatment process, the soil is wetted, thus reducing or preventing dust. A dust control plan is included in Appendix C of this WIP.

- Toxic Substances Control Act (TSCA). PCB wastes generally are regulated for disposal under TSCA at concentrations of 50 ppm or greater. Cleanup decisions at CERCLA sites have relied on the 1987 TSCA PCB Spill Cleanup Policy. Soil washing, as long as it meets the requirements of Section 761.61(a)(5)(i)(A)(1) through (6), does not require prior USEPA approval.

- Title 27, Division 2, Solid Waste Requirements. Title 27, Division 2, Subchapter 4 – Criteria for Landfills and Disposal Sites. These regulations are applicable to this project because they provide provisions for the safe excavation of landfill material and requirement for the safe management of non-hazardous solid waste.

- Title, 23 Division 3, Chapter 15, Article 2 – Waste Classification and Management. This section is applicable to this treatment study because it provides waste classification criteria. It also provides provisions on managing the classified waste.
- Mixed Waste Regulations. These regulations are not applicable because the soil washing and solidification/ stabilization study system is not being evaluated for treatment of mixed wastes (*e.g.*, RCRA wastes mixed with radioactive wastes).
- Federal Insecticide, Fungicide, Rodenticide Act (FIFRA). These regulations are not applicable because the unit will not be used to demonstrate treatment of FIFRA-regulated substances.
- Occupational Safety and Health Act (OSHA). Since McClellan AFB is a federal site, the operation of the treatability study system is governed by federal OSHA regulations. This requires the preparation of a site-specific health and safety plan for all work to be conducted on the site. Workers also need to be informed of the nature of the hazards present on the site. Additionally, workers on-site must have successfully completed the OSHA 24-hour health and safety training and attended an annual 8-hour refresher course as outlined in 29 CFR Part 1910.120. If the site is deemed fully characterized, then no OSHA training would be required except as deemed necessary for handling waste. All equipment used on the site complies with OSHA safety regulations. Since McClellan AFB is located in California, the operation of the treatability study system will also substantively comply with the regulations contained in Title 8 of California/OSHA.
- State and Local Regulations. The concerned state and local regulatory agencies include the SMAQMD, the state of California Central Valley Regional Water Quality Control Board (RWQCB), and the state of California DTSC. No permits are required from these agencies for the demonstration; however, recognizing that all sites have unique characteristics, each potential full-scale application of the technology would need to comply with all applicable state and local regulations promulgated by these agencies, such as CCR Title 27 and 22.

7.0 SAMPLING PLAN

This WIP section includes the sampling objectives, rationale for locations and sample quantity, analytical methods, field procedures, and quality control samples for each type of process stream. The individual streams identified in Figure 3-1 are separated into three categories based upon sampling objectives:

Stream	Description	***Objective***
1) Preoperation stream	Feed soils	Determine suitability of feed soil to soil washing process
2) Process streams	Input and output solids for each internal process	Optimize and assess system performance
3) Product/residual streams	Solids remaining after process is complete	Determine disposal or reuse options

Samples will be collected at various locations throughout the process illustrated in Figure 7-1 to meet the above objectives. Although specific sample locations are designated on the figure and specified in Tables 7-1 and 7-2, sampling locations and frequency may vary based upon sample variability or equipment performance. The analyte lists will be tailored to include the most recent RI data, which has not, as yet, been published. Soil will be processed through the system in the order of least contaminated to most contaminated.

7.1 PREOPERATION SAMPLING AND ANALYSIS

Preoperation sampling will occur in two steps; initial, visual inspection and physical parameter testing; and representative composite sampling and both physical and chemical analysis of the selected soils.

For the initial step (site sampling), the JV and McClellan AFB management team will conduct a field walkover of the candidate sites. Ten non-VOC sites have been identified as possible remediation candidates for this study. In Subsection 2.4, these sites have been prioritized, and at least one site from each general category will be subjected to testing. At a minimum, the 6 highest-priority sites, CS 011 and CS 013 (landfills), PRL S-006 (SVOC spill), and PRL S-004, waste pile and SAFR (metals only) should be sampled. Representative samples would be collected by excavating a test pit at each of the sites. With the exception of the landfill sites (CS 011 and CS 013), impacted soils are reportedly shallow, and test pits would also be quite shallow (approximately 2 feet or less). At the landfills, the trench would be advanced to approximately 6 to 8 feet depth, in order to observe and sample stratified layers, if present. At each site, the backhoe bucket will be used to excavate and mix the soil sample. A sample will be collected from the homogenized soils by hand shovel. The sample will be tested during the preliminary treatment test to define the nature of the soil matrix for the candidate site. Soil from each potential excavation area will be evaluated as described in the preliminary treatment study (Appendix F) to determine the amenability of soil from that area to the treatment process. If the soil is not suitable for soil washing, no further excavation would be undertaken at the site and the excavation will be backfilled. If the soil is acceptable, excavation and feed soil stockpiling will be undertaken at the site as described in the Excavation Plan in Appendix E.

For the second step (feed soil sampling), a composite sample will be collected from the feed soil stockpile for each site prior to operation and analyzed for physical parameters in the field laboratory, screened for chemical constituents and gamma radiation (where applicable), and analyzed for chemical contaminants in a fixed laboratory facility.

7.1.1 Sampling Objectives

The two preoperation sampling objectives are described below.

- The amenability of the soil to the treatment process will be determined by analyzing grain size distribution, moisture content, and estimated contaminant loading as discussed in the Preliminary Treatment Study (Appendix F). If the soil tested exhibits characteristics beyond the operational parameters of the treatment process, the site will not be selected and soil from a different area will be selected. If the soil is shown to be a good candidate for the soil washing and solidification/ stabilization study, excavation will be conducted at the site, according to the Excavation Plan (Appendix E). Soils will be transported to the staging area of the treatment pad, and set in feed soil stockpiles.

Chemical analyses will identify the constituents and concentrations in the feed soil to be introduced into the system for treatment, will verify the suitability of the site, and will provide initial process parameters.

7.1.2 Rationale for Sample Locations, Numbers of Samples, and Analytical Parameters

Three complete preoperational samples will be collected from the stockpile from each chosen site. To acquire a representative sample from the site, a 5-gallon composite sample consisting of at least 6 grab samples will be collected from each feed soil stockpile after oversized debris has been removed. The composite sample will be homogenized and ground if the soil particle size is variable or too large for homogenization.

The parameters necessary to characterize the feed soil include grain size distribution, moisture content, and total contaminant loading, as listed in Tables 7-1 and 7-2. The physical testing and chemical screening may be completed in the field lab and the samples for definitive chemical analysis will be shipped to a fixed laboratory. The chemical analyses performed by the fixed laboratory are listed in Table 7-2 for feed soils from candidate sites for each site type. The selection of these analyses is based upon historical contaminants of concern listed in Table 2-1 and more recent RI data. Landfill site samples will be analyzed for VOCs and radiation screening, also.

7.1.3 Field Methods and Procedures

Field methods and procedures will follow those identified in the McClellan AFB Basewide Quality Assurance Program Plan (QAPP; Radian 1999b), where the procedures are applicable to the soil sampling for this project.

7.1.3.1 Sample Collection

The following standard operating procedures (SOPs) from the McClellan AFB QAPP will be followed. In some cases, only parts of the SOPs are applicable to this project. The SOPs are: McAFB-042 – General Field Operations, McAFB-012 – Trenching, and McAFB-016 – Collection of Surface and Sub-Surface Soil Samples.

Table 7-1

FIELD ANALYSIS SCHEME

Stream Number	Name	Particle Size Range	Field Analyses: Grain Size Distribution (%wt/fraction)	Moisture Content (%)	Percent Solids (%)	Flocculation/ Settling (Clarity)	Contaminant Concentrations	Radiation Screening [(1)]
Method			**ASTM Method D422**	**ASTM Method D2216**	**APHA Methods 2540F and 2710C**	**ASTM Method D2216**	**XRF and GC**	**Gamma Radiation Screening**
Preoperation Sampling								
1	Feed Soil	Native	X	X	-	-	X	X
Process Control								
5	Fine Sand	<3/8"	X	X	-	-	X	
6	Oversize	2mm - 3/8"	X	X	-	-	X	
7	Hydrocyclone Underflow	≤2mm	X	-	X	-	X	
8	Spiral Concentrate	0.05mm-2mm	X		X	X	X	
10	Clarifier Influent	NA	-	-	X	X	-	
11	Clarifier Underflow	NA	X	-	X	-	X	
Residuals								
2	Oversize/ Debris	≥4"	-	-	-	-	X	
3	Cobbles/ Gravel	1" - 4"	X	X	-	-	X	
4	Coarse Sand	3/8" – 1"	X	X	-	-	X	
12	Clarifier Effluent	NA	-	-	X	-	-	

Note: Stream numbers are associated with sample location numbers in Figure 7-1.
(1) The XRF, GC, and radiation screening may or may not be used pending the results of the preliminary treatment test.

%wt	Percent weight
ASTM	American Society of Testing and Materials
APHA	American Public Health Association
mm	Millimeters
"	Inches
XRF	X-ray fluorescence
GC	Gas chromatography
NA	Not applicable
-	Not analyzed

Table 7-2

SAMPLE ANALYSIS SUMMARY

Sample Location		Quantity and Analytical Method					
Number	Name	Metals Only			Landfill Sites		SVOCs Spill Sites
		PRL S-004	IC 7 Wastepile	SAFR	CS 011	CS 013	PRL S-006
Preoperation							
	Feed Soil	3 x 7421, 1 EB (same methods), 1FD (same methods)	3 x 6010B, 7131A, 7421, 1 EB (same methods), 1FD (same methods)	3 x 7421, 6010B, 1 EB (same methods), 1FD (same methods)	3 x 6010B, 7131A, 7421, 8082, 8081A, 8270C, 8290, 8260B, 8310, 8015B, 1 EB (same methods), 1FD (same methods)	3 x 6010B, 7131A, 7421, 8082, 8081A, 8270C, 8290, 8260B, 8310, 8015B, 1 EB (same methods), 1FD (same methods)	3 x 8310, 6010B, 1 EB (same methods), 1FD (same methods)
Process Control							
5	Fine Sand (Pretreatment)	**7 x 7421, 1 FD (same method)**	**7 x 6010B, 1 FD (same method)**	**7 x 7421, 6010B, 1 FD (same method)**	**7 x 6010B, 8081A, 8082, 8270C, 8015B, 8310, 1FD (same methods)**	**7 x 6010B, 8081A, 8082, 8270C, 8015B, 8310,**	**7 x 6010B**
7	Hydrocyclone Underflow (Pretreatment)	**7 x 7421**	**7 x 6010B**	**7 x 7421, 6010B**	**7 x 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421, 1FD (same methods)**	**7 x 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421, 1FD (same methods)**	**7 x 6010B, 1FD (same methods)**
6	Oversize (Post Treatment)	**7 x 7421,** 1311 w/ 7421, WET w/ 7421, 1 FD (same method)	**7 x 6010B, 7131A, 7421,** 1311 w/ metals, WET w/ metals, 1 FD (same method)	**7 x 7421, 6010B,** 1311 w/ 7421, WET w/ 7421, 1 FD (same method)	**7 x 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421;** WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8270C; 1 8290	**7 x 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421;** WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8270C; 1 8290	**7 x 6010B, 8310,** WET w/ metals, 1311 w/ metals, 1 FD (same method)
9	Sand (Post Treatment)	**7 x 7421,** 1311 w/ 7421, WET w/ 7421	**7 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841,** 1311 w/ metals, WET w/ metals	**7 x 7421, 6010B,** 1311 w/ 7421, WET w/ 7421	**7 x 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421;** WET w/ Metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8270C; 1 8290, 1FD (same methods)	**7 x 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421;** WET w/ Metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8270C; 1 8290, 1FD (same methods)	**7 x 6010B, 8310,** WET w/ metals, 1311 w/ metals, 1FD (same methods)

Table 7-2 (Cont'd)

SAMPLE ANALYSIS SUMMARY

Sample Location		Quantity and Type of Analyses					
		Metals Only			Landfill Sites		SVOCs Spill Sites
Number	Name	PRL S-004	IC 7 Waste pile	SAFR	CS 011	CS 013	PRL S-006
Product/Residuals							
2	Oversize/ Debris	3 x 7421, 1311 w/ 7421, WET w/ 7421, 1 FD (same methods)	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, WET w/ metals, 1 FD (same methods)	3 x 7421, 6010B, 1311 w/ 7421, WET w/ 7421, 1 FD (same methods)	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A, 7421; WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A, 7421; WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C	3 x 6010B, 8310, WET w/ metals, 1311 w/ metals
3	Cobbles/Gravel	3 x 7421, 1311 w/ 7421, WET w/ 7421	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, WET w/ metals	3 x 7421, 6010B, 1311 w/ 7421, WET w/ 7421	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A, 7421; WET w/ Metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C (1FD same methods)	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A, 7421; WET w/ Metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C (1FD same methods)	3 x 6010B, 8310, WET w/ metals, 1311 w/ metals
4	Coarse Sand	3 x 7421, 1311 w/ 7421, WET w/ 7421	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, WET w/ metals	3 x 7421, 6010B, 1311 w/ 7421, WET w/ 7421	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A, 7421; WET w/ Metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A, 7421; WET w/ Metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C	3 x 6010B, 8310, WET w/ metals, 1311 w/ metals, 1 FD (same methods)
15	Process Water	**2 x 7421**	**1 x 6010B**	**2 x 7421, 6010B**	**6 x 6010B, 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421, 1 FD (same methods)**	**6 x 6010B, 8081A, 8082, 8270C, 8015B, 8310, 6010B, 7131A, 7421, 1 FD (same methods)**	**6 x 6010B, 8310, 1 FD (same methods)**

Table 7-2 (Cont'd)

SAMPLE ANALYSIS SUMMARY

Sample Location		Quantity and Type of Analyses					
		Metals Only			Landfill Sites		SVOCs Spill Sites
Number	Name	**PRL S-004**	**IC 7 Waste pile**	**SAFR**	**CS 011**	**CS 013**	**PRL S-006**
13	Sludge Cake	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, WET w/ metals, 1 FD (same methods)	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, WET w/ metals, 1 FD (same methods)	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, WET w/ metals, 1 FD (same methods)	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A 7421, WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C; 1 8290	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A 7421, WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C; 1 8290	3 x 6010B, 8310, WET w/ metals, 1311 w/ metals
14	Stabilized Product	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, DI WET w/ metals	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, DI WET w/ metals	3 x 6010B, 7040, 7060A, 7131A, 7421, 7471A, 7740, 7841, 1311 w/ metals, DI WET w/ metals	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A 7421, DI WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C; 1 8290, 1 FD (same methods	3 x 8081A, 8082, 8260B, 8270C, 8015B, 8310, 6010B, 7131A 7421, DI WET w/ metals, 8081A, 8082, 8270C; 1311 w/ metals, 8081A, 8082, 8260B, 8270C; 1 8290, 1 FD (same methods	3 x 6010B, 8310, DI WET w/ metals, 1311 w/ metals

Sample number corresponds to sample locations indicated on Figure 7-1.

Bold	**Indicates expedited turnaround time (48-hour for all but leachates)**		
WET	Waste extraction test	DI WET	Waste extraction test using deionized water
FD	Field duplicate	FD	Field duplicate
EB	Equipment blank	EB	Equipment blank
SAFR	Small Arms Firing Range		

All soil samples for this project will be composites of at least 5-gallons and consist of a minimum of 6 grab samples. To form composite samples, each waste pile will be divided into six sections of equal size and one grab sample will be taken randomly within each section and composited. Samples will be collected using decontaminated shovels and placed in clean plastic pails for mixing. The composite samples will be homogenized and a portion used to determine the physical properties specified in Subsection 7.1.2. The remainder of the sample will be crushed and pulverized to pass 400 mesh, and will be used to determine the pertinent chemical properties. The homogenization, grinding, and pulverizing minimizes the variability commonly exhibited in contaminated soil and increases the representativeness of the samples. The composite will then be coned and quartered and placed in the appropriate sample container (see Table 7-3).

7.1.3.2 Sample Containers

The laboratories will provide precleaned sample containers for all analyses. The containers will be stored away from sources of possible contamination.

Table 7-3

ANALYTICAL METHODOLOGY REQUIREMENTS: SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Reference Parameter (Matrix)	Method	Holding Time	Container(s)	Preservation	Storage Requirements
Metals (soil)	SW-846 Method 6010B or 6020, 7471A, (or 7000 series methods if appropriate)	6 months; 28 days for mercury	8 oz. Clear wide-mouth jar	None	4°C
Total Extractable Petroleum Hydrocarbons (soil)	Modified SW-846 Method 8015	14 days to extraction, 40 days from extraction to analysis	8 oz. Glass jar	None	4°C
Pesticides (soil)	SW-846 Method 8081A	14 days to extraction, 40 days from extraction to analysis	8 oz. Glass jar	None	4°C
Polychlorinated Biphenyls (soil)	SW-846 Method 8082	14 days to extraction, 40 days from extraction to analysis	8 oz. Glass jar	None	4°C
Volatile Organic Compounds (soil)	SW-846 Method 8260B	48 hours to preservation; 14 days from preservation to analysis	3 Encore® Samples	None in the field; sodium bisulfate solution in the lab	4°C
Semivolatile Organic Compounds (soil)	SW-846 Method 8270C	14 days to extraction, 40 days from extraction to analysis	8 oz. Glass jar	None	4°C
Dioxins and Furans (soil)	SW-846 Method 8290	30 days to extraction, 45 days from extraction to analysis	8 oz. Glass jar	None	4°C
Polynuclear Aromatic Hydrocarbons (soil)	SW-846 Method 8310	14 days to extraction, 40 days from extraction to analysis	8 oz. Glass jar	None	4°C
Metals (water)	SW-846 Method 6010B or 6020, 7470A, (or 7000 series if appropriate)	6 months; 28 days for mercury	1 500-mL polyethylene bottle	pH< 2 with HNO_3	4°C
Total Extractable Petroleum Hydrocarbons (water)	Modified SW-846 Method 8015	7 days to extraction, 40 days from extraction to analysis	2 liter amber glass bottle	None	4°C
Pesticides (water)	SW-846 Method 8081A	7 days to extraction, 40 days from extraction to analysis	2 liter amber glass bottle	None	4°C
Polychlorinated Biphenyls (water)	SW-846 Method 8082	7 days to extraction, 40 days from extraction to analysis	2 liter amber glass bottle	None	4°C
Volatile Organic Compounds (water)	SW-846 Method 8260B	14 days	3 40-mL vials	pH<2 with HCl	4°C
Semivolatile Organic Compounds (water)	SW-846 Method 8270C	7 days to extraction, 40 days from extraction to analysis	2 liter amber glass bottle	None	4°C
Dioxins and Furans (water)	SW-846 Method 8290	7 days to extraction, 40 days from extraction to analysis	2 liter amber glass bottle	None	4°C
Polynuclear Aromatic Hydrocarbons (water)	SW-846 Method 8310	7 days to extraction, 40 days from extraction to analysis	2 liter amber glass bottle	None	4°C

°C	degrees Centigrade	oz.	ounce
mL	milliliter	<	less than
HCl	Hydrochloric acid	HNO_3	nitric acid

7.1.3.3 Sample Preservation

Table 7-3 lists analytical methodology requirements for sample size, preservation, and holding times.

7.1.3.4 Sample Packaging and Shipment

Each glass sample container will be wrapped in bubble wrap to reduce breakage. The inside of the cooler will be lined with a plastic garbage bag and the bottom of the cooler with bubble wrap to prevent breakage during shipment. High level samples shall be sealed in Ziploc® plastic bags. As samples are added to the ice chest, the sample containers will be interspersed with double-bagged ice or bubble wrap. The samples will be transported to the fixed laboratory by overnight courier service. Samples will be accompanied by custody paperwork (chain of custody, airbills) identifying the shipment container's contents and analyses needed for each sample. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time in the appropriate space on the custody paperwork. When shipping samples by overnight courier, the individual in possession of the samples relinquishes the samples by signing, dating, and noting the time and completing the Received By box with the courier name and airbill number. The original documents will be sealed in a plastic bag and taped to the lid of the ice chest.

7.1.3.5 Disposal of Contaminated Materials

Wastes suspected to be hazardous will be placed in 55-gallon drums for disposal by the McClellan AFB field team.

7.1.3.6 Equipment Decontamination

During soil excavation and treatment operations, field and sampling equipment that may contact samples will be decontaminated at the treatment area, or other location designated by the McClellan AFB field project manager (FPM), after each use. All decontamination liquids will be containerized and transferred to the McClellan AFB field team or designated McClellan AFB contractor for disposal. The contracting officer (CO) will be consulted two weeks prior to disposal to identify the appropriate discharge location, confirm characterization of the fluids, and notify the receiving plant of estimated quantities. The McClellan AFB field team or designated McClellan AFB contractor will then remove the containerized fluids from the site. If liquids are generated while decontaminating excavation or treatment equipment and contain solids, the solids will be allowed to settle, and the liquid will be pumped into separate containers, such as 55-gallon drums, and handled as previously described. The remaining solids will be placed in drums and handled with treatment soil. Solvents, acids, and ASTM Type II water used for decontamination will be stored and transported only in glass, stainless steel, or Teflon® containers.

7.1.3.7 Sample Documentation

All field activities will be adequately and consistently documented to support data interpretation and ensure defensibility of any data used for decision making. The field data will be collected and entered into logbooks kept by the sampler. All entries will be signed and dated. The following elements will be recorded in this logbook:

- Name(s) of field personnel.
- Site/sampling location identification.
- Date and time of sample collection or field activity.
- Field meter calibration.

- All field measurements such as excavation logs, photoionization detector (PID), organic vapor analyzer (OVA), or organic vapor monitor (OVM) reading, etc.
- Observations of weather or other conditions that could influence sample results.
- Any problems encountered and/or resolved.

A chain-of-custody form to be used to provide sample information will include the following:

- Name(s) of sampler
- Site/sampling location identification
- Date of sample collection
- Time of sample collection
- Sample number
- Sample matrix
- Analysis and method requested
- Number and type of containers
- Preservation
- Cooler identification

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking purposes in the laboratory. Samples will have pre-assigned, identifiable sample numbers. Sample labels will be completed using block-printed text and indelible ink (*e.g.*, Sharpie® pen). At a minimum, the sample labels will contain the following information:

- Sampler's initials
- Sample identification
- Analyses requested
- Date of collection
- Time of sample collection
- Preservative(s)

7.1.4 Quality Control (QC) Sampling

The following field QC samples apply to the samples collected for this project.

7.1.4.1 Duplicate Samples

During the system startup, system operation, and post-operation characterization phases, duplicate soil samples will be collected from each process phase at a frequency of ten percent, and submitted blind to the fixed laboratory for analysis. The duplicate sample results will be compared to the original sample results to assess overall precision. The PE sample associated with this project is described in Section 8.8.

7.1.4.2 Blank Samples

Equipment blanks will be collected and submitted to the laboratory for analysis in accordance with the McClellan AFB Basewide QAPP (Radian 1999b) to identify contamination from the sample collection procedures. One equipment blank will be collected for each feed stock, which would be considered to be the most contaminated sample per site. Trip blanks will be shipped and analyzed with each cooler containing aqueous samples for VOC analysis.

7.1.4.3 Laboratory QC Samples

The fixed laboratory will perform internal QC procedures as described in the QAPP (Radian 1999b). These include initial calibrations, continuing or daily calibration, laboratory control samples (LCS), system blanks, matrix spikes/matrix spike duplicates (MS/MSDs), surrogate spikes, and laboratory duplicates. These QC procedures are designed to quantify precision and accuracy and identify any problems or limitations in the associated sample results. The internal QC components of the sampling and analysis program will ensure that data of known quality are produced and documented, and that any problems are identified as soon as possible and corrected.

7.2 PROCESS CONTROL SAMPLING

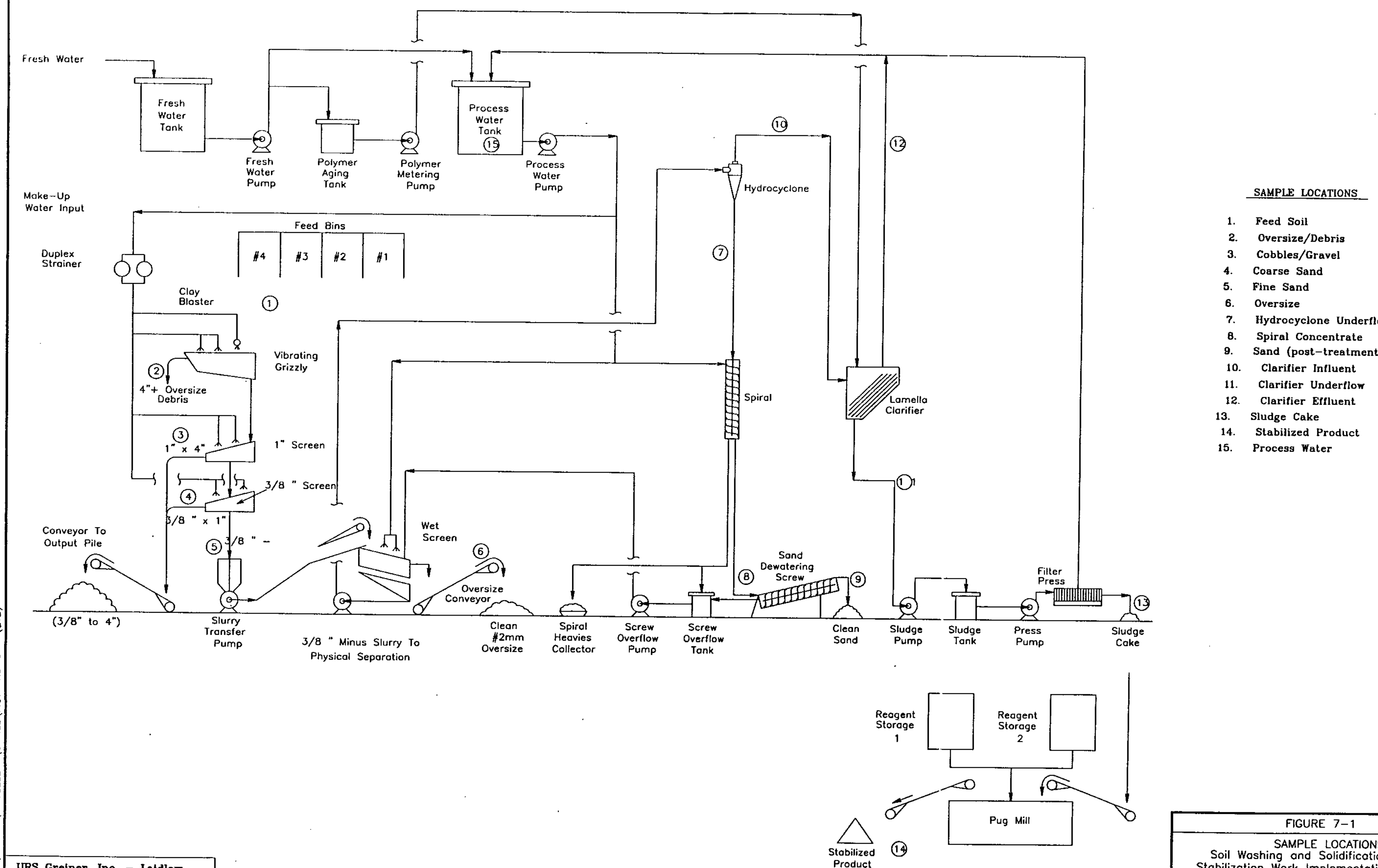
An estimated seven composite samples will be collected from each process stream identified in Table 7-2 once steady state is reached. The samples will be collected during operation and analyzed for the constituents identified in the preoperational samples. Samples will also be analyzed for field analyses if listed in Table 7-1.

7.2.1 Sampling Objective

The objective of sample collection during steady state operations is to confirm system performance and effectiveness and allow optimization, if necessary. Some of these streams (6 and 9) will require disposal 1AW Figure 2-3.

7.2.2 Rationale for Sample Locations, Numbers of Samples, and Analytical Parameters

The proposed sample locations are designated on Figure 7-1 and a summary of the locations and associated parameters for definitive data are presented in Tables 7-1 and 7-2. The pretreatment and post-treatment samples will be collected to determine both the efficiency of the process and to determine the final concentration for comparison to the RPRGs. Samples will be collected at intervals approximating residence time for each unit operation so that pre-and post-treatment samples represent the same soil. Each set of composite samples will be collected from approximately every 50 cubic yards. This frequency is based on the assumption of 350 cubic yards per site. The analyses for the pretreatment and post-treatment samples will be expedited to allow process parameter optimization, if necessary, and to closely gauge system performance. In addition, the post-treatment samples will be tested to determine materials classification. Intermediate samples will be collected to evaluate performance of individual portions of the system; for example, the clarifier influent and underflow will be collected to assess clarifier performance.



SAMPLE LOCATIONS

1. Feed Soil
2. Oversize/Debris
3. Cobbles/Gravel
4. Coarse Sand
5. Fine Sand
6. Oversize
7. Hydrocyclone Underflow
8. Spiral Concentrate
9. Sand (post-treatment)
10. Clarifier Influent
11. Clarifier Underflow
12. Clarifier Effluent
13. Sludge Cake
14. Stabilized Product
15. Process Water

S:\TAMARA\MCCLELLAN\CAFILE\FIG7-1.DWG (ETB)

URS Greiner, Inc. – Laidlaw

FIGURE 7-1
SAMPLE LOCATIONS
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

A total of 7 composite samples are considered adequate based upon the USEPA Decision Error Feasibility Trials (DEFT) software using information developed during the DQO process (see Section 8.0). All soil process control samples will be composited from a random grab sample from each of six equal portions of the waste pile or stream to provide a representative sample of soil during the various phases of operation. Each composite sample will be homogenized and ground to minimize the variability commonly exhibited in environmental soil samples and to increase the representativeness of the samples. Additional samples will be collected if the system is adjusted to optimize system performance.

The WET and TCLP analyses shall include only those compounds that are regulated compounds for determining waste characterization. Any changes to the WIP will be addressed as discussed in Subsection 1.4.

7.2.3 Field Methods and Procedures

The same field methods and procedures will be used to collect process samples as were described in Subsection 7.1.3.

7.2.4 Quality Control Sampling

Process QC sampling will be the same as preoperation QC sampling, as described in Subsection 7.1.4.

7.3 PRODUCT/RESIDUALS SAMPLING

The following waste streams will remain once the treatability study is complete: oversize/debris, cobbles/gravel, the coarse sand, oversize post treatment soil, the post treatment sand, sludge cake, process water, and stabilized product. The waste streams are considered products or residuals based upon their final disposition. The products can be used as fill or may be altered for reuse as construction-grade products. The residuals are those waste streams that require further treatment (such as solidification/ stabilization), reuse, or disposal. Residuals and products will be tested to determine their materials classification. The tests performed will be determined using the logic in Figure 2-3.

7.3.1 Sampling Objectives

Products to be "used in a manner constituting disposal" will undergo testing to ensure they meet the relevant LDRs for the contaminants of concern. They will also undergo physical testing prior to and during reuse product preparation to determine amenability to their intended use. Residuals will be analyzed to determine disposal options, including discharge of process waste waters.

7.3.2 Rationale for Sampling Locations, Numbers of Samples, and Analytical Parameters

The soil designated for product reuse is determined as described in Subsection 4.4.2. Three composites of each solid residual type are estimated. Once composite will be collected approximately every 50 cubic yards of residual collected. Process water samples will be collected each time a new site has began soil treatment and at the end of each site treatment. In addition, one sample of the final process water will be analyzed for each 4,000-gallon water trucks. It is assumed that approximately 25,000 gallons of process water will produced.

7.3.3 Field Methods and Procedures

The same field methods and procedures will be used to collect solid product samples as were described in Subsection 7.1.3. The aqueous residual samples will be sampled from a drainage port directly into sample containers. These samples will be discrete; *i.e.*, no compositing is required due to the homogeneity of aqueous samples.

7.3.4 Quality Control Sampling

Product QC sampling will be the same as preoperation QC sampling, as described in Subsection 7.1.4.

8.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

8.1 PROJECT OBJECTIVES

The overall project goal is to develop and assess a soil washing and solidification/stabilization remediation strategy that offers a substantial reduction in the life cycle cost of remediating non-VOCs in soil at the selected sites and other applicable sites at McClellan AFB. Data for performance and cost analysis will be collected. The technology performance will be assessed by comparison with the RPRGs for contaminants in soil at the selected demonstration sites. The life cycle costs of soil washing with solidification/stabilization will be compared to the costs of excavation and off-base disposal. Quality cost-related data for the excavation and off-base disposal option will be provided by EM.

To accomplish the overall project goal, individual project objectives have been established for each portion of this test. DQOs specify the type, quality, quantity, and uses of data required to reach the project goal. The primary and secondary objectives for the soil washing and solidification/stabilization remediation strategy are presented below.

Primary Objective 1 – Collect site-specific data to support *ex situ* soil washing and solidification/stabilization performance evaluation.

> To facilitate evaluating the treatment completeness and efficiency, soil samples will be collected and analyzed for site-specific non-VOCs using U.S EPA methods cited in the Basewide QAPP (methods listed in Section 8.2). Samples will be composited throughout the duration of the test for each site to obtain the most representative estimate for inlet and outlet contaminant concentrations. The results will be used to calculate the percent removal for the site-specific contaminants. The test and sampling strategy presented in Sections 5.0 and 7.0 will be used. The Basewide QAPP (Radian International, 1999c) contains procedures and quality control specifications for these measurements. Process parameters such as grain size distribution and soil moisture will be also be monitored or measured to provide data needed for the performance assessment.

Primary Objective 2 – Evaluate if the soil washing and solidification/stabilization process is economically feasible.

> This project goal will be accomplished by calculating and scaling costs for the pilot-scale treatment to full-scale operation, and comparing with the costs of excavation and disposal options. Process operating parameters will be monitored by field staff throughout the test. Utility consumption and other cost related factors discussed in Sections 4.0 and 5.0 will be measured and recorded in field logbooks. Costs for handling process residuals will be estimated from volumes of generated wastes and treatment residuals not meeting estimated clean up standards. The volumes of these wastes will be quantified (see other project goals) and unit costs assigned. Total system up time and other operations and maintenance performed during the demonstration will also be documented. Descriptive statistics will be calculated for the items directly measured in the field (*e.g.*, electrical usage, natural gas usage, etc.).

> Secondary Objective 1 - Determine the contaminant status and volumes of secondary treatment wastes (e.g., solidified solids) and oversized materials.

> The oversize materials that are screened out prior to treatment will be sampled to determine final disposition alternatives. Samples will be collected from the sludge cake and stabilized product to

evaluate system performance and for waste characterization purposes. The process water will be analyzed to determine process performance and to allow for characterization for waste disposal.

8.2 MEASUREMENTS

The following measurements will be made during the course of this project.

- Grain Size Distribution by ASTM Method D422
- Moisture Content by ASTM Method D2216
- Percent Solids by ASTM Method D2216
- Flocculation/Settling by American Public Health Association (APHA) Standard Methods 2540F and 2710C
- Lead, cadmium, and chromium by field XRF
- 3 PAHs by field GC
- Metals by USEPA Method 6010B or 6020 and 7000 series methods for arsenic, antimony, cadmium, lead, selenium, and thallium
- Mercury by USEPA Method 7470A/7471A
- TPH-extractable by USEPA Method 8015B
- Pesticides by USEPA Method 8081A
- PCBs by USEPA Method 8082
- VOCs by USEPA Method 8260B
- SVOCs by USEPA Method 8270C
- Dioxins by USEPA Method 8290
- PAHs by USEPA Method 8310
- TCLP by USEPA Method 1311
- WET by CCR, Title 22, Article 11, Section 66700

Method descriptions, analyte lists, QC limits, and quantitation limits are defined in the following sections.

8.3 KEY PERSONNEL

The project organization is described in Section 12. The project organization chart is presented as Figure 12-1.

8.4 QUALITY ASSURANCE OBJECTIVES AND DATA QUALITY OBJECTIVES

DQOs and quality assurance objectives (QAOs) are related data quality planning and evaluation tools for all sampling and analysis activities. A consistent and comprehensive approach for developing and using these tools is necessary to ensure that enough data are produced and are of sufficient quality to make decisions.

DQOs are developed during the planning stage of the project to determine the data type, quality, and quantity necessary to make decisions, and achieve the project objectives stated in Subsection 4.3. QAOs are the detailed QC specifications for precision, accuracy, representativeness, comparability, and completeness (PARCC). The aim is to provide quality data that can be used to meet the project objectives. The QAOs are presented in this section.

8.4.1 Data Quality Objectives

The purpose of the seven-step DQO process is to plan and appropriately design the data collection process. The seven steps of the DQO process for the soil washing and solidification/ stabilization study follow.

Step 1: State the Problem. Evaluate the cost and performance of the Soil Washing and Solidification/ Stabilization study at McClellan AFB. Specifically the study objectives are to:

- Demonstrate the ability of a soil washing operation, in conjunction with stabilization/solidification to treat selected McClellan AFB soils contaminated with SVOCs and/or metals.
- Demonstrate real-world operating characteristics.
- Quantify the cost and performance data under McClellan AFB field conditions comparing the capital and operating costs to those of conventional treatment technologies.
- Generate a scientifically defensible data set to assess the performance and cost of the technology.

Step 2: Identify the Decision. Decide whether or not the soil washing operation, in conjunction with solidification/ stabilization can cost-effectively remove SVOCs and/or metals from McClellan AFB soils to concentrations not considered hazardous to human health. The results of the demonstration, if successful, may be used to incorporate soil washing/stabilization/solidification into McClellan AFB's overall site clean-up strategy.

A second decision will be made regarding the ultimate disposition of all waste streams remaining after the treatability study is complete.

Step 3: Identify the Inputs to the Decision. The data required include the mass of contaminants removed during the treatability study, physical parameters of the soil being treated, and direct and labor costs. The measurements that will be taken include:

- Measurement of pertinent soil conditions, including particle size distribution.
- Measurement of the concentration of constituents of concern, to calculate the mass of contaminants removed and potential for reuse or recycling.
- Operational data (including cost) to document operation and maintenance (O&M) activities specific to this technology.
- Measurement of concentration of constituents of concern in a TCLP and WET leachate to characterize the waste streams for disposal.

Step 4: Define the Boundaries of the Study. The data will only be applicable to the specific site soils used for the study, although the information may be extrapolated to other similar soils at McClellan AFB. It is assumed that the sampling data represent both the current and future SVOC and metal contaminated soils. The data will be collected over a twelve-week period as shown on the project schedule, Section 12.0. The area to be treated will be the selected excavation areas identified in Section 2.0. The decisions reached by the study will guide the usage of this technology at McClellan AFB sites with similar soil conditions.

Step 5: Develop a Decision Rule. If individual sample analyte concentrations in post-treatment soils are consistently below RPRGs and the overall costs are less than excavation and off-site disposal, this technology will be considered for incorporation into McClellan AFB's overall non-VOC site clean-up strategy. This decision rule will be used at each site type. If individual sample analyte concentrations in post treatment soils are consistently above RPRGs or the overall costs are 25 percent less than excavation and off-site disposal, life-cycle costs (or better than 25 percent), no further studies will be conducted for this technology. The decision rules for the disposition of residuals or products is presented in Figure 2-3. Figure 2-3 shows inert classification; sample results will be compared to background concentrations and detections. This is not considered a primary decision rule.

Step 6: Specify Tolerable Limits on Decision Errors. The null hypothesis is that the soil washing process will cost-effectively decrease SVOC and metals concentrations in soil to levels considered non-hazardous to human health.

False positive error (or Type I Error) for this study is to find the process ineffective in terms of cost or removal efficiency when, in truth, the process is acceptable. Analytical results would be biased high or the cost incorrectly considered prohibitive. This decision error results in expended funds for this treatability study and other treatability study(ies) to determine a process that will adequately clean up the contaminated soil. The acceptable false positive error is 5 percent.

False Negative Error (or Type II Error) for this study is to conclude that the process is acceptable when it cannot clean up SVOCs or metals to below hazardous levels at a reasonable cost. Analytical results would be biased low or the cost is considered acceptable (when it is prohibitive). This decision error results in potential implementation of a large-scale operation which is unsuccessful, *i.e.*, the soil is still considered hazardous to human health and must be retreated or disposed in a hazardous landfill. The additional cost is considered large. The acceptable false negative error is 10 percent. Above twice the RPRG, the acceptable false negative error is 2 percent.

The gray region would extend from the half the action level (RPRGs, background extractions, or detections) to the action level for each compound. In general, the 20 percent error is considered reasonable compared to typical organic analytical method error, but may not be achievable for all contaminants. The gray region for cost comparison is from 20 to 25 percent lower overall cost than excavation and off-site disposal.

Step 7: Optimize the Design for Obtaining Data. Three primary decisions for adequate data collection were identified.

- One critical aspect of the sampling design is to provide the minimum adequate number of samples to adequately represent the characteristics of each waste stream. Systematic composite sampling is considered the most appropriate sampling design to assess the soil washing process. Seven composite samples are considered adequate based upon the output from DEFT for benzo(a)anthracene, lead, and 1,4-dichlorobenzene using the information developed in Step 6 above. The variability values were estimated based upon the mean concentrations documented in the remedial investigation characterization summaries (RICS) for each site and the accepted relative percent difference (RPD)/relative standard deviation (RSD) of 50 for solid samples (*e.g.*, 50 = mean concentration/standard deviation x 100). Total recommended samples varied from 6 to 7 because of the large differences in the RPRG concentrations for these three constituents. The number of grab samples entered into DEFT to make the composite was 6.

- All analytical data performed by the fixed laboratory is considered critical. All analyses must provide detection limits for COCs below half of their respective RPRGs. The quantitation limits and QAOs stated in the McClellan AFB Basewide QAPP are generally considered sufficient and achievable for the majority of the constituents of interest (some PAH quantitation limits may be slightly higher than required). Treated soil concentrations close to the RPRGs will be assessed more stringently in determining bias (*i.e.*, QC criteria may be met, but data near the RPRGs may still be qualified as estimated). Also, all quantitation limits for leachates (both WET and TCLP) are below the respective regulatory levels.

- Operational data will be collected on a daily basis or, at a minimum, whenever changes to the system are performed. The documented information is described in Subsection 4.5, and includes chemical and utility usage rates and costs these are considered non-critical data.

8.4.2 Quantitative QA Objectives

The quantitative QAOs are precision, accuracy, completeness, and method quantitation limits. The precision and accuracy objectives and quantitation limits for all constituents tested in the soil washing and solidification/ stabilization study are listed in the Basewide QAPP (Radian 1999b).

Precision is a measure of variability between duplicate analyses and is calculated for field and laboratory duplicates. Precision is evaluated by comparing the RPD of MS/MSDs and field duplicate samples with the RPD objectives stated in Section 4.0 of the Basewide QAPP (Radian 1999b).

Accuracy is associated with correctness and is a comparison between a measured value and a known or expected value. Accuracy is assessed by comparing LCS, MS, surrogate spike, and performance evaluation sample recoveries with the project objectives presented in Section 4.0 of the Basewide QAPP (Radian 1999b).

Completeness is calculated for each method and matrix after the QC data have been evaluated and data qualifiers assigned. Completeness for the data set is defined as the percentage of unqualified and estimated results and represents the results usable for data interpretation and decision making. Results qualified as rejected or unusable, or that were not reported because of sample loss, breakage, or analytical error, negatively influence completeness and are subtracted from the total number of results to calculate completeness. Completeness is calculated by subtracting the number of rejected and unreported results from the total and dividing by the total number of results. The estimated results do not count against completeness because they are usable as long as any limitations are identified. The completeness objective for this project is 95 percent.

The quantitation limits, taken from the McClellan AFB Basewide QAPP for each chemical analytical method, are listed in Tables 8-1 through 8-8, which follow Subsection 8.5.2. The tables list all analytes for these methods; however, only those constituents italicized have been identified as constituents of concern for any of the potential sites for this study (see Table 2-1). Any analytes with quantitation limits greater than their respective RPRGs are in bold. The majority of analytes with quantitation limits greater than the RPRGs are those for PAHs by Method 8270C. Method 8310 will be used to analyze for those constituents.

8.4.3 Qualitative QAOs

Comparability and representativeness are considered qualitative QAOs. Objectives for representativeness are defined for each sampling and analysis task and are a function of the project objectives. Representativeness for the treatability study is achieved with the collection of a sufficient quantity of homogenized, pulverized composite samples. Representativeness is also achieved through the use of standard sampling and analytical methods.

Comparability is the confidence with which one data set can be compared to another. The precision and accuracy objectives, quantitation limits, field procedures, and guidelines presented in this document have been established to attain the greatest possible degree of comparability. Comparability is achieved by meeting the precision and accuracy specifications and using standard methods for sampling and analysis, reporting data in standard units, and using standard reporting formats.

8.5 ANALYTICAL PROCEDURES AND CALIBRATION

This section briefly describes analytical methods and calibration procedures for the water and soil samples. Analogous water and soil methods are described together, and quantitation limits (QLs) are tabulated for each method in Tables 8-1 through 8-8, where applicable.

8.5.1 Analytical Procedures

Most of the methods included in this QAPP are published in the USEPA *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846*, Third Edition, revised November 1986, Update II, September 1994, Update IIB, January 1995, and Update III, January 1997. Updates II, IIB, and III contain the current and promulgated SW-846 methods. Other methods referenced in this section are found in Title 22, Article 11 of the CCR, *Criteria for Identification of Hazardous and Extremely Hazardous Waste,* ASTM Test Methods, and *Standard Methods for the Examination of Water and Wastewater,* APHA, American Water Works Association, Water Environment Federation, 19^{th} Edition, 1995.

Field Test Methods

X-Ray Fluorescence Field Screening

A Spectrace 8000 bench top XRF may be used for screening soil samples produced before and during the process for lead, cadmium, and chromium – three constituents of concern at the proposed sites. Samples will be ground and homogenized prior to analysis. If soil moisture is greater than approximately 20 percent, the XRF will not be used for screening. Matrix-specific one-point calibration standards will be used to determine the instrument response. Feed samples will be split and one split analyzed by a fixed laboratory for definitive analysis. This concentration will be considered the known value and the other split used as the calibration standard. The instrument will be calibrated for each of the sites. Duplicates will be analyzed at a frequency of at least 10 percent. The reporting limit will be approximately 10 milligrams per kilogram (mg/kg).

Gas Chromatography Field Screening

The soil may be screened for three PAH indicator compounds to optimize and assess system performance on a real-time basis. PAHs will be solvent extracted from soil samples at the field laboratory using a soxhlet extraction procedure similar to Method 3540C. PAHs in the extracts will be separated with a GC and detected by a flame ionization detector. The retention times and responses will be compared to a one-point standard of the three compounds. Duplicates will be analyzed at a frequency of at least 10 percent. The reporting limit will be approximately 1 mg/kg. GC field screening may only be used for sites where PAH concentrations are greater than the detection limit.

ASTM Method D422, Grain Size Distribution

This method determines the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 microns (µm) is determined by sieving, while the distribution of particle sizes smaller than 75 µm is determined by a sedimentation process, using a hydrometer.

Table 8-1

QUANTITATION LIMITS AND REGULATORY LIMITS FOR METALS ANALYZED BY METHOD SW6010B, SW6020 OR 7000 SERIES (TOTAL METALS)

Analyte (By Analytical Method)	Quantitation Limits [1]		Comparison Concentrations			
	Soil (mg/kg)	Water and Extracts (mg/L)	RPRGs (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
Aluminum	20	0.05	75,000	--	--	--
Antimony (7041)	10	0.1	30	500	15	--
Arsenic (7060A)	0.03	0.005	0.38	500	5.0	5.0
Barium	1	0.01	5,200	10,000	100	100
Beryllium	1	0.004	150	75	0.75	--
Cadmium	0.1	0.005	37 (9)	100	1.0	1.0
Chromium (7131A)	2	0.01	210	2,500	5	5.0
Cobalt	3	0.05	3,300	8,000	80	--
Copper	2	0.03	2,800	2,500	25	--
Lead (7421)	10	0.05	400 (130)	1,000	5.0	5.0
Manganese	2	0.02	3,100	--	--	--
Mercury (7470/7471)	0.5	0.0002	22	20	0.2	0.2
Molybdenum	5	0.05	370	3,500	350	--
Nickel	4	0.05	1,500 (150)	2,000	20	--
Selenium (7740)	0.5	0.005	370	100	1.0	1.0
Silver	2	0.01	370	500	5	5.0
Thallium (7481)	0.5	0.002	5.2, 6.0, 6.7 [2]	700	7.0	--
Vanadium	2	0.02	520	2,400	24	--
Zinc	2	0.02	22,000	5,000	200	--

Italicized compounds have been identified as constituents of concern present at the six top candidate sites (Table 7-2) identified for this soil washing and solidification/ stabilization study

1 Quantitation limits are from the McClellan AFB Basewide QAPP (Radian 1999b).
( ) Values are California-modified PRGs
2 PRGs vary based on the thallium compound; method measures total thallium

RPRG Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
mg/L milligrams per liter
mg/kg milligrams per kilogram
STLC Soluble Threshold Limit Concentration
TCLP Toxic Characteristic Leaching Procedure
TTLC Total Threshold Limit Concentration
WET Waste Extraction Test
-- Not applicable

Table 8-2

QUANTITATION LIMITS AND REGULATORY LIMITS FOR TOTAL EXTRACTABLE PETROLEUM HYDROCARBONS (TPH-E) BY SW-846 METHOD 8015B

Analyte	Quantitation Limits [1]		Comparison Concentrations	
	Soil (mg/kg)	Water and Extracts (mg/L)	RPRGs (mg/kg)	UST Criteria (mg/kg)
Extractable TPH [2]	10	500	-	100 [3]

Italicized compounds have been identified as constituents of concern present at the six top candidate sites (Table 7-2) identified for this soil washing and solidification/ stabilization study

1 Quantitation limit is from the McClellan AFB Basewide QAPP (June 1999).
2 Extractable TPH components used for calibration are diesel and oils up to C_{24}. Representative peak patterns are noted on the analytical report. A range of TPH concentrations is usually reported; the quantitation limit represents the lowest concentration in that range.
3 From Tri-Regional Guidelines, considered protective of groundwater.

RPRG	Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
mg/L	Milligrams per liter
mg/kg	Milligrams per kilogram
-	Not applicable
UST	Underground storage tank

Table 8-3

QUANTITATION LIMITS AND REGULATORY LIMITS FOR ORGANOCHLORINE PESTICIDES BY SW-846 METHOD 8081A

Analyte	Quantitation Limits [1]		Comparison Concentrations			
	Soil (mg/kg)	Water and Extracts (µg/L)	RPRGs (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
alpha-BHC	0.0017	0.05	0.086	-	-	-
gamma-BHC (Lindane)	0.002	0.05	0.42	4	0.4	0.4
beta-BHC	0.005	0.05	0.3	-	-	-
Heptachlor	0.002	0.05	0.099	4.7	0.47	0.008
Delta-BHC	0.0017	0.05	NE	-	-	--
Aldrin	0.0017	0.05	0.026	1.4	0.14	-
Heptachlor epoxide	0.002	0.05	0.049	-	-	-
Endosulfan I	0.003	0.05	330 [2]	-	-	-
4,4'- DDT	0.0034	0.1	1.7	1	0.1	-
Dieldrin	0.0034	0.05	0.028	8	0.8	-
Endrin	0.0033	0.1	16	0.2	0.02	0.02
4,4'-DDD	0.005	0.1	2.4	1	0.1	-
Endosulfan II	0.0033	0.1	330 [2]	-	-	-
4,4'-DDE	0.0034	0.1	1.7	1	0.1	-
Endrin aldehyde	0.0034	0.1	NE	-	-	-
Endosulfan sulfate	0.005	0.1	NE	-	-	-
Methoxychlor	0.017	0.5	270	100	10	10
Chlordane	0.033	0.10	1.6	2.5	0.25	0.03
Toxaphene	0.17	5	0.4	5	0.5	0.5

Italicized compounds have been identified as constituents of concern present at the six top candidate sites (Table 7-2) identified for this soil washing and solidification/ stabilization study

1 Quantitation limits are from the McClellan AFB Basewide QAPP (June 1999).

2 Endosulfan I and II PRGs not distinguished.

RPRG	Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
mg/L	milligrams per liter
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
STLC	Soluble Threshold Limit Concentration
TCLP	Toxic Characteristic Leaching Procedure
TTLC	Total Threshold Limit Concentration
WET	Waste Extraction Test
-	Not applicable
NE	Not established

Table 8-4

QUANTITATION LIMITS AND REGULATORY LIMITS FOR POLYCHLORINATED BIPHENYLS (PCBs) BY SW-846 METHOD 8082

Analytes	Quantitation Limits [1]		Comparison Concentrations		
	Soil (mg/kg)	Water (µg/L)	RPRGs (mg/kg)	TTLC (mg/kg) Total	WET-STLC (mg/L) Total
PCB-1016	0.034	1	0.2	50	5
PCB-1221	0.034	2			
PCB-1232	0.034	1			
PCB-1242	0.034	1			
PCB-1248	0.034	1			
PCB-1254	0.034	1			
PCB-1260	0.034	1			

Italicized compounds have been identified as constituents of concern present at the six top candidate sites (Table 7-2) identified for this soil washing and solidification/ stabilization study

1 Quantitation Limits are from the McClellan AFB Basewide QAPP (Radian 1999b).

RPRG Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
mg/L milligrams per liter
mg/kg milligrams per kilogram
STLC Soluble Threshold Limit Concentration
TCLP Toxic Characteristic Leaching Procedure
TTLC Total Threshold Limit Concentration
µg/L Microgram per liter
WET Waste Extraction Test

Table 8-5

QUANTITATION LIMITS AND REGULATORY LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOCs) BY SW-846 METHOD 8260B

Analytes	Quantitation Limits [1]		Comparison Concentrations			
	Soil (mg/kg)	Water and Extracts (µg/L)	RPRGs (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
Acetone	5.0	100	1,400	--	--	--
Benzene	0.01	5	0.62	--	--	0.5
Bromobenzene	0.01	5	28	--	--	--
Bromochloromethane	0.01	5	NE	--	--	--
Bromodichloromethane	0.01	5	0.98	--	--	--
Bromoform	0.01	5	56	--	--	--
Bromomethane	0.01	5	3.8	--	--	--
n-Butylbenzene	0.01	5	130	--	--	--
sec-Butylbenzene	0.01	5	100	--	--	--
tert-Butylbenzene	0.01	5	120	--	--	--
Carbon tetrachloride	0.01	5	0.23	--	--	0.5
Chlorobenzene	0.01	5	54	--	--	100
Chloroethane	0.01	10	NE	--	--	--
Chloroform	0.01	5	0.24	--	--	6
Chloromethane	0.01	10	1.2	--	--	--
2-Chlorotoluene	0.01	5	150	--	--	--
4-Chlorotoluene	0.01	5	NE	--	--	--
Dibromochloromethane	0.01	5	5.3	--	--	--
1,2-Dibromo-3-chloropropane	0.01	20	0.06	--	--	--
Dibromomethane	0.01	5	550	--	--	--
1,2-Dibromoethane	**0.01**	**5**	**0.0049**	--	--	--
1,2-Dichlorobenzene	0.01	5	370	--	--	--
1,3-Dichlorobenzene	0.01	5	41	--	--	--
1,4-Dichlorobenzene	0.01	5	3.0	--	--	--
Dichlorodifluoromethane	0.01	5	94	--	--	--
1,1-Dichloroethane	0.01	5	570	--	--	0.5
1,2-Dichloroethane	0.01	5	0.34	--	--	--
1,1-Dichloroethene	0.01	5	0.052	--	--	0.7
cis-1,2-Dichloroethene	0.01	5	45	--	--	--
trans-1,2-Dichloroethene	0.01	5	62	--	--	--
1,2-Dichloropropane	0.01	5	0.34	--	--	--
1,3-Dichloropropane	0.01	5	NE	--	--	--
2,2-Dichloropropane	0.01	5	NE	--	--	--
1,1-Dichloropropene	0.01	5	NE	--	--	--
cis-1,3-Dichloropropene	0.01	5	0.081[2]	--	--	--
trans-1,3-Dichloropropene	0.01	5	0.081[2]	--	--	--
Ethylbenzene	0.01	5	230	--	--	--
Hexachlorobutadiene	0.01	5	5.7	--	--	--
2-Hexanone	0.01	5	NE	--	--	--
Isopropylbenzene	0.01	5	NE	--	--	--
p-Isopropyltoluene	0.01	10	NE	--	--	--
Methylene chloride	0.01	5	8.5	--	--	--
Naphthalene	0.01	10	55	--	--	--
n-Propylbenzene	0.01	10	130	--	--	--
Styrene	0.01	5	1700	--	--	--
Tetrachloroethene	0.01	5	4.7	--	--	0.7
1,1,1,2-Tetrachloroethane	0.01	5	2.8	--	--	--

Table 8-5 (Cont'd)

QUANTITATION LIMITS AND REGULATORY LIMITS FOR VOLATILE ORGANIC COMPOUNDS (VOCs) BY SW-846 METHODS 8260B

Analyte	Quantitation Limits[1]		Comparison Concentrations			
	Soil (mg/kg)	Water and Extracts (μg/L)	RPRGs (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
1,1,2,2-Tetrachloroethane	0.01	5	0.36	--	--	--
Toluene	0.01	5	520	--	--	--
1,2,3-Trichlorobenzene	0.01	5	NE	--	--	--
1,2,4-Trichlorobenzene	0.01	5	480	--	--	--
1,1,1-Trichloroethane	0.01	5	680	--	--	--
1,1,2-Trichloroethane	0.01	5	0.82	--	--	--
Trichloroethene	0.01	5	2.7	2040	204	0.5
Trichlorofluoromethane	0.01	10	380	--	--	--
1,1,2-Trichloro-1,2,2 trifluoroethane	0.10	20	5600	--	--	--
1,2,3-Trichloropropane	0.01	5	**0.0014**	--	--	--
1,2,4-Trimethylbenzene	0.01	10	51	--	--	--
1,3,5-Trimethylbenzene	0.01	10	21	--	--	--
Vinyl chloride	0.01	10	0.021	--	--	0.2
p-Xylene	0.01	10	370	--	--	--
m- Xylene	0.01	10	210	--	--	--
o- Xylene	0.01	10	280	--	--	--

1 Quantitation limits are from the McClellan AFB Basewide QAPP (Radian 1999b).
2 No distinction made between cis- and trans-1,3-Dichloropropene

Bolded compounds do not meet all comparison criteria; however, these compounds are not constituents of concern for the soil washing and solidification/ stabilization project.

RPRG	Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
mg/L	Milligrams per liter
mg/kg	Milligrams per kilogram
STLC	Soluble Threshold Limit Concentration
TCLP	Toxic Characteristic Leaching Procedure
TTLC	Total Threshold Limit Concentration
μg/L	Microgram per liter
WET	Waste Extraction Test
--	Not applicable
NE	Not established

Table 8-6

QUANTITATION LIMITS AND REGULATORY LIMITS FOR SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs) BY SW-846 METHOD 8270C

Analytes	Quantitation Limits [1]		Comparison Concentrations			
	Soil [2] (mg/kg)	Water and Extracts (μg/L)	RPRGs (mg/kg)	TTLC (mg/kg)	WET-STLC (mg/L)	TCLP (mg/L)
Base/Neutral Extractables						
Acenaphthene	1	15	2,600	--	--	--
Acenaphthylene	1	15	-	--	--	--
Anthracene	0.33	10	14,000	--	--	--
Benzo(a)anthracene	0.33	10	0.56	--	--	--
Benzo(b)fluoranthene	0.33	10	0.56	--	--	--
Benzo(k)fluoranthene [3]	**1**	10	5.6 (0.61)	--	--	--
Benzo(g,h,i)perylene	1	15	-	--	--	--
Benzo(a)pyrene [3]	**0.33**	10	0.056	--	--	--
Benzyl alcohol	1	20	16,000	--	--	--
bis(2-Chloroethoxy)methane	1	10	-	--	--	--
bis(2-Chloroethyl)ether	**0.33**	10	0.18	--	--	--
bis(2-Chloroisopropyl)ether	0.33	10	2.5	--	--	--
bis(2-Ethylhexyl)phthalate	1	10	32	--	--	--
4-Bromophenyl phenyl ether	1	10	-	--	--	--
Butyl benzyl phthalate	1	10	-	--	--	--
4-Chloroaniline	1	20	220	--	--	--
2-Chloronaphthalene	1	15	3,700	--	--	--
4-Chlorophenyl phenyl ether	1	15	-	--	--	--
Chrysene	0.33	10	56 (6.1)	--	--	--
Dibenz(a,h)anthracene [3]	**0.33**	10	0.056	--	--	--
Dibenzofuran	1	15	210	--	--	--
Di-n-butylphthalate	1	15	5,500	--	--	--
1,2-Dichlorobenzene	1	15	370	--	--	--
1,3-Dichlorobenzene	1	15	41	--	--	--
1,4-Dichlorobenzene	0.33	10	3.0	--	--	7.5
3,3'-Dichlorobenzidine	0.33	20	0.99	--	--	--
Diethyl phthalate	1	15	44,000	--	--	--
Dimethyl phthalate	1	15	100,000	--	--	--
2,4-Dinitrotoluene	1	15	110	--	--	0.13
2,6-Dinitrotoluene	1	15	55	--	--	--
Di-n-octylphthalate	1	15	1,100	--	--	--
Fluoranthene	1	15	2,000	--	--	--
Fluorene	1	15	18,000	--	--	--
Hexachlorobenzene	**0.33**	10	0.28	--	--	0.13
Hexachlorobutadiene	1	10	5.7	--	--	0.5
Hexachlorocyclopentadiene	1	15	380	--	--	--
Hexachloroethane	1	10	32	--	--	3.0
Indeno(1,2,3-cd)pyrene	0.33	10	0.56	--	--	--
Isophorone	1	15	470	--	--	--
Naphthalene	1	15	56	-	-	55
2-Methylnaphthalene	1	15	-	--	--	--
2-Nitroaniline	0.33	50	3.3	--	--	--
3-Nitroaniline	1	50	-	--	--	--
4-Nitroaniline	1	50	-	--	--	--
Nitrobenzene	1	10	16	--	--	2.0
n-Nitrosodiphenylamine	1	10	91	--	--	--
n-Nitrosodipropylamine	**0.33**	10	0.063	--	--	--
Phenanthrene	1	15	-	--	--	--
Pyrene	1	15	15,000	--	--	--

Table 8-6 (Cont'd)

QUANTITATION LIMITS AND REGULATORY LIMITS FOR SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs) BY SW-846 METHOD 8270C

Analytes	**Quantitation Limits [1]**		**Comparison Concentrations**			
	Soil [2] (mg/kg)	**Water and Extracts (µg/L)**	**RPRGs (mg/kg)**	**TTLC (mg/kg)**	**WET-STLC (mg/L)**	**TCLP (mg/L)**
Acid Extractables						
Benzoic acid	3	75	150,000	--	--	--
4-Chloro-3-methylphenol	1	30	-	--	--	--
2-Chlorophenol	1	15	59	--	--	--
2,4-Dichlorophenol	1	15	160	--	--	--
2,4-Dimethylphenol	1	25	1,100	--	--	--
4,6-Dinitro-2-methylphenol	1	50	-	--	--	--
2,4-Dinitrophenol	1	50	110	--	--	--
2-Methylphenol	1	25	2,700	--	--	--
4-Methylphenol	1	15	270	--	--	--
2-Nitrophenol	1	15	-	--	--	--
4-Nitrophenol	1	15	3,400	--	--	--
Pentachlorophenol	1	50	2.5	17	1.7	100
Phenol	1	15	33,000	--	--	--
2,4,5-Trichlorophenol	1	50	5,500	--	--	400
2,4,6-Trichlorophenol	1	10	40	--	--	2.0

Italicized compounds have been identified as constituents of concern present at the six top candidate sites (Table 7-2) identified for this soil washing and solidification/ stabilization study

1 Quantitation limits are from the McClellan AFB Basewide QAPP (Radian 1999b).
2 Gel permeation chromatograph (GPC) cleanup of samples, if necessary, raises detection limits twofold.
3 The presence of these compounds in historical or preoperation data will necessitate the use of Method 8310, which provides lower quantitation limits.

Bolded compound quantitation limits do not meet all comparison criteria.

()	California – modified RPRG
RPRG	Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
mg/L	Milligrams per liter
mg/kg	Milligrams per kilogram
µg/L	Micrograms per liter
STLC	Soluble Threshold Limit Concentration
TCLP	Toxic Characteristic Leaching Procedure
TTLC	Total Threshold Limit Concentration
µg/L	Microgram per liter
WET	Waste Extraction Test
--	Not applicable

Table 8-7

QUANTITATION LIMITS AND REGULATORY LIMITS FOR DIOXINS AND FURANS BY SW-846 METHOD 8290

Analytes	Quantitation Limits [1,2]		Comparison Concentrations		
	Soil (μg/kg)	Water and Extracts (ng/L)	RPRGs (μg/kg)	TTLC (μg/kg)	WET-STLC (ng/L)
Dioxins					
2,3,7,8-TCDD	0.001 [3]	0.01 [3]	3.8	10	1000
1,2,3,7,8-PeCDD	0.005 [3]	0.05 [3]	--	--	--
1,2,3,4,7,8-HxCDD	0.005 [3]	0.05 [3]	--	--	--
1,2,3,6,7,8-HxCDD	0.005 [3]	0.05 [3]	--	--	--
1,2,3,7,8,9-HxCDD	0.005 [3]	0.05 [3]	--	--	--
1,2,3,4,6,7,8-HpCDD	0.005 [3]	0.05 [3]	--	--	--
OCDD	0.01 [3]	0.1 [3]	--	--	--
Furans					
2,3,7,8-TCDF	0.001	0.1	--	--	--
1,2,3,7,8-PeCDF	0.005	0.5	--	--	--
1,2,3,4,7,8-PeCDF	0.005	0.5	--	--	--
1,2,3,4,7,8-HxCDF	0.005	0.5	--	--	--
1,2,3,6,7,8-HxCDF	0.005	0.5	--	--	--
2,3,4,6,7,8-HxCDF	0.005	0.5	--	--	--
1,2,3,7,8,9-HxCDF	0.005	0.5	--	--	--
1,2,3,4,6,7,8-HpCDF	0.005	0.5	--	--	--
1,2,3,4,7,8,9-HpCDF	0.005	0.5	--	--	--
OCDF	0.01	1.0	--	--	--

Italicized compounds have been identified as constituents of concern present at the six top candidate sites (Table 7-2) identified for this soil washing and solidification/ stabilization study. In this case "dioxins" were reported without distinguishing the congener.

1 Quantitation Limits are from the McClellan AFB Basewide QAPP (Radian 1999b).
2 Assuming 100 percent internal standard recovery
3 The sensitivity of the method is dependent on the level of interference in the matrix

RPRG	Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
ng/L	nanogram per liter
ng/g	nanogram per gram
STLC	Soluble Threshold Limit Concentration
TCLP	Toxic Characteristic Leaching Procedure
TTLC	Total Threshold Limit Concentration
TCDD	2,3,7,8-Tetrachlorodibenzo-*p*-dioxin
TCDF	2,3,7,8-Tetrachlorodibenzofuran
HpCDD	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin
HxCDF	1,2,3,7,8-Pentachlorodibenzofuran
OCDD	1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin
OCDF	1,2,3,4,5,6,7,8-Octachlorodibenzofuran
HpCDF	1,2,3,4,6,7,8-Heptachlorodibenzofuran
HxCDD	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin
PeCDD	1,2,3,7,8-Pentachlorodibenzo-p-dioxin
--	not applicable

Table 8-8

QUANTITATION LIMITS AND REGULATORY LIMITS FOR POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs) BY SW-846 METHOD 8310

Analyte	Quantitation Limits		Comparison Criteria
	(Soil (mg/kg)	Water (µg/L)	RPRGs (mg/kg)
Acenaphthene	0.4	2.5	2,600
Acenaphthylene	0.4	5	-
Anthracene	0.14	0.7	14,000
Benzo(a)anthracene	0.016	0.15	0.56
Benzo(a)pyrene	0.01	0.10	0.056
Benzo(b)fluoranthene	0.004	0.5	0.56
Benzo(g,h,i)perylene	0.04	0.5	-
Benzo(k)fluoranthene	0.004	0.25	5.6 (0.61)
Chrysene	0.067	2	56 (6.1)
Dibenzo(a,h)anthracene	0.04	0.20	0.056
Fluoranthene	0.04	0.5	2,000
Fluorene	0.04	1	1,800
Indeno(1,2,3-cd)pyrene	0.04	0.4	0.56
Naphthalene	0.04	2.5	56
Phenanthrene	0.12	1	-
Pyrene	0.067	2	1,500

Italicized compounds have been identified as constituents of concern present at the six top candidate sites (Table 7-2) identified for this soil washing and solidification/ stabilization study

1	Quantitation Limits are from the McClellan AFB Basewide QAPP (Radian 1999b).
( )	Values are California-modified PRGs
mg/kg	milligrams per kilogram
µg/L	microgram per liter
RPRG	Preliminary Remediation Goal, Residential Scenario (EPA Region IX)
--	not applicable

ASTM D2216, Moisture Content and Percent Solids

This method measures the water content of soil, rock, and soil-aggregate mixture by weight. The known weight of soil is dried to a constant mass in drying oven at 110 degrees Centigrade (°C). The dried soil is reweighed. The moisture content is the difference of the two weights divided by the dried weight of soil expressed as a percentage. Percent solids are calculated by dividing the dried weight by the initial weight expressed as a percentage.

Standard Method 2540F, Flocculation

A known volume of sample is transferred to an Imhoff cone. The sample is allowed to settle. The volume of solids which settled is measured directly in the calibrated Imhoff cone.

Standard Methods 2710C, Settling

A known volume of sample is transferred to a settling column. While stirring, determine the volume occupied by the suspension and by the settled sludge at measured time intervals. The volume is measured directly in the graduated settling vessel.

Sample Preparation Procedures

WET

The WET, described in the CCR, Title 22, Article 11, Section 66700, is used to determine the amount of extractable analyte in waste material. The sample is separated into liquid and solid phases. The solid phase is mixed with a buffer solution and agitated for 48 hours. The resulting WET leachate is mixed with any liquid phase of the original sample and both are analyzed for the parameters of interest. Sample results are compared to STLC limits to determine if the sample is considered hazardous under California waste disposal regulations. The WET may also be modified to use deionized water in place of the buffer solution to determine materials classification.

Method 1311, TCLP

Method 1311 is designed to determine the mobility of organic (semivolatile and volatile) and inorganic (metals and chromium VI) constituents extractable from liquid, solid, and multiphase wastes. An aliquot of sample is placed in a buffer solution and tumbled for 18 hours while maintaining the pH in a specified range. The resulting aqueous leachate is filtered from the solid phase and analyzed for the compounds of interest. Analyte concentrations are compared to TCLP limits, to determine if samples are subject to federal waste disposal regulations.

Inorganic Analytical Methods

Method 6010B, Trace Elements (Metals) by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPES) for Water and Soil

Water and soil samples are analyzed for trace elements or metals using Method 6010B. All matrices, excluding filtered acid preserved water samples, require digestion prior to analysis. This digestion is performed using USEPA Method 3005A or 3010A for water and extracts or USEPA Method 3050B for soil. Following digestion, the trace elements are simultaneously or sequentially determined using ICPES.

Method 6010B measures element-emitted light by optical spectrometry. The samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific atomic-line emission spectra are produced by radio frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the line intensities are monitored by photomultiplier tubes for element quantitation.

Method 6020, Trace Elements (Metals) by Inductively Coupled Plasma Mass Spectroscopy (ICP-MS) for Water and Soil (may be used in place of Method 6010B)

Water and soil samples are analyzed for trace elements or metals using Method 6020. All matrices, excluding filtered acid preserved groundwater samples, require digestion prior to analysis using the methods outlined in the previous section. Following digestion, the trace elements are simultaneously or sequentially analyzed using ICP-MS.

Method 6020 measures ions produced by a radio frequency inductively coupled plasma. The sample is nebulized and the resulting aerosol is transported by argon gas into the plasma torch. The ions produced are entrained in the plasma gas and introduced, by means of an interface, into a mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier.

Methods 7041, 7060A, 7131A, 7421, 7740, and 7841, Antimony, Arsenic, Cadmium, Lead, Selenium, and Thallium (Graphite Furnace Atomic Absorption [GFAA])

GFAA spectrometry is used to measure low concentrations of antimony, arsenic, cadmium, lead, selenium, and thallium in water and soil samples. Samples are digested using Method 3020A or 3050B. Discrete aliquots of digestate are deposited in a graphite tube furnace. The graphite tube is resistively heated by an electric current. The sample digestate is dried and charred to remove sample matrix components, then atomized at temperatures sufficient to vaporize the element of interest. Absorbance of an element-specific wavelength by the vapor is proportional to the concentration of that element.

Method 7470A-7471A, Mercury - Manual Cold-Vapor Technique

Water and soil samples are analyzed for mercury using SW7470A and SW7471A, respectively. This method is a cold-vapor flameless atomic absorption (AA) technique based on the absorption of radiation by mercury vapor. Mercury is reduced to the elemental state and aerated (volatilized) from solution. The mercury vapor passes through a cell positioned in the light path of an AA spectrophotometer. Mercury concentration is measured as a function of absorbance.

Organic Analytical Methods

Method 8015B, TPH-Extractable

TPH-extractable expressed as diesel range organics from the carbon range C_{10} through C_{28} are determined by gas chromatography with a flame ionization detector (GC/FID). The soil and water preparation methods include 3510C, 3520C, 3540C, 3550B and 3580A. The extracts are concentrated by removing the methylene chloride solvent through evaporation. The extracts are separated and detected on the GC/FID instrument. Identification of TPH components is based on pattern recognition techniques and requires a greater degree of analytical judgement than other GC methods. The TPH chromatograms consist of groups of peaks that have a general shape or pattern and that fall within the noted carbon range. Quantitation is performed by comparing the peak area of the sample from the C_{10} through C_{28} range with the area in the diesel standard or other petroleum hydrocarbon products.

Method 8081A, Organochlorine Pesticides

Organochlorine pesticides in soil and aqueous samples are analyzed using Method 8081A. This analytical method involves extraction of the aqueous sample with methylene chloride and the extraction of soil samples with hexane-acetone or methylene chloride-acetone using Method 3510C, 3520C, 3540C, 3541, 3545, 3550B, or 3580A. Cleanup techniques, such as Method 3610, 3620, 3630, 3640, and/or 3660, may be used for difficult matrices. The pesticides are quantified by GC using electron capture detection. Any pesticide analytes tentatively identified in the primary analysis are confirmed on a second GC column of dissimilar phase. Quantitation is accomplished by comparing the response of a major (quantitative) ion relative to an internal standard with a five-point calibration curve.

Method 8082, PCBs

Method 8082 is used to determine the concentration of PCBs as Aroclors or as individual PCB congeners in extracts from solid or aqueous matrices. GC with electron capture and electrolytic conductivity detector are used for quantitation. Compound identification based on single-column analysis will be confirmed on a second column, or supported by another qualitative technique (*i.e.*, gas chromatography/mass spectroscopy [GC/MS] Method 8270C).

Method 8260B, VOCs by GC/MS

VOCs in aqueous and soil samples are analyzed using Methods 8260B. VOCs in aqueous samples are purged onto an adsorbent trap using an inert gas and the VOCs are backflushed onto a GC column, where they are separated and detected by MS. These procedures are documented in Method 5030B. VOCs in soil are collected in Encore® or similar samplers using Method 5035 procedures. Compounds of interest are quantified by comparing mass spectra with the electron impact spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitative) ion relative to an internal standard with a five-point calibration curve. This method includes specific calibration and QC steps that augment the general requirements in SW-846 Method 8000B.

Method 8270C, SVOC

SVOCs, also known as base/neutral and acid extractables, are analyzed using Method 8270C in water and soil samples. Based on the behavior and structure of the compound, various extraction techniques are used to prepare samples for analysis by Method 8270C. These preparation methods include 3510C, 3520C, 3540C, 3550B and 3580A. The extracts are concentrated by removing methylene chloride through evaporation. The extracts are injected into a GC equipped with a mass selective detector. Compounds of interest are separated and quantified by comparing mass spectra with the electron impact spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitative) ion relative to an internal standard with a five-point calibration curve. This method includes specific calibration and QC steps that augment the general requirements in SW-846 Method 8000B.

Method 8290, Polychlorinated Dibenzo-P-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs)

PCDDs and PCDFs are analyzed using a matrix-specific extraction, analyte-specific clean up, and high-resolution capillary column GC/high resolution MS techniques to separate and identify the analytes of interest. The method's sensitivity is dependent on the level of matrix interference; selected cleanup methods may be used to reduce or eliminate interference. Target analytes include all congener classes, tetra- through octa-dioxins, and furans.

The MS is used in the selected ion-monitoring mode, and internal standards are used for quantitation. The retention time windows for each isomer group are determined by injection of a PCDD/PCDF retention time standard, which contains the first and last compound to elute from each isomer group. Quantitation is accomplished by adding a mixture of C-13 internal standards to each sample before extraction. Each isomer class is quantitated using the C-13 internal standard from that class.

Method 8310, PAHs

Selected PAHs are measured using high performance liquid chromatography. The PAHs are initially extracted from soil or water using Methods 3510C, 3520C, 3540C, or 3550B. Detection is accomplished by ultraviolet and fluorescence detectors.

Identification is accomplished by comparing the retention time of the peak with the retention time of a standard. Quantitation is performed by comparison of the response with a standard of known concentration. Method 8310 is preferred over Method 8270C, which also detects PAHs, in some applications because of the lower quantitation limits that are less than RPRGs.

8.5.2 Calibration Procedures and Frequency

Calibration procedures for all laboratory analyses will follow the requirements specified in the most recent update of the analytical method and the Basewide QAPP (Radian, 1999). Initial calibration is performed as required for each analytical method, using a range of calibration standards with the lowest standard at or near the quantitation limit for the analyte. These standards are used to determine the calibration range of the instrument. The reported concentration of any analyte in a sample or dilution must not exceed the instrument calibration range determined by the highest concentration calibration standard. All method-specific initial calibration frequency and acceptance criteria must be met prior to sample analysis. Calibrations are verified by analysis of a mid-concentration standard at a minimum of once per day. Calibration procedures for the field methods when applicable, are described in Subsection 8.5.1.

8.6 DATA REDUCTION, VALIDATION, AND REPORTING

Information flow from the field and laboratory to the data users is critical. The data management system for the soil washing and solidification/ stabilization study has been developed to facilitate the flow of information from the field and laboratory to those persons involved in project decision-making by providing a means of tracking, cataloging, and organizing information. Such a system includes hardware and software for data handling (the database), data management protocols such as chain-of-custody (COC) forms and sample collection forms, and trained personnel to maintain the data and keep the system updated and operational. The primary objective of a data management system is to provide the user with data sets that have been verified and are internally consistent.

8.6.1 Data Reduction and Verification

The data are reduced from instrument output to analytical report at the laboratory, generally using a Laboratory Information Management System. Electronic raw data or magnetic data tapes will be maintained for those methods for which instrumentation allows (*e.g.*, GC/MS) and made available to the Air Force or regulatory agencies upon request. Laboratory quality assurance procedures dictate that a percentage of the reported results are verified by a third party prior to analytical report submittal.

Copies of the field data logbooks and COC forms will be transferred to the JV's office for review and correction, if necessary. Once reviewed, field data (sample numbers, sample collection dates, etc.) will be manually entered from these documents into a spreadsheet database. As analytical data deliverables arrive from the laboratory, they are reviewed and any questions, concerns, or discrepancies are resolved. The analytical results are then imported or entered into the database. Printouts from the database will be compared to the field data sheets and analytical reports to identify any entry errors. Following this check, the data will then be available for data analysis, statistics, plotting, etc. All field logbooks and one copy of each COC form will be stored at the field trailer throughout the field effort. During demobilization, this information will be transferred to the project files at the JV's office.

8.6.2 Data Validation

Cursory validation and full validation of final data are conducted by following the data review procedures outlined in SOP Numbers McAFB-028 and McAFB-029 (Radian 1999b). Cursory validation (data review or USEPA, Region IX Level 1A) will be performed for all laboratory data. This includes comparing QC data such as holding times, initial calibration, continuing calibration, LCS, duplicates, and method blanks to established acceptance criteria and control limits contained in this QAPP. For data which fall out of established control limits (based upon QC criteria for accuracy and precision established for the project) and affect data usability, corrective action(s) is required and implemented as appropriate. Data usability is determined by the data reviewer and data user based upon the degree of non-compliance from established control limits, compounds of concern or site-specific historical data (*i.e.*, trend analysis), and the use of the suspect result. Any invalid data without appropriate corrective action may result in qualification as rejected. The data reviewer notifies the JV project team and a decision regarding resampling is made.

Full validation (EPA Region IX Level 3) will be performed for 10 percent of the data for each method according to the requirements in the McClellan AFB Basewide QAPP and SOP-029. If errors are identified which affect the usability of the data, a greater percentage of data will be validated.

8.6.3 Data Reporting

Monthly project status reports will be generated and the analytical data and data quality summary will be included. A final data quality assessment will be presented for each site study, and incorporated into the TAAR, as outlined in Section 10.0 of this WIP. This will include any deviations from QC procedures and criteria and the affect upon usability for the soil washing and solidification/ stabilization study. Percent completeness by method will also be presented.

8.7 INTERNAL QUALITY CONTROL CHECKS

8.7.1 Quality Control Samples

The specific QC samples associated with the analytical methods used for this project and the frequency of analysis are documented in each analytical method and Section 10.0 of the McClellan AFB Basewide QAPP (Radian 1999b). Field QC samples are discussed in Subsection 7.1.4. Descriptions of the purpose and frequency of the laboratory QC samples analyzed during the project follow:

Method Blanks. A method blank is a clean matrix carried through the same sample preparation procedure as a sample. Method blanks are used to ensure that interference from the analytical system, gases, and glassware is minimized. The concentration of any analyte in a method blank must be less than the quantitation limit. The corrective action for method blanks that exceed allowable concentrations is to reanalyze the blank; if contamination still exceeds allowable concentrations, the source of contamination must be identified and corrected, and the blank and all associated samples are then reanalyzed.

Laboratory Control Samples. LCSs are blank (reagent water or ultra-pure nitrogen) spikes containing all analytes at a specified concentration, usually in the mid-calibration range. The LCS undergoes the entire sample preparation and analysis process to demonstrate that the method/instrument is stable and operating within acceptable accuracy limits. LCSs are required for most methods at a frequency of one per ten samples for frequently analyzed methods and 1 per analytical batch. LCS acceptance criteria are presented in Sections 4 and 10 of the McClellan AFB Basewide QAPP.

Laboratory Duplicates (Duplicate Analyses). Laboratory duplicates are repeated but independent measurements of the same sample under the same conditions. The sample is split in the laboratory and each fraction is carried through all stages of sample preparation and analysis. The RPD between duplicate analyses is used to assess precision for each analytical method. Laboratory duplicates will be analyzed at a minimum of 10 percent of samples collected and will only be performed for methods that do not require MS/MSDs.

Matrix Spike/Matrix Spike Duplicates. An MS is a solution of method analytes at known concentrations that is spiked into a field sample before sample preparation and analysis. Two aliquots of the sample are spiked to provide a MS/MSD. MS/MSDs are analyzed to assess the accuracy and precision of sample data. MS/MSDs are also used to identify the presence of analytes that might interfere with contaminant quantitation. The percent recovery of each spiked analyte is used to assess bias caused by matrix interference, and the RPD between the duplicate spikes is used to assess the precision of the method for the specific sample matrix. The MS/MSD frequency is one pair for every 20 field samples. All MS/MSDs will be identified on the sample COC. MS/MSD percent recovery and RPD acceptance criteria are presented in Sections 4 and 10 of the McClellan AFB Basewide QAPP.

Surrogate Spikes. Surrogate compounds are a group of compounds that do not occur naturally but behave similarly to target analytes for each organic analytical method. Surrogate spike results provide a measure of method performance and indicate sample-specific matrix effects. Surrogates are required for SVOC analyses and dioxin/furan analyses (vapor, liquid, solid). A spiking solution of known concentration is added to each field and QC sample before preparation and analysis. Acceptance criteria for surrogate recoveries for SVOCs and dioxin/furan analyses are presented in Sections 4 and 10 of the McClellan AFB Basewide QAPP.

8.8 PERFORMANCE AND SYSTEM AUDITS

One field audit will be performed during the first week of treatment system operation to ensure that unit operation and sampling procedures are conducted in accordance with this WIP. One double blind performance evaluation (PE) sample will be submitted for each matrix and method at the beginning of the project. The results will be compared to vendor-derived performance criteria for acceptability. The PE results will be made available to the Air Force and regulatory agency personnel. No laboratory audits are scheduled due to the type of project (innovative technology study, not remedial investigation, removal action, etc.) and the use of the PE samples to assess data quality.

8.9 CALCULATION OF DATA QUALITY INDICATORS

Data quality indicators are the detailed QC specifications for PARCC. The equations for calculating percent relative standard deviation (RSD), percent difference, percent recovery, and RPD are presented in Section 13 of the McClellan AFB Basewide QAPP.

8.10 CORRECTIVE ACTION

Corrective action is required when data quality falls outside of established DQOs (acceptance criteria). Corrective action procedures are described in this section. The QA process has been developed to minimize the requirement for corrective actions; however, should a non-conformance be discovered, QA reporting to the appropriate management authority is instituted to ensure early and effective corrective action involving the following steps:

- Discovery of a non-conformance. A non-conformance is defined as failure to comply with procedures and standards established in this QAPP. Non-conformances are generally identified during audits or during data review; however, the quality assurance coordinator (QAC) or any project team member who discovers or suspects a non-conformance is responsible for initiating a non-conformance report without waiting for a scheduled audit.
- The QAC reviews all audit and non-conformance reports and reports non-conformances to the project manager (PM).
- The PM ensures that no additional work, which depends on the nonconforming activity, is performed until a confirmed non-conformance is corrected.
- Development of a plan and schedule for the corrective action. The PM confers with the QAC or other project personnel on the required steps and schedule for the corrective action. All corrective action measures are selected to prevent or reduce the likelihood of future non-conformances, to be appropriate to the seriousness of the non-conformance, and to be realistic in terms of the resources required for implementation. The plan identifies:
    - The cause of the non-conformance.
    - An appropriate corrective action.
    - The personnel responsible to take the corrective action.
    - The steps to be taken for correction and prevention.
    - Approval for the corrective and preventative action.
- Review of the corrective action taken. Upon completion of the corrective action, the QAC or the PM evaluates the adequacy and completeness of the action taken.
- Confirmation of results. If the corrective action is found to be adequate, the QAC notifies the PM of the satisfactory corrective action and the completion of the audit. If the action is found to be inadequate, the QAC and PM and any other appropriate team member confer to resolve the problem and determine any further actions. Implementation of any further action is scheduled by the PM.

8.11 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

All personnel will follow the training procedures specified in Subsection 5.2.7 of the Basewide QAPP (Radian 1999). In particular, the following training or certifications will apply to personnel associated with the non-VOC soil washing project.

Project Manager and asphalt pad designer will have a professional engineer license.

All field crew will be current in health and safety training as required in the OSHA regulations and be familiar with the project-specific Health and Safety Plan.

All heavy equipment operators will have been trained to meet competency requirements (competent operator).

The Site Safety Coordinator will have completed First Aid and CPR training.

The hazardous waste haulers will be licensed and trained to meet department of transportation regulations.

Laboratory personnel training requirements are documented in the laboratory SOP for "Analyst's Training Documentation."

8.12 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Instruments will be inspected upon receipt to verify that they are undamaged. Testing of measurement equipment generally consists of calibration, method detection limit studies, and retention time studies. If the testing indicates a problem, corrective action will occur, including possible replacement of the item. The laboratory procedures for acceptance of supplies is documented in "The Requisition, Purchasing, and Receipt of Chemical and Non-chemical Supplies" SOP.

Preventative maintenance requirements will follow those in Section 12.0 of the Basewide QAPP (Radian 1999).

8.13 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Field sampling and laboratory supplies will be inspected upon receipt to verify that they are undamaged and that all requested items are present. Consumable standards are tested using second source standards to verify certified concentrations.

Inspection/acceptance requirements will follow those in Subsection 5.2.8 of the Basewide QAPP (Radian 1999). The laboratory maintenance book procedures are documented in the "Maintenance Logbook Documentation" SOP.

9.0 SITE-SPECIFIC HEALTH AND SAFETY PLAN

9.1 INTRODUCTION

This site-specific health and safety plan (SHSP) defines the health and safety (H&S) requirements for JV and subcontractor personnel engaged in the soil washing and solidification/ stabilization study. The SHSP contains information that is applicable to all or most H&S issues related to field activities, and the subsurface soils to be treated. This SHSP addresses treatment system operations, personnel responsibilities, site- and task-specific chemical and physical hazards, PPE and controls, personal monitoring requirements, site control measures, decontamination procedures, and emergency response. Table 9-1 provides a list of the H&S equipment that will be used or immediately available at project work site(s) during the course of field activities.

The SHSP provides project-specific information not addressed in the METRIC Comprehensive Health and Safety Plan (HSP) (URSG-Laidlaw 1996) or McClellan AFB Basewide HSP, a subsection of the McClellan AFB SVE Removal Action Work Plan (URSG 1998), included as Attachment D to Appendix A of this document. The requirements and protocols specified in the SHSP take precedence over those presented in the HSPs. Nevertheless, **neither the METRIC Comprehensive HSP, McClellan AFB Basewide HSP, nor this SHSP are stand-alone documents; all three documents contain important information and represent the H&S program for the project work site(s).** All field team members will be required to read this SHSP and sign a statement acknowledging that they have met that requirement. Copies of this SHSP, HSPs, and SOPs will be maintained at the project work site(s).

9.2 BACKGROUND

9.2.1 Technology Description

Section 3.0 contains a detailed technology description.

9.2.2 Site Description

Section 2.0 contains a detailed site description.

9.2.3 Field Activities

The preliminary treatment test field activities include soil excavation to collect soil samples and sample shipment to Surbec-ART. Treatability study field activities include soil excavation, soil transfer to the treatment site, treatment system installation, treatment system operation, and demobilization. See Section 5.0 for a complete description. The project team will be responsible for all field activities throughout the estimated 12 weeks of the study.

9.3 FIELD PERSONNEL

Project field personnel are identified in Table 9-2, and their H&S responsibilities summarized in the following paragraphs. The JV H&S responsibilities are addressed in Subsection 2.3 of the METRIC Comprehensive HSP and Subsection 8.3 of the McClellan AFB Basewide RAWP. Project management responsibilities are discussed further in Section 12 of this WIP, and a project organization chart is included as Figure 9-1.

Table 9-1

HEALTH & SAFETY EQUIPMENT CHECKLIST

Personal Protective Equipment (per person)

X	Air-purifying respirator (full- and half-face)
X	Cartridges (combination P100 filter/organic vapor/acid gas)
X	Safety boots
X	Chemical-resistant boots (PVC/nitrile, neoprene, butyl), as needed
X	Chemical-resistant coveralls (Saranex®, polyethylene), as needed
X	Coveralls (Tyvek® or cotton)
X	Hard hat
X	Face shield
X	Latex gloves (not to be used as chemical-resistant gloves)
X	Nitrile gloves (22 mil., 15 mil., 11 mil)
X	Safety goggles
X	Ear plugs
X	Ear muffs
___	Chemical-resistant boot covers (neoprene or butyl)

Misc. PPE/First Aid and Emergency Equipment

1	Emergency shower/eyewash
1	First aid kit
X	Drinking water
2	Fire extinguisher (10 pound UL Rating 4A:80B:C)
3	Portable air horn (one at each work site support zone)
1	Cellular phone
X	Site control equipment: fencing (surrounding work site), cones, barricade tape, placards, signs, etc.
1	Chemical spill kit

Monitoring/Sampling Equipment

___	Radiation detector
___	Oxygen level/CGI
___	OVA
___	Ozone monitor/sensor
1	PID
1	Aerosol monitor
X	Draeger® short-term colorimetric detector tubes
1	Bellows pump
1	Sound level meter
1	Personal sampling pump
3	Hi-Vol sampling pump
X	Sampling media (MCE, PTFE, PVC filter cassettes)
X	Passive dosimeter/diffusion tube, as necessary for volatiles
___	Windsock, wind cone (with ½" or appropriate diameter pipe)

Decontamination Equipment

X	Tub (boot wash)
X	Deionized water
___	Garbage can w/liner
X	Buckets (10 gallons)
X	Plastic garbage bags
___	55-gallon drums
X	Brushes
X	Hand pressurized portable water sprayer
X	Detergent (Liquinox®, Alconox®)
X	Paper towels
1	Table
X	Decontamination solutions (hexane, HCl, HNO3)

1 - 3	Quantity of items needed.
X	Item is necessary, yet total quantity will depend on the usage rate.
TBD	To be determined
PPE	Personal protective equipment
PTFE	Teflon ®
CGI	Combustible gas indicator
OVA	Organic vapor analyzer
HCl	Hydrochloric acid
HNO3	Nitric acid
PVC	Polyvinyl chloride
PID	Photoionization detector

The project will be conducted under the oversight of the URSG Corporate Director of H&S, Mr. Mark Litzinger, C.I.H, and Ms. Mary Lou Sullivan, C.I.H., the H&S manager (HSM) for the URSG Western Region. Mr. Jerry Hinck, Sacramento office safety coordinator (OSC), will ensure that provisions of the URSG H&S program are implemented, assist in the investigation of project-related injuries and significant incidents, prepare and maintain OSHA records of occupational injury and illness, and oversee implementation of the JV medical surveillance and training program.

Table 9-2

PROJECT FIELD PERSONNEL

Team Member	Title	Organization
Sarabjit Singh	Program Manager	JV
Richard Beyak	Project Manager	JV
Gary Smith	Field Services Manager, Site Safety Coordinator (SSC)	JV
Tamara Zielinski	Project Engineer, Field Operations Coordinator (FOC)	JV
Jim Reese	Radiation Safety Officer (RSO)	JV
Carl Seward	Treatment System Operations	Surbec-ART
Erik Groenendijk	Treatment System Operations	Surbec-ART
Craig Jones	Treatment System Operations	BESCORP

- **Project Manager (PM).** Richard Beyak, P.E. is the PM for the treatability study and has overall responsibility and oversight of field activities. Mr. Beyak will ensure work is performed safely in compliance with the provisions of this SHSP and applicable McClellan AFB, federal, state, and local requirements. He will serve as the primary point of contact for communications with McClellan AFB. Mr. Beyak will also ensure that only trained and qualified personnel are assigned to project activities and that appropriate H&S equipment and resources are available throughout the treatability study.

- **Field Services Manager (FSM) and Site Safety Coordinator (SSC).** Mr. Gary Smith will serve as the SSC. Mr. Smith will ensure that field activities are conducted safely and in accordance with the provisions of this SHSP. He will be responsible for overseeing and interacting with field personnel and responding to H&S issues and emergencies during the course of project field activities. He will provide an independent check on proper SHSP implementation and conduct assessments to determine compliance. Mr. Smith will review the need for any changes in protection levels, protective equipment, or control measures, provide support to project field personnel, and, as part of his responsibility as the FSM, will oversee and coordinate activities with field personnel on a regular basis to ensure proper handling, storage, and disposal of hazardous materials and wastes.

- **Field Operations Coordinator (FOC).** Ms. Tamara Zielinski, PE, the project engineer, will provide technical guidance and support for field personnel and ensure that work tasks are completed in accordance with the provisions of task-specific SOPs and this SHSP.

- **Radiation Safety Officer (RSO).** Mr. Jim Reese will serve as the RSO throughout preliminary bench-scale treatability test activities, principally the survey of the candidate sites, and thereafter as necessary. Mr. Reese, currently serves as the project manager for the radiological removal action at CS 10 and PRL 32. Mr. Reese will help ensure that field activities are conducted safely and in accordance with radiation protection rules, regulations, and procedures. He will conduct surveys of the candidate sites, particularly the landfill site at CS 13, and report the results to the PM and SSC.

- **Treatment System Operators**. Qualified JV field team and subcontractor personnel will provide additional assistance on an as needed basis. The operators are first and foremost responsible for taking all reasonable precautions to prevent injury to themselves, fellow workers, McClellan AFB personnel, and the public. They are required to read and adhere to the provisions of the SHSP, McClellan AFB requirements, O&M manuals, and SOPs, and to report all accidents and any unsafe conditions to the PM, SSC, FOC, or other supervisory personnel.
- **Subcontractors**. Companies subcontracted by the JV project team or McClellan AFB are responsible for meeting their contract requirements and providing a safe workplace for their employees. The JV will inform all subcontractors of the potential hazards present at project work site(s) and provide them with the results of any personal or area monitoring being conducted near on or near their work site(s)

9.4 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

All project field team personnel working within a hazardous waste site designated work zone, or EZ will have successfully completed classroom and field training for hazardous waste site operations in accordance with OSHA requirements specified in 29 CFR 1910.120(e). Pre-assignment training requirements include successful completion of 40-hour initial H&S training, 3-day (24-hour) field activities training, and annual 8-hour H&S refresher. When the 3-day field activities training has not been formally documented, one or more years of active hazardous waste site field experience is considered equivalent training meeting this requirement. Field personnel will also have completed permit-required confined space awareness training in accordance with 29 CFR 1910.146. At least one person (the SSC) has currently valid certification in standard first aid and cardiopulmonary resuscitation (CPR).

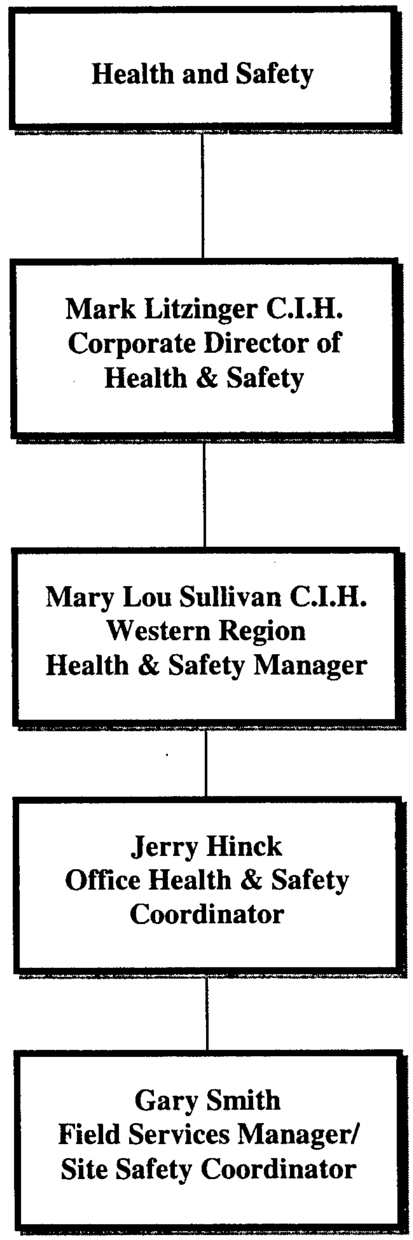
Field personnel that may be entering areas potentially contaminated with radiation (e.g., landfill site) and other contaminants will participate in a radiation safety awareness training during the safety kickoff meeting or tailgate safety meeting prior to conducting the site survey. The RSO and SSC will familiarize personnel with basic radiation physics, contamination control, hazards and dose limits, effects, risks, and the use of monitoring or survey instruments and interpreting the readings.

JV field personnel are required to participate in their corporate medical surveillance program in accordance with OSHA requirements for cleanup operations at uncontrolled hazardous waste sites (29 CFR 1910.120[f]). All O&M and other field personnel potentially exposed to hazardous substances or health hazards must be found physically qualified to perform their assigned work tasks without increased health risks prior to their assignment (29 CFR 1910.120) and, if necessary, to use a respirator (29 CFR 1910.134). For JV field personnel, annual medical examinations are conducted by a qualified physician as part of the JV medical surveillance program overseen by an independent occupational medicine consultant, Dr. Peter P. Greaney of GMG WorkCare.

General JV training and medical surveillance requirements are addressed in Sections 8.0 and 9.0 of the METRIC Comprehensive HSP. If requested, copies of training certificates or other documentation for O&M field personnel will be provided to McClellan AFB prior to the start of field activities.

Figure 9-1

HEALTH & SAFETY ORGANIZATION CHART



Site-specific H&S training is to be conducted by the SSC or other designated and qualified member of the field team. The H&S training, at a minimum, is to include a review of the SHSP, HSPs, H&S procedures, task- and site-specific hazards, as well as O&M manuals, SOPs, and other requirements unique to treatment system facilities. The project-specific training, instructed by the JV and attended by the project field team, will include: orientation, including basic H&S; operations, including comprehensive H&S, and sample collection.

9.5 HAZARD ASSESSMENTS

9.5.1 Introduction

This section identifies the potential chemical and physical hazards that may be encountered by field personnel. The anticipated hazards are based upon information presented in this WIP, including current and anticipated work site conditions (Section 2.0), field activities (Section 3.0), treatment system equipment and components (Sections 3.0 and 5.0), and soil contaminants based on available analytical data (Section 2.0). Table 9-3 summarizes the task-specific hazards and control measures. Specific physical and chemical hazards are discussed in the following subsections. Subsection 9.6 discusses the PPE and controls that will be used to eliminate or reduce the risks of exposure to these hazards.

The project team, accompanied by McClellan AFB personnel, will conduct a visual walkover inspection of candidate sites to help prioritize and select those sites that are most amenable to treatment and which have the best access for excavation. Excavation will be conducted using backhoe and will range from removing above-ground soil piles to excavating trenches to 8 feet bgs. Soil will be transported by truck to the treatment site.

The treatment system consists of soil washing modules designed to handle a range of soils and contaminants from selected sites on McClellan AFB. The treatment system applies both physical and chemical means to remove particulate contaminants from the soil. Project work tasks may expose field personnel to soil contaminants through direct dermal contact or inhalation of airborne dust or particulates released during treatment or transfer of contaminated soil, sludge, or water. The project team will make every effort to eliminate or minimize generation of fugitive dust including watering, as necessary, and careful handling and lowering of equipment and components. In addition, there are physical hazards commonly associated with physical labor and operation of treatment system equipment and components. The physical and chemical hazards are addressed in the following subsections.

9.5.2 Physical Hazards

Physical hazards may include:

- Temperature extremes (heat/cold stress)
- Elevated noise levels
- Excavation
- Machinery and mechanized equipment (pumps, conveyors, filter presses, cranes, derricks, hoists, trucks, backhoes, hand and power tools)
- Elevated work platforms (scaffolds, ladders, towers)
- Electrical hazards
- Underground/aboveground utilities
- Slip-trip-fall hazards
- Muscle strains
- Welding, hot work, grinding, and cutting.

Table 9-3

TASK HAZARD ASSESSMENT

Work Task	Hazard	Control Measures
General work activities: weather extremes	▪ Heat stress	▪ Monitor ambient temperatures ▪ Monitor work temperatures ▪ Provide drinking water, work breaks, scheduling during cooler parts of day ▪ Awareness of early signs of heat stress
	▪ Cold stress	▪ Provide shelter, rain gear, insulating clothing and maintain change of clothing on-site in case of cold or wet weather.
	▪ Adverse weather conditions	▪ Terminate field activities if high winds, electrical storms, heavy rains, visibility-impairing conditions pose potential safety hazard. ▪ Provide shelter or cover, as feasible, and non-slip safety matting in slippery open areas.
General work activities during treatment system operations: exposure to contaminants.	▪ Inhalation of airborne contaminants (*e.g.*, heavy metals, SVOCs) ▪ Dermal contact with contaminants in soil/sludge/water	▪ Don proper PPE (respiratory protection, safety boots, shin/foot guards, hearing and eye protection, coveralls, rubber apron, heavy gloves, etc.) ▪ Conduct monitoring of the work area and field personnel breathing space ▪ Follow safety SOPs, Appendix A, Attachments C and F
Excavation	▪ Excavation collapsing and trapping or burying workers. ▪ Falling equipment or construction materials ▪ Hazardous or oxygen deficient atmospheres created in an enclosed trench/excavation.	▪ Install proper protection in the trench/excavation (shoring and sloping) on the basis of soil type (i.e., stability), trench depth and width, and expected loads. ▪ Establish and enforce appropriate controls (barriers, warning systems) to prohibit personnel from working or operating equipment near the edge of excavations. ▪ Adequately monitor the atmosphere to ensure it is safe for personnel to enter. ▪ See Appendix A, Attachment F, Safety Management Standard (SMS) 13, Excavation Safety
Operation of heavy machinery, mobile equipment	▪ Fire/explosion ▪ Burns ▪ Exposure to fuels/hydraulic fluids ▪ Contact with moving equipment ▪ Roll-over	▪ Limit use in certain areas; keep fire extinguishers handy. ▪ Leave safety covers/guards in place. ▪ Assume equipment is hot, don't touch exhaust pipes, mufflers, radiators, radiator caps, hoses until equipment has been allowed to cool. ▪ Check cooling systems through overflow tank. ▪ Shut down equipment in event of hydraulic system failure; contain fluid/fuel line leaks. ▪ Leave hydraulic system servicing/repairs to trained mechanic. ▪ Mobile equipment to have backup lights and alarms. ▪ Flagman to be used when mobile equipment is backing up, entering work area, when operator□s view is limited, terrain is hazardous and when other vehicles are backing up. ▪ Operators to be aware of location of ground personnel. ▪ Ground personnel near mobile equipment to alert operator of their presence. ▪ SSC or designee to control access of heavy equipment to work area. ▪ Operators prohibited from entering areas not cleared by SSC or PM, exceeding posted speed limits, or disregarding existing conditions, and required to use seat belts. ▪ See Appendix A, Attachment F, SMS 19, Heavy Equipment Operations

Table 9-3 (Cont'd)

TASK HAZARD ASSESSMENT

Work Task	Hazard	Control Measures
Powered equipment, power tools	▪ Physical injury to operator and/or nearby workers	▪ Follow general safety rules for equipment and power tool safety presented in manufacturer's O&M manuals and SOPs. ▪ Thorough training and demonstration of competence to operate equipment. ▪ Unplug (turn off power) or disconnect air source when servicing equipment. ▪ Never exceed maximum pressure ratings. ▪ Wear safety glasses. ▪ Check electrical cords for broken insulation and potential exposure to water/liquids.
Tasks on elevated work platforms (scaffolds, ladders, towers)	▪ Physical injury due to falls or falling objects	▪ Platforms to be constructed in accordance with OSHA, Cal/OSHA and McClellan AFB or COE requirements and limitations. ▪ Provide appropriate fall protection, as necessary. ▪ Install guardrails, toe boards, steel perimeter cable, or warning system (flagging, warning tape at least 6 feet from exposed platform edge) in any open area ≥4 feet above adjacent surfaces. ▪ Designate and enforce work site as hard hat area.
Welding/hot work, grinding, cutting	▪ Burns ▪ Fire ▪ Explosion ▪ Flying debris ▪ Flying cylinder ▪ Lifting hazard	▪ Follow hot work and compressed gas cylinder handling safety procedures. ▪ Work area must be inspected and approved by McClellan AFB fire protection personnel. ▪ Notify McClellan AFB Fire Department 3 days prior to work, and obtain burn permit from fire inspector at fire station #2 for any hot welding. ▪ Complete Hot Work Permit and have it signed by SSC, PM, or site supervisor. ▪ Maintain 15 lb. A:B:C fire extinguisher in welding/hot work area, and a clear 35-foot radius around area free of flammable/combustible materials. ▪ Inspect equipment (*e.g.*, cylinders, regulators, hoses, fittings) for leaks, keep fittings/equipment free of grease, oil or lubricant. ▪ Torches to be lit only with friction spark lighters, and never to be left unattended when lit. ▪ Don proper PPE during welding (welding hood with shaded lenses, welding respirator, flame-retardant clothing, welding/cutting goggles, gloves, chaps, aprons). ▪ Position work to avoid contact with hot metal, falling slag and waste material (*i.e.*, start at the top and work to bottom); do not weld or cut on concrete or gravel. ▪ All grinders to be equipped with guards and not to exceed specified grinding disc rpm. ▪ Secure all cylinders in up-right position with valve caps in place and store in protected area away from heat, combustible and incompatible materials. ▪ These activities cannot be performed without prior approval from the McClellan Fire Department and FPM.
Operations near noise-generating equipment	▪ Noise hazard ▪ Interference with communication	▪ Monitor area with sound level meter. ▪ Hearing protection (earplugs, ear muffs). ▪ Engineering controls (acoustic screens, foam sheets, enclosures) if necessary.

Table 9-3 (Cont'd)

TASK HAZARD ASSESSMENT

Work Task	Hazard	Control Measures
Operations near underground/aboveground utilities	▪ Shock/electrocution hazard; ▪ Physical injury	▪ Identify and mark location(s) of underground utilities 2 days before start of any intrusive activities; SSC or PM to contact McClellan AFB engineering services (286-5000). ▪ Sweep area with metal detector, as necessary. ▪ Work near overhead power lines permitted only at safe clearance distance in accordance with federal, state, and COE standards as presented in SHSP. ▪ Electrical systems to meet appropriate standards and installed in accordance with state and federal regulations, and NESC and NEC standards. ▪ Provide sufficient access and working space about all live parts of electrical equipment, screen/guard live parts of electrical equipment 50V or more. ▪ Implement lockout/tagout requirements as discussed in SHSP Subsection 9.6 and SOP (see SOP in Attachment C to Appendix A), and applicable state, federal and COE requirements.
General system operations	▪ Slip, trip and fall hazards ▪ Skeleto-muscle injury	▪ Follow fundamental H&S and general housekeeping rules. ▪ Initial and regular safety meetings to identify potential hazards (unstable or slippery surfaces, uneven terrain, etc.) and control or avoidance measures to be implemented. ▪ Maintain work area(s) free of obstructions. ▪ Prohibit individual lifting of large, heavy, or cumbersome objects. ▪ Provide appropriate material handling/lifting equipment (cylinder carts, handcarts, dollies, etc.).
ork in confined space(s)	▪ Entrapment, engulfment ▪ Hazardous atmospheres (toxic, asphyxiating)	▪ Prohibit entry into confined space including, but not limited to manholes, sewers, pipelines, tanks, process/reaction units, stacks, any space or enclosure with limited ventilation, portals of entry/egress, or spaces not meant for human occupancy. ▪ Evaluate and monitor confined space for oxygen content, flammable and toxic atmospheres, and internal configuration for trapping, asphyxiation or engulfing hazards. ▪ Complete and obtain approval of Work Permit for Confined Space Operations in accordance with OSHA and Cal/OSHA requirements, and as provided in the SOP (Attachment C, Appendix A).
Work near hot surfaces	▪ Burns	▪ Cover hot surfaces exceeding 140°F (*e.g.*, thermal oxidizer, ducts, piping) with thermal insulation or guard against contact in accordance with federal, COE, and state regulations. ▪ Identify hot surfaces with appropriate "HOT" or "HOT SURFACE–DO NOT TOUCH" tags, placards, tapes, or warning/danger/caution signs. ▪ Use appropriate PPE (*e.g.*, heat resistant gloves). ▪ Install thermal shielding, as necessary.

PPE	Personal protective equipment	O&M	Operations and Maintenance	≥	Greater than or equal to
SVOCs	Semi volatile organic compounds	OSHA	Occupational Safety and Health Administration	lb.	Pound(s)
SOPs	Standard operating procedures	Cal/OSHA	California OSHA	rpm	Revolutions per minute
SSC	Site Safety Coordinator	SHSP	Site Health and Safety Plan	PM	Project Manager
COE	Corps of Engineers	NESC	National Electrical Safety Code	^{0}F	Degrees Fahrenheit
V	Volts	NEC	National Electric Code	FPM	Field project manager

These hazards are discussed further in the following paragraphs. If project team field personnel are not cognizant of these hazards, do not implement appropriate safety precautions, and follow prescribed safety procedures and protocols, there is a greater potential for accidents and personal injury. The SSC will ensure that safe work practices are followed at the project work site(s) and make any changes necessary to ensure the safety of the public, JV, subcontractor, and McClellan AFB personnel..

9.5.2.1 Temperature Extremes

Heat and cold stress hazards and controls are discussed in the Basewide HSP Subsection 8.5.3. Although strenuous activities, particularly in impermeable clothing, are not anticipated during the 12-week duration of the treatability test, personnel will be monitored and the work schedule adjusted as necessary during periods of elevated ambient temperatures or humidity. Activities requiring strenuous labor will, whenever feasible, will be scheduled during morning hours.

<u>Heat Stress Hazards</u>. Field personnel may be susceptible to heat stress during periods of elevated ambient temperatures or humidity, or during the performance of strenuous activities, particularly if impervious personal protective clothing is worn. The SSC will monitor field personnel for early signs of heat stress whenever ambient temperatures reach or exceed 85°F. If impervious clothing (*e.g.*, Saranex-coated Tyvek® coveralls) is worn, personnel will be monitored when temperatures exceed 70°F. The first aid kit will include a digital thermometer to measure oral temperatures.

Personnel whose oral temperatures exceed 100°F will not be permitted to continue working until their temperature returns to a normal range (96.8°F to 100°F). Drinking water and electrolyte beverages will be available and personnel will be encouraged to drink sufficient fluids to prevent salt loss and dehydration. At a minimum, personnel should break every two hours for 10 to 15 minutes. Personnel should be cognizant of the early signs of heat stress and the necessary treatment procedures, as summarized below.

<u>Heat Cramps</u>

Symptoms:	Muscle cramps, particularly in the legs and abdomen; may also accompany heat exhaustion.
Treatment:	Move affected individual to a cool, covered area and provide water or electrolyte beverage; apply firm pressure and place warm, wet towels over the cramped area for relief.

<u>Heat Exhaustion</u>

Symptoms:	Elevated body temperature (100 to 104°F); pale and clammy skin; profuse perspiration; lethargy and fatigue; possible headache, nausea, or fainting.
Treatment:	Move victim to cool area and provide water every 15 minutes for 3 or 4 doses; seek medical care in severe cases.

<u>Heat Stroke</u>

Symptoms:	Elevated body temperature (may be as high as 106°F); skin is red or flushed, dry, and hot to the touch. There may be nausea, headache, and pulse may be rapid and strong; and possible loss of consciousness, delirium, or coma. These symptoms indicate a potential life-threatening situation; notify emergency medical services (EMS)

immediately. The worker's temperature control system has stopped working correctly. The body temperature could rise so high that brain damage and death could result if the body is not cooled quickly.

Treatment: Rapidly cool victim by sponging the body with isopropyl alcohol or cool water, or pour water on the body. Continue to closely observe the victim. If the temperature starts to rise, cool the victim again. Heat stroke requires medical attention, ensure that the victim is transported to the nearest medical facility.

Whenever possible, laborious tasks should be scheduled during early mornings or evenings to take advantage of the coolest parts of the day. If not feasible, work schedules should be established which provide frequent rest periods.

<u>Cold Stress Hazards</u>. Although extended exposure to bitter-cold temperatures is unlikely during project field activities, personnel may be working in open areas and could be exposed to windy working conditions and inclement weather. Cold stress resulting in hypothermia (*i.e.*, when the body core temperature drops below 96.8°F is possible when individuals work for extended periods at ambient temperatures of 40°F or less. Symptoms could include shivering, pain in the extremities, and drowsiness or disorientation. To help lessen or ease the effects of cold, personnel will be instructed to wear adequately insulated/layered clothing and maintain a change of clothing on-site during periods of inclement weather. All field personnel are provided with rain suits but will be advised to change immediately if clothing gets wet or damp. Since a centrally located field trailer will be available near the project work site, personnel will have a warm sheltered area available for periodic breaks.

<u>Adverse Weather</u>. The SSC, in consultation with the PM or FOC, will determine if outdoor field activities can be continued in a safe manner. In the event of high winds, electrical storms, heavy rain, or visibility-impairing conditions, outdoor activities will be terminated and field personnel will remain inside the trailer until conditions improve. Some outdoor activities may be permitted during inclement weather (rain, wind) but personnel must be alert to possible slip-trip-fall-hazards, and must limit activities to safe areas at ground level.

9.5.2.2 Noise

Noise-generating equipment will be used during project activities. This equipment includes pumps, conveyors, filter presses, high-pressure sprayers, heavy mobile equipment (cranes, backhoes, trucks, etc.), and assorted power tools The noise levels near some of this equipment could exceed 85 decibels (dBA) and may approach 95 dBA. Elevated noise levels could constitute a hearing hazard and interfere with communication. The SSC will determine if field personnel are exposed to unacceptable noise levels (*i.e.*, exceeding 85 dBA) and ensure that appropriate protection (*i.e.*, ear plugs, ear muffs) are employed by all individuals working near noise sources.

In addition, ambient noise levels at McClellan AFB may exceed 85 dBA constituting a noise hazard and potentially interfering with communication. Aircraft operations (landings, takeoffs, overflights) can result in occasional impulsive noise levels of 85 to 95 dBA at McClellan AFB work sites. Consequently, field personnel are required to wear their hearing protection throughout the workday.

9.5.2.3 Heavy Equipment and Tool Hazards

Heavy mobile equipment (backhoes, trucks, etc.) present potential struck-by/run-over hazards. Mobile equipment must have backup alarms and lights. Movement of the equipment will be only on dedicated equipment ramps (personnel not to walk on them when equipment is in operation). Storage areas will be marked and access restricted. Treatment system rotating and crushing equipment pose potential hazards that include entanglement of hair, clothing or extremities. All machine guards are to be in position whenever equipment is operational. No loose clothing, long hair, or jewelry is allowed during operation. Only authorized operators who have received orientation and full training are to operate the equipment. Overhead lifting and rigging operations pose potential hazards not only to the operator but project team and McClellan AFB personnel as well. Only certified crane operators are allowed to operate the crane, and personnel access into the work site(s) will be restricted during these operations. Only loads within the rated capacity will be lifted. Pre-lift meetings will be conducted. Personnel are required to stay out from under suspended loads, and use tag lines when guiding or setting pieces. Hazards commonly associated with the operation of machinery and mobile equipment (pumps, presses, conveyors, backhoe, cranes, forklifts, trucks, lifts) include:

Fire/Explosion. The equipment is a source of ignition and, therefore a fire safety hazard. Fires can be caused by exhaust sparks, friction sparks, and directly by fires within the engine compartments, batteries or electrical systems. The use of internal combustion engines will not be permitted in areas containing potentially flammable material or in flammable/explosive atmospheres where they could provide the necessary ignition for an explosion.

Burns. Contact with equipment hot surfaces (exhaust pipes, mufflers, radiators) can result in serious burns. Although generally enclosed or covered, contact with these surfaces should be carefully avoided. Leave safety covers or guards in place. Personnel should always assume that equipment is hot, and not touch the engine, exhaust pipes, mufflers, radiators, radiator caps, and hoses unless the equipment has been shut off for several hours or until the engine and surfaces have sufficiently cooled. Check cooling systems through the overflow tank rather than removing the radiator cap.

Hydraulic Fluids and Fuels. Contact with pressurized hydraulic fluids and fuels can cause severe injury to the eyes and skin. Hydraulic fluids and fuels can penetrate the skin and may require immediate medical attention. In the event of a hydraulic system failure or fuel line rupture, the operator is to shut down the equipment immediately and contain the fluid or fuels. Hydraulic system repairs and servicing should be left to a mechanic familiar with the piece of equipment.

Ground Personnel Contact. Movement of mobile equipment and motor vehicles, particularly in tight or congested areas, poses a potential safety hazard to ground personnel as well as the operator. The equipment will be required to have backup lights and alarms. In addition, a flagman or signal person must be used whenever mobile equipment is backing up or entering a project work area, or when the operator does not have full view of the area, the terrain is hazardous, and when two or more vehicles are backing up in the same area. Operators must be informed and aware of the exact location of ground personnel. Ground personnel working near mobile equipment who are unable to leave the area will be instructed to make eye contact with the operator and alert him/her of their presence, and to move cautiously at all times. The SSC or designee will be responsible for controlling access of heavy equipment onto the work site and informing field personnel where and when equipment will be moved.

Roll-Over. Roll-overs occur primarily from operating mobile equipment or vehicles on steep slopes, unstable surfaces, near excavations, or when making sharp turns at unsafe speeds. Injuries from roll-overs can be fatal, particularly when the operator is thrown from the vehicle or equipment. Operators will be prohibited from entering areas not previously cleared by the SSC or PM. Seat belts are to be used by all personnel operating vehicles or mobile equipment. At no time will posted speed limits be exceeded, or vehicles/equipment operated at speeds that directly disregard existing conditions (weather, traffic, intersections, roadway width, grade, etc.).

Project personnel must first be trained and demonstrate their competence to operate or maintain the treatment component equipment, power tools, and associated equipment (air compressors, generators, motors, pumps, etc.) used during operations or installation/disassembly activities. Project personnel are reminded to follow the manufacturers instructions, O&M manuals, SOPs, and these basic safety guidelines:

- Turn off appropriate circuit breakers when servicing electrically actuated equipment (motors, mixers, pumps, conveyors, valves).
- Do not operate any controls when hands are wet.
- Disconnect air sources prior to servicing any air-operated equipment.
- Never exceed maximum pressure ratings.
- Always wear safety glasses when servicing or operating equipment or power tools.
- Check electrical cords for broken insulation and potential exposure to water or other liquids.

9.5.2.4 Elevated Work Platforms (Scaffolds, Ladders, Towers)

Working above ground without sufficient protection, even at elevations of as little as three to four feet, pose falling hazards. In addition, elevated work areas pose overhead hazards (falling objects, overhanging structures) to personnel working below. Consequently, work platforms (scaffolds, temporary floors) must be provided for all work except that which can be done safely from the ground. Use of ladders as work platforms is limited only to use of small hand tools, or handling of light material. Ladder jacks, lean-to, prop-scaffolds, and emergency descent devices are not to be used as work platforms. Work platforms and ladders will be constructed and used in accordance with OSHA, California OSHA (Cal/OSHA), and McClellan AFB or Corps of Engineers (COE 1996) requirements and limitations. The SSC will designate the project work site as a hard hat area and ensure that appropriate warning signs or placards are visibly displayed.

9.5.2.5 Electrical Hazards

Electrical hazards are discussed in the METRIC Comprehensive HSP Subsections 3.5 and 14.4, and the Basewide HSP Subsection 8.5.1. Additional safety guidelines to be implemented at the system trailer and work site include the following.

Personnel must be aware of potential hazards due to unexpected start-up (energizing) of equipment, or the release of stored energy or material causing injury to personnel working on or near powered equipment or machinery. The SSC or PM will determine if machinery or equipment pose a potential hazard and should be locked or tagged out during maintenance activities. Lockout/tagout guidelines are included in the METRIC Comprehensive HSP Subsection 14.4, and an SOP is included in Attachment C of Appendix A. The SSC or PM will assist in defining and implementing the procedures by locating all energy isolating controls to be certain which switch, valve, or other device may need to be locked or tagged out. Lockout/tagout procedures will be implemented during maintenance, servicing, troubleshooting, or other activities conducted on equipment/machinery whose unexpected activation could pose a hazard.

Electrical repairs on energized equipment are to be left to electricians and qualified personnel trained to avoid electrical hazards while working on exposed energized parts. When it is absolutely necessary to test energized circuits, the SSC will ensure personnel don appropriate PPE (*e.g.*, rubber gloves, rubber-soled boots) and use rubber mats, and tools with insulated handles. Personnel are to follow manufacturer's operations manual and other specified requirements for the piece of equipment, and remove metal jewelry, watches, or other metals that could act as a conductor.

All electrical systems (wiring and equipment) will be a type listed by a nationally recognized testing laboratory suitable for installation and installed in accordance with: applicable state and federal regulations (29 CFR 1910 Subpart S; 8 CCR Div. 1, Subchapter 5, Electrical Safety Orders); National Electrical Safety Code (NESC), National Electrical Code (NEC); U.S. Coast Guard (USCG) standards; and manufacturer's instructions. Whenever feasible, low-voltage equipment with ground-fault interrupters and watertight corrosion-resistant connecting cables will be used. All electrical circuits will be grounded in accordance with NEC and NESC standards.

The use of extension cords should be avoided unless absolutely necessary. Extension cords could pose a potential shock or electrocution hazard if workers contact or sever them during construction activities. If used, cords are to be inspected before each use. Cords that appear damaged, defective, or non-waterproof; are not to be used. Plugs that do not match the receptacle (*i.e.*, two-prong in a three-prong) are not to be used, nor are they to be modified for an intended use (voltage/current capacity). Ensure that cords have proper grounding, insulation, and tight connections.

Sufficient access and working space (no less than three feet) will be provided about all live parts of electrical equipment. Live parts of electric equipment 50 volts or more will be guarded against accidental contact by limiting access or by partitioning or screening. Project team personnel are also to be aware that use of some electrical equipment could also provide an ignition source in the presence of an explosive or flammable environment. The work area and electrical equipment is to be kept clean, potentially flammable materials or wastes (oily rags, paper, etc.) are to be properly disposed, and outlets, circuits, and motors are not be overloaded.

9.5.2.6 Underground/Aboveground Utilities

During excavation, contact with buried or aboveground utilities, such as electric powerlines or pipelines, pose a substantial hazard. The location of any underground utilities (*e.g.*, cables, water, sewer, natural gas pipelines, etc.) must be identified at least two working days before breaking ground. The PM will ensure that McClellan AFB engineering services or other appropriate entity is contacted to mark all underground facilities in the vicinity of the site where intrusive activities are planned. A comprehensive records search and review of utility and other appropriate maps of the site, followed by a sweep of the area with a metal detector, should also be conducted if deemed necessary by McClellan AFB or PM.

Work activities adjacent to overhead power lines will not be initiated until the safe clearance distance has been determined by the PM or SSC. Cranes, derricks, lifts, and equipment with elevated booms must be positioned away from overhead power lines by a distance at least equal to the height of the extended boom, crane, or other equipment and in accordance with COE (1996) minimum clearance from energized overhead electric lines, and standards specified in the California Department of Industrial Relations' Electrical Safety Orders (8 CCR §2946[b]):

System Voltage (kilovolts [kV])	Minimum Required Clearance (feet)
0 - 50 kV	10
51 - 100 kV	12
101 - 200 kV	15
201 - 300 kV	20
301 - 500 kV	25
501 - 750 kV	35
751 – 1,000 kV	45

9.5.2.7 Slip, Trip, Fall Hazards

The SSC will ensure that field personnel observe proper site control measures, safe work practices, and keep the work site free of obstructions. Safety briefings are to be held daily during system installation and initial operations, and thereafter at a minimum of twice per week, or as necessary. The briefings will address specific areas of concern (*e.g.*, unstable structures, slippery surfaces, protruding pipes, berms, and curbs) and to specify work practices and controls necessary to avoid or deal with the hazards. Non-skid mats, runners, pallets or other appropriate equipment will be used to control slippery surfaces. Ladder safety considerations include the following: only one person is to be on a ladder at one time, and the ladder is to be tied off. Barricades are to be appropriately positioned while people are on elevated work areas. A harness/lanyard is to be utilized during rigging, or when no handrails are available. Whenever feasible, obstructions or overhanging structures encroaching commonly used areas posing potential safety hazards will be covered with sufficient padding to protect personnel from possible injury. Dedicated utility corridors and personnel/equipment routing should also be designated as needed.

9.5.2.8 Skeleto-Muscle Injury

Skeleto-musculature injuries (*i.e.*, strains, sprains, muscle pulls, etc.) are the most common work place injuries. Field activities may require occasional lifting of heavy objects. No one is to attempt to lift large, heavy, or cumbersome objects without assistance. JV project team personnel generally required to do frequent lifting are trained in proper lifting procedures. The SSC and PM will ensure that appropriate material handling equipment (*e.g.*, cylinder carts, hand carts, drum cradles) are available at the work site as needed.

9.5.2.9 Confined Spaces

Entry into any confined space is strictly prohibited unless a Work Permit for Confined Space Operations in accordance with OSHA and Cal/OSHA (29 CFR 1910.146; 8 CCR 5156 et. seq.) is obtained and McClellan AFB confined space permit requirements are met. The work permit, a copy of which is included in Attachment C to Appendix A, will be prepared by the SSC or PM and approved by the HSM prior to any entry into a confined space. A confined space for the purposes of this SHSP includes: manholes, sewers, pipelines, storage tanks, process/reaction units, stacks, pits, basements, tunnels, and any spaces or enclosures that have limited ventilation and openings for entry or egress, or are not meant for human occupancy.

9.5.2.10 Biological Hazards

Biological hazards that may be encountered at the project work site could include spiders and biting/stinging insects. Personnel will be reminded prior to each day's activities to be aware of these hazards and to take the necessary precautions to avoid them by adhering to safe work practices (*e.g.*, avoid reaching into covered or dark areas or picking up rocks and other objects). Individuals with specific allergies to insects should remember to note this fact on the Medical Data Sheet they are required to complete, and to remind the SSC or PM prior to the start of field activities. A first aid kit will be available to treat minor insect bites and stings. First aid procedures for minor insect bites and stings include: cold applications, use of soothing lotions (*e.g.*, calamine), and for a bee sting, removal of the venom, stinger, and venom sac. If the bite or sting is from a poisonous spider or produces a severe reaction, implement the following procedures: calm the victim and keep him/her from moving about, preferably in a prone position, and call 9-1-1 from a base phone; otherwise, call 643-2111. It is essential to get the victim to a hospital immediately.

9.5.3 Chemical Hazards

Prior to the start of project activities and, as necessary, throughout the Soil Washing and Solidification/ Stabilization study, the SSC or qualified designee will conduct hazard communication training in accordance with the METRIC Hazard Communication Program (see METRIC Comprehensive HSP Section 6.0). The training will cover chemical hazards, chemical handling and storage, MSDSs, labeling, and employee responsibilities.

Although all feasible measures and controls will be implemented to limit potential exposure to the chemical hazards present in the contaminated soils undergoing treatment, field personnel could be exposed to potential chemical hazards during system operations and associated field activities (monitoring/sampling) as a result of:

Inhalation, dermal contact, or accidental ingestion of contaminated soils, equipment, surfaces, or airborne dust/particulates.

- Inhalation of soil or treatment system vapors or gases.
- Accidental ingestion or dermal contact with process water.

Table 9-4 provides a list of the potential chemical hazards that may be present at the work site and the permissible airborne levels to which workers may be repeatedly exposed without adverse health effects. The list includes only the most common soil contaminants previously detected at the candidate sites. The table identifies the most stringent enforceable federal OSHA or Cal/OSHA permissible exposure limits (PELs), short-term exposure limits (STELs), concentrations considered immediately dangerous to life or health (IDLH), and Proposition 65 chemicals known to the state of California to cause cancer or reproductive toxicity.

Additional information on the potential health effects of these chemicals, and MSDSs for the chemicals related specifically to the treatment system (polymers, surfactants) are included in Attachment B to Appendix A of this WIP. The MSDSs will be posted at the project work site along with the spill prevention plan (see Appendix B).

Exposure to VOCs, SVOCs, nonvolatile organics, and inorganic materials in the site soils could occur during excavation or while the project field team is handling contaminated soil, sand, slurry, sludge, recycled water, dewatered liquids, or treatment system components. Excavation may generate dust and potentially contaminated airborne particulates. Appropriate dust suppression measures will be implemented as necessary to control airborne emissions. In addition, field personnel, as discussed in the following subsection, will wear appropriate PPE, including chemical-resistant gloves, and, if determined necessary by the SSC, rubber apron or coveralls (Saranex®-coated Tyvek®), face-shield, and respiratory protection.

Chemical hazards associated with the excavation of soils and buried materials at the landfill site are related to the chemical contaminants that may be present in the landfill, including chemicals in buried drums, tanks, bottles and other containers that may be uncovered. It is likely that buried drums or containers are in poor condition and possibly leaking thereby posing a potential exposure hazard, particularly if the contents are highly volatile or radioactive. The chemicals that could be encountered include landfill gases (VOCs, methane, hydrogen sulfide), SVOCs, fuels, pesticides, dioxins, and metals. Real-time air monitoring will be used during the excavation and related intrusive activities to identify potential chemical contaminants. The potential health effects and permissible exposure limits for the chemicals commonly encountered at McAFB sites are discussed and identified in the SHSP (see WIP Subsection 9.5.3 and Table 9-4) and the METRIC Comprehensive HSP (see Section 6.0, Tables 6-1 and 6-2). Additional information on methane and hydrogen sulfide is provided in Attachment E of Appendix A.

Certain chemicals may be used to decontaminate reusable sampling equipment or as preservatives for water samples. These chemicals may include decontamination solutions containing hexane, and sample preservatives containing dilute acids (hydrochloric, nitric, sulfuric acids). The preservatives will be prepared and inserted into sample containers by the analytical laboratory. The JV, in accordance with 29 CFR 1920.1200 (Hazard Communication and the METRIC Hazard Communication Program; see METRIC Comprehensive HSP, Section 6.0), will maintain MSDSs at the project trailer, work site, or JV field trailer for these and all other chemicals used during the system treatability test. Personnel are instructed to refer to the MSDSs for information on the chemical hazards, PPE and special precautions, storage, handling, spill/leak cleanup procedures, and other details about these chemicals.

Table 9-4

POTENTIAL CHEMICAL HAZARDS AIRBORNE EXPOSURE LIMITS

Contaminant	PEL[a] (mg/m³)	STEL[b] (mg/m³)	IDLH[c] (mg/m³)	Health/Safety Hazards
Semivolatile Organic Compounds (SVOCs)				
benzidine *	NE (skin)	NE	Ca	Human carcinogen
benzo(a)anthracene*	0.2	NE	80 Ca	Combustible
benzo(a)pyrene *	0.2	NE	80 Ca	Suspected human carcinogen
benzo(b)fluoranthene *	0.2	NE	80 Ca	Combustible; may be absorbed via skin.
chlordane *	0.5 (skin) Ca	NE	500 Ca	Treat as carcinogen; combustible
chrysene *	0.2	NE	80 Ca	Suspected human carcinogen
DEHP	5	10	5000 Ca	Combustible; animal carcinogen
dieldrin *	0.25 (skin) Ca	NE	50 Ca	Treat as carcinogen
dibenzo(a,h)anthracene*	0.2	NE	80 Ca	Carcinogen, poison, mutagen
dibenzofuran	NE (skin)	NE	NE	Eye, skin, respiratory irritant
1,2-dichlorobenzene	150	300	1200	Combustible, irritating
1,3-dichlorobenzene	NE (skin)	NE	NE	Irritating, combustible
1,4-dichlorobenzene *	450	675	1200	Toxic, irritating
2,6-dinitrotoluene *	0.15 (skin) Ca	NE	50 Ca	Treat as carcinogen; combustible
dioxin *	NE	NE	NE Ca	Carcinogen, eye, skin effects
naphthalene	50	75	1310	Affects eyes, skin, CNS
n-nitrosodi-n-propylamine	NE (skin)	NE	NE	Carcinogen, mutagen
n-nitrosodiphenylamine	NE (skin)	NE	NE	Eye, skin, respiratory irritant
polychlorinated biphenyls *	0.5 (skin)	NE	5 Ca	Irritating; may be absorbed
pentachlorophenol *	0.5 (skin)	NE	2.5	Affects eyes, skin, liver, CNS
Inorganics				
arsenic *	0.010	NE	100	Human carcinogen
cadmium * (dust)	0.005	NE	50	Suspected human carcinogen
chromium (Cr II and Cr III compounds)	0.5	NE	25	Affects skin, respiratory system
chromium (Cr VI compounds)*	0.05	0.1 C	25	Treat as carcinogen
lead	0.1	NE	700	Affects CNS, blood

(a) Most stringent of the federal Occupational Safety and Health Administration (OSHA) or California (Cal/OSHA) Permissible Exposure Limits (PELs) (29 CFR §1910.1000; 8 CCR §5155).
(b) STEL (Short-term exposure limit); OSHA and Cal/OSHA 15-minute time-weighted average (TWA) concentration that should not be exceeded unless otherwise noted.
(c) IDLH (Immediately dangerous to life or health). National Institute of Occupational Safety and Health (NIOSH) values represent the maximum concentration from which one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects (NIOSH 1994).
* Chemical known to the state of California to cause cancer (22 CCR §12000).
C Ceiling limit; OSHA and Cal/OSHA concentrations that must not be exceeded during any part of the workday.
skin "Skin" notation indicates potential for dermal absorption.
Ca NIOSH (1997) recommends substance be treated as a potential human carcinogen and exposures reduced to lowest feasible concentration.

NA	Not available or applicable	dioxin	2,3,7,8-Tetrachlorodibenzo-para-dioxin
NE	No level established	CNS	Central nervous system
DEHP	di-Ethylhexyl phthalate	mg/m³	milligrams per cubic meter

Copies of all MSDSs, as discussed in the METRIC Comprehensive HSP (Subsection 6.4) and the Basewide HSP (Subsection 8.5.1), will also be forwarded to McClellan AFB before hazardous materials are brought on to the base or work site.

9.5.4 Radiological Hazards

Contact with or exposure to radiological contaminants present within surface or subsurface soils at the candidate non-VOC sites, primarily the landfill sites, may occur. The radiological hazards include the potential for direct exposure to ionizing radiation or ingestion, inhalation, and absorption of the radionuclides ^{226}Radium, ^{137}Cesium, and ^{90}Strontium. ^{226}Radium emits alpha, beta and gamma radiation; ^{137}Cesium emits primarily beta radiation with secondary emissions of gamma radiation; and ^{90}Strontium emits only beta radiation. Potential radioactive wastes were likely generated during removal of radioactive paints used for aircraft instrument dials, laboratory supplies, medical wastes, and wastewater potentially contaminated with low-level radioactivity that may have been disposed in the landfill. There is also a potential for other low-level radioactive wastes to be present at any of the other candidate sites being surveyed.

Internal radiation exposure presents the greatest hazard. Radionuclides commonly enter the body through inhalation and ingestion of contaminated materials. External radiation also presents a hazard, but radiation monitoring at McClellan AFB to date indicates that hazards due to external exposure are low. Internal radiation exposure will be controlled by performing radiation screening to identify contaminated soils and materials, using appropriate PPE, and following strict decontamination and personal hygiene practices. Real time monitoring will be conducted throughout the site survey, soil sampling, excavation, analyses, and bench-scale treatability test activities.

X-ray fluorescence (XRF) analysis may be used to analyze for lead in soils throughout the bench-scale test. The JV treatment system operators (Surbec-ART and Brice Environmental Services Corp) will be responsible for operation of the XRF analyzer instrument. The instrument contains radioactive material, but when used properly it does not pose a radiation hazard. The radioactive sources (^{55}Iron, ^{109}Cadmium, ^{241}Americium) are encapsulated and also protected and shielded by metal source holders. The instruments have built in fail-safe designs that will drive sources into a safe position in the event of a power failure during sample analysis. Only the sample is directly exposed to the radioactive source or probe, and the operator uses a sample shield that prevents any external exposure to the source. Unless the instrument is damaged there is no leakage. Consequently, under normal operating conditions there is no need to monitor personnel for radiation exposure due to the operation of the XRF instrument. Nevertheless, the operator and licensee, is subject to U.S. Nuclear Regulatory Commission regulations; and the requirements of the California DHS for licensing of radioactive material (17 CCR §30100, *et seq.*, and §36000, *et seq.*; Health and Safety Code §114960, *et seq.*). The requirements include record keeping, training, periodic leak testing, inspection, and instrument maintenance.

Field personnel should refer to the METRIC Comprehensive HSP Attachment 17-A, Radiation Safety Standard Operating Procedures, for additional information and guidance on radiation hazards, acceptable exposure levels, control measures, and monitoring instruments and devices.

9.5.5 Excavation Hazards

At the landfill site, the trenches are expected to be as much as 8 feet bgs. At the other sites, sampling will require that only shallow pits be excavated to depths no deeper than 2 feet bgs. Personnel will not be permitted to enter any excavations exceeding a depth of 4 feet unless appropriate excavation protection (sloping or shoring) has been completed in accordance with URS Safety Management Standard (SMS) for excavation safety.

Potential injuries or fatalities associated with excavations and trenching activities are almost always the result of an unprotected trench or excavation collapsing and trapping or burying workers. Injuries can also occur when equipment or construction materials fall into a trench or excavation and strike worker(s), or when hazardous (toxic vapors, fumes/gases) or oxygen deficient atmospheres are created in an enclosed trench/excavation. Cave-ins are commonly the result of failure to install proper protection in the trench/excavation (shoring and sloping) on the basis of soil type (i.e., stability), trench depth and width, and expected loads. Materials or equipment falling into trenches/excavations is generally the result of a failure to establish and enforce appropriate controls (barriers, warning systems) to prohibit personnel from working or operating equipment near the edge of excavations. Exposure to hazardous atmospheres in trenches/excavations is generally a result of a failure to adequately monitor the atmosphere to ensure it is safe for personnel to enter.

In accordance with US SMS for excavation safety, a general job-site inspection checklist is to be employed to document that all safety issues have been adequately addressed. SMS 113 for excavation safety, included in Attachment F of Appendix A, provides a checklist, soil classification and sloping guidance, and an excavation authorization form.

Other hazards associated with excavation activities are related to the operation of heavy mobile equipment. The hazards and control measures are discussed in the SHSP (see WIP Subsection 9.5.2.2) and SMS 19 included in Attachment F to Appendix A. Field personnel engaged in activities around operating heavy equipment should be reminded to be aware of the location, speed, and direction of heavy equipment and to make their presence known to the operators.

9.6 PERSONAL PROTECTIVE EQUIPMENT AND CONTROLS

Section 12.0 of the METRIC Comprehensive HSP identifies the policies, procedures and guidelines used in the selection of PPE and respiratory protection for the project.

9.6.1 Level of Protection

The level of PPE required at project work sites depends not only on the specific work tasks to be performed but also on the monitored conditions and observed hazards present at the site. All field personnel engaged in specific tasks must wear appropriate PPE specified for that task, and when activities involve potential exposure to chemicals or other exposure hazards that cannot otherwise be adequately controlled through engineering or administrative controls. Respiratory, dermal, eye, head, hand, and foot protection are required when activities may result in exposure to airborne dust or other chemical or physical hazards. Chemical hazards, as discussed in Subsection 9.5.2, include dermal, eye, or inhalation exposure to airborne dust. To avoid or control exposure to these substances, personnel will be provided with, and required to use, PPE that is specific to the individual's work tasks and potential work site hazards. PPE selection criteria and USEPA protection levels are summarized in the METRIC Comprehensive HSP, Subsection. 12.7

PPE requirements for specific activities or tasks are summarized in Table 9-5. Each level of protection will incorporate PPE shown in Table 9-6. The SSC and PM will ensure that the required PPE is inspected, and maintained in serviceable and sanitary condition during the course of project activities. Any defective PPE will be discarded or returned to the manufacturer.

USEPA Level D PPE will provide the basic work uniform for project field personnel. As shown in Table 9-6, it includes: hard hat, steel-toed safety boots (leather, rubber, polyvinyl chloride [PVC], neoprene), heavy-duty work gloves, safety glasses, goggles or face shield, and ear plugs/ear muffs (noise levels >85 dBA). This level of protection is the minimum required during routine tasks at project work sites where there is no potential inhalation or dermal exposure to air-borne chemicals, soil contaminants, or contaminants on equipment or other surfaces.

USEPA Level D-modified which includes the above PPE as well as chemical or water-resistant coveralls (Tyvek®/Saranex®), rubber apron, chemical-resistant splash shield (visor attached to hard hat or separate), steel-toed rubber or neoprene safety boots, and chemical-resistant gloves (Nitrile® or latex). This PPE is the minimum level of protection required when there are no inhalation hazards (*i.e.*, exposure to dust or vapors exceeding PELs) based on results of personal monitoring, but will provide sufficient protection from potential dermal or eye exposure. Personnel engaged in cleaning surfaces or equipment with high-pressure washers, will don appropriate chemical-resistant clothing (safety boots, rain suits, gloves, eye and face protection, hearing protection, etc.). Respiratory protection or Level C PPE, discussed below, may also be required for these activities unless cleared by the SSC. The SSC is responsible for determining the need to upgrade (or downgrade, if appropriate) PPE required for particular site activities.

Table 9-5

TASK-SPECIFIC REQUIRED LEVELS OF PROTECTION

Work Area	Activity/Work Task	Level of Protection	
		Anticipated	Contingency
All	Non-intrusive activities Site setup Equipment assembly Work area delineation Site inspection	Level D	Modified Level D
Support Zone	Site management/supervision Shipping/receiving supplies	Level D	Modified Level D
EZ-1 (Treated Soil Storage)	Treated material storage Material handling Sampling activities Treatability lab activities	Modified Level D	Level C
EZ-2 (Feed Soil Storage)	Feed soil storage STSP disposal Material handling Soil processing	Modified Level D	Level C
Soil Excavation Areas	Soil excavation	Modified Level D	Level C

EZ Exclusion Zone
STSP Secondary Treatment Staging Pile

Table 9-6

PERSONAL PROTECTIVE EQUIPMENT

Level of Protection	Required Personal Protective Equipment (PPE)
Level D	Boots: steel-toed work boots Outer gloves: leather or rubber work gloves, as necessary Head protection: hard hat Eye protection: safety glasses, goggles, or face shield Hearing protection: ear plugs and/or ear muffs
Modified Level D	All of the above Level D PPE plus the following: Boots: steel-toed rubber safety boots Inner chemical-resistant gloves: Nitrile® or latex Protective coverall: cotton, Tyvek® or, as necessary, chemical-resistant (*e.g.*, Saranex®) coveralls or rubber apron Chemical-resistant splash shield
Level C	All of the above Modified Level D PPE plus the following respiratory protection: Respirator: half- or full-face air-purifying respirator with organic vapor/P100 filter cartridge

USEPA Level C will be used when airborne concentrations are at levels that pose a potential inhalation hazard but are low enough that an air purifying respirator (APR) provides sufficient protection. Level C PPE will include all of the above Level D-modified PPE plus a half- or full-face APR fitted with P100 filter cartridges (formerly high-efficiency particulate air [HEPA] filters) or combination organic vapor/P100 filter cartridges, if organic vapors are present. This level of protection is the minimum required when airborne concentrations exceed PELs. Level C will be worn whenever there is a potential exposure to airborne particulates or dust, and personal monitoring indicates PELs may be exceeded and there is an increased potential for exposure to dust, particulates, or other airborne contaminated media. Level C will be the minimum level of protection during field tasks that generate or otherwise expose personnel to dust exceeding, or potentially exceeding their PELs or action levels.

There are no provisions to upgrade to Level B. If conditions are encountered requiring an upgrade, activities will be halted until such time as the PM, SSC, and project team H&S supervisory personnel, in consultation with the HSM, establish it is safe to resume work in Level C or Level D PPE. If Level B or Level A is required, an SHSP modification will be prepared specifying the protocols and PPE to be used.

9.6.2 Engineering/Administrative Control Measures

The project team will be constantly reminded during daily safety meetings to be aware of potential chemical and physical hazards and to immediately inform the SSC, PM, or supervisory personnel of any unsafe conditions or new hazards they may encounter. The SSC and/or PM are responsible for overall site control measures (*e.g.*, marking, warning signs, placards, erecting barriers, securing access) and informing field personnel of the hazards associated with each treatment system operation and associated work tasks during daily "tailgate" safety briefings. Special engineering control measures include water mist/tarps for dust control. The appropriate PPE required for specific work tasks and work sites were discussed above.

In addition to the control measures identified in Table 9-3, the PM and SSC are to ensure that following measures are implemented at project work sites to reduce the risk of injuries or exposure:

- Adequate lighting is to be provided whenever treatment system operations or project activities are conducted during evening or nighttime hours or in areas with poor lighting. Work areas require a minimum intensity of 30 footcandles. Areas outside of the immediate work areas (exitways, walkways, stairs, etc.) may require substantially less illumination, normally about 10 footcandles. Lighting is to be arranged so that any single lighting unit failure will not leave any area of the work site in total darkness.
- All persons shall follow safe work practices, render every possible aid to safe operations, and report all unsafe conditions or practices to the SSC or PM.
- The SSC shall insist on employees observing and obeying every rule, regulation, and orders necessary for the safe conduct of the work, and shall take such actions as are necessary to ensure observance.
- Anyone known to be under the influence of drugs or intoxicating substances shall not be allowed on the job while in that condition.
- Horseplay, scuffling and other acts which tend to have an adverse influence on the safety or well being of the employees shall be prohibited.
- Work shall be well planned and supervised to prevent injuries in the handling of materials and in working together with equipment.
- No one is to be knowingly permitted or required to work while his/her ability or alertness is so impaired by fatigue, illness, or other causes that it might unnecessarily expose him/her or others to injury.
- Employees shall not enter manholes, underground vaults, chambers, tanks, silos, or other similar places that receive little ventilation, unless it has been determined that it is safe to enter.
- Employees shall be instructed to ensure that all treatment system guards and other protective devices are in proper places and adjusted, and shall report deficiencies promptly to the SSC or PM.
- Workers shall not handle or tamper with any electrical equipment, machinery, or air or water lines in a manner not within the scope of their duties, unless they have received instructions from the PM or immediate supervisor.
- All injuries shall be reported promptly to the SSC or PM so arrangements can be made for medical or first aid treatment.

In addition, project field activities will be conducted in pairs, commonly called the "buddy system." The use of the buddy system will ensure project field team members have the assistance of a partner to observe signs of chemical exposure, physical injury, or illness. The partner or "buddy" can secure emergency assistance, notify management or appropriate response agencies in the event of an emergency, and provide any other assistance that may be necessary. Enforcement of the "buddy system" will be the responsibility of the SSC. No one will be permitted to enter a contaminated or potentially hazardous work area unaccompanied. The presence of other authorized subcontractor personnel at the work site will, in most instances, satisfy the buddy system requirement. Routine treatment system operations or related field activities outside of designated work areas or EZs can be handled safely by one person. For these routine activities, the required use of the buddy system can be waived, but only with the approval of the SSC.

9.6.3 Controls for Exposure to Radiological Contamination

Radiological hazards include the possible exposure of field personnel to radionuclides and the potential spread of contamination to other individuals on- or off-Base, sampling and bench-scale treatment system equipment, treated soils, treatment system waste stream, heavy equipment, and personal property (clothing, autos). The following measures will be implemented to control the spread of radiological contamination:

- Surveying each candidate site with direct-reading radiological instruments (see Section 6.0).
- Identifying and clearly delineating contaminated areas, soils, and items based on the survey.
- Establishing perimeters, exclusion zones, or demarcating contaminated areas.
- Prohibiting movement of personnel, equipment, or materials into contaminated areas.
- Monitoring all items, equipment, and personnel exiting work areas.
- Using appropriate PPE, including respiratory protection as determined necessary by the SSC or RSO.

Segregating and avoiding contact with contaminated soils or materials. A lay down area covered with Visqueen or other disposable plastic sheeting will be established near excavations. Soils and materials excavated with the backhoe will be deposited on the sheeting and scanned with the radiological instruments. Contaminated soils or materials (*i.e.*, exceeding twice background radiation) will be segregated and returned to the excavation.

Decontaminating or wrapping equipment or items found to be contaminated. The guidelines for determining when reusable equipment or other items are considered uncontaminated are presented in Table 9-7.

Controlling dust by minimizing initial generation during excavation, including using water or manufactured dust suppressants, scheduling operations to take advantage of prevailing winds, covering any stockpiles for long-term storage, and limiting drop heights from material loading equipment to dump point impact.

Additional information and guidance on radiation safety, monitoring, and instrumentation is presented in the METRIC Comprehensive HSP Attachment 17-A, Radiation Safety Standard Operating Procedures.

Table 9-7

RECOMMENDED MAXIMUM* CONTAMINATION GUIDELINES FOR REUSABLE EQUIPMENT AND ITEMS FOR RADIATION CONTAMINATION CLEARANCE

Direct Reading Instrument (dpm/100 square centimeters)	
Alpha	Beta-gamma
100	1,000

* Detection limit is related to the instrumentation
dpm disintegration per minute

9.6.4 Excavation Safety Measures

Excavation procedures are further detailed in URS SMS 13 for excavation safety (see Attachment F of Appendix A). The requirements of this SMS will be implemented throughout this project.

Entry into an excavation is not anticipated or necessary. Should it be required, prior to entry into an excavation 4 feet deep or greater, the excavation must be shored, sloped, or otherwise made safe for entry. Excavations less than 4 feet in depth that a competent person (as defined by Cal/OSHA and OSHA) has examined and determined to have no potential for cave-in do not require protective systems. Cal/OSHA (8 CCR 1539, *et seq.*) is to be notified before starting work on excavations at depths of 5 feet or more into which workers are required to enter.

All excavations will be performed from a stable ground position. An excavation competent person will perform daily excavation inspections to determine the likelihood of a cave-in. Remedial action, such as sloping or shoring, will be taken if the walls appear to be unstable. In addition, the competent person will verify that adequate means of egress are in place.

All spoil will be located at least 2 feet from the edge of the excavation. Perimeter protection will be used for all excavation activities at the site, consisting of warning barricades or fencing placed at a distance not closer than 6 feet from the edge of the excavation and displaying adequate warning at an elevation of 3 feet to 4 feet above ground.

All project personnel shall participate in the site-specific training session and be instructed on the following requirements:

- Before excavating, the existence and location of underground utilities will be determined and documented. If the locations of any utilities are in question, the appropriate locating tool will be used to positively locate them.
- No ignition sources are permitted if the ambient airborne concentration of flammable vapors exceeds 10 percent of the lower explosive limit (LEL) during the excavation.
- Operations must be suspended and the area vented if the airborne flammable concentration reaches 10 percent of the LEL in the area of an ignition source (i.e., sparks from bucket of excavator).
- Excavations greater than 4 feet in depth that require personnel to enter shall have sufficient means of entry and egress (stairs, ladders, and ramps). Means of entry/egress shall not require personnel to travel laterally more than 25 feet.
- Excavations occurring within 3 feet of communication cables will be performed by hand digging until the cable is exposed.

9.7 PERSONAL MONITORING/AIR SAMPLING

Air monitoring helps ensure that workers, both on- and off-site, are not exposed to airborne contaminants exceeding permissible exposure limits. Monitoring will be conducted during initial treatment system operations, both within the immediate work area and at the work site perimeter. The extent and frequency of subsequent monitoring will depend on initial monitoring results as well as existing work site conditions (*e.g.*, airborne dust, vapors, soil contaminant concentrations). The SSC and PM, in consultation with the project team, will determine the need for additional monitoring.

High volume air samplers will be used to monitor and collect airborne dust or particulate matter within the treatment system work area and at the work site perimeter. Three stations would be set up: two at the perimeter of the work site, one upwind and another downwind; and the third would be placed in the immediate work area subject to the highest levels of airborne dust (stockpile, feed bins, output piles, conveyors, filter press, sludge cake, clarifier, etc.). During the first week of initial operations, particulate samples collected in the work area will be submitted to an accredited American Industrial Hygiene Association (AIHA) laboratory for analysis. The analytes will be limited to those inorganic and organic chemicals previously detected in stockpiled or impacted soils to be treated. The frequency, analytes, and extent of subsequent sampling during the remaining weeks of project activities will depend on the site conditions and analytical data from earlier monitoring and sampling of stockpiled soils.

Personal monitoring of individual on-site workers will be conducted during the first weeks of operation. Two representative workers will be monitored for an entire work shift. Each worker will have a sampler with appropriate filter media (*e.g.*, mixed cellulose ester, Teflon®, PVC) attached to his/her collar and positioned in the breathing zone. The sampler, connected to a calibrated personal sampling pump and attached to the workers belt, will simulate dust potentially inhaled through the nose and mouth. The sampler filters with the trapped particulates will then be submitted to an AIHA laboratory for analysis and determination of 8-hour time-weighted average worker exposure levels for each suspected contaminant based on analytical data for the excavated site or stockpiled soil.

The results of the monitoring will help to determine the need for additional control measures to suppress dust and particulate emissions at the perimeter of treatment system and within the immediate work area. Dust suppression and other engineering controls commonly instituted to control dust (*e.g.*, misting and watering) will be the primary measures implemented to control airborne particulate emissions.

A direct-reading aerosol monitor (MIE PDM Miniram) will be used to provide real-time concentrations of airborne particulates, mists, fumes and aerosols at the project work site. In concert with the use of the aerosol monitor, action levels for total dust in the work area and at the perimeter of the work site will be developed. The action levels will be based on the results of the analyses of airborne particulates collected during initial air monitoring, as well as available analytical data for the excavated site or feed stockpile soils. Any time the action level is exceeded, as measured by the monitor, SHSP-identified control measures must be implemented. Action levels for the different stockpiled soils will be calculated using the following relationship:

$$\text{Action level (mg/m}^3\text{)} = \frac{CF}{Cs/PEL}$$

Where

CF	=	Conversion factor (10^6 mg/kg)
Cs	=	Stockpiled soil contaminant concentration (mg/kg)
PEL	=	Soil contaminant permissible exposure limit (mg/m^3)

A PID will also be used to monitor the presence of airborne vapors and gases. Although soils selected for treatment are from sites that are expected to contain SVOCs and/or metals, there is a potential that VOCs may be present in some soils. Consequently, the PID will be used to monitor the presence of total VOCs at the work site even though VOC concentrations in open, well-ventilated areas of the work site are not expected to pose a potential exposure hazard. The action levels for total organic vapors or VOCs, noise levels and particulate matter are summarized in Table 9-8.

9.7.1 Radiological Monitoring and Control Measures

URS strongly supports the policy of maintaining exposures as low as reasonably achievable (ALARA). The overall objective of the ALARA program is to control radiation exposure to field personnel as well as subcontractors, and members of the public such that all exposures are well below applicable regulatory limits. As discussed in the Radiation Safety Standard Operating Procedures (see METRIC Comprehensive HSP Attachment 17-A) it is the essential that individual and collective dose equivalents be maintained at ALARA levels. This applies to annual, committed, and cumulative dose equivalents. Natural background, therapeutic, and diagnostic medical exposures are not included in occupational exposure.

Occupational and non-occupational radiation exposure or dose limits have been recommended by the Nuclear Regulatory Commission, International Commission on Radiological Protection (ICRP), OSHA, and the National Council on Radiation Protection (NCRP). The recommended maximum whole-body radiation dose is currently 5 rem per year. The recommended action level for occupational radiation exposure is 1 milliroentgen per hour (mR/hr), which is considered an extremely safe level. An individual would have to be continuously exposed to 1 mR/hr for 14 hours per work day for an entire year before the maximum recommended annual dose limit of 5 rem would be exceeded.

The primary means of controlling radiological exposures are by controlling access and duration of stay in radiation areas. The methods used to control exposure include evaluating the radiological conditions, specifying proper precautions, providing experienced health physics personnel, providing extra controls for high radiation areas, posting areas, using appropriate protective clothing, monitoring personnel, and updating personnel records to determine where exposure reduction is warranted.

The SSC and RSO are responsible for ensuring that field personnel are appropriately monitored for exposure to ionizing radiation. Given the short project duration, personal dosimetry, such as film badges or thermoluminescent dosimeter badges are not considered necessary and will not be used during field activities associated with the bench-scale test. However, dosimetry will be provided when deemed necessary by the SSC or RSO.

Table 9-9 summarizes radiation monitoring requirements. All radiological detection instrumentation will be carefully maintained, calibrated , and source checked prior to use in the field. The radiological monitoring instruments to be used include a Ludlum Model 177 Geiger-Mueller Meter (Geiger counter) with a pancake probe, and a Ludlum scintillation detector which incorporates a sodium iodide crystal into the probe. The Geiger counter is able to detect very small amounts of beta, gamma, and x-ray radiation, and is especially sensitive to beta radiation. The scintillation detector is used for the detection of low energy gamma emitters and reports the readings in units of dose equivalent (e.g., mrem/hr; mR/hr). The efficiency or sensitivity of a scintillation probe may be better than a Geiger-Muller probe for some radionuclides.

Table 9-8

ACTION LEVELS

Contaminant/ Hazard(DRI)	Reading*	**Action****
Unidentified Vapor or Gas (PID - 10.2 eV or 11.7 eV lamp)	<1 ppm	Continue operations in Level D.
	>1 to <5 ppm (intermittent***)	Continue operations in Level D. Identify vapor with colorimetric detector tube(s) and locate source, monitor continuously.
	>1 to <5 ppm (continuous***)	Requires Level C. Continue operations, check for leaks in treatment system, implement engineering controls, and continue to monitor area with PID.
	>5 to <25 ppm (intermittent***)	Shut down treatability system, remove personnel, and discontinue operations at the work site. SSC in Level C, to identify vapor/gas, attempt control, and monitor continuously. Operations not to continue until SSC determines it is safe to do so in Level C or Level D PPE. Notify McClellan AFB.
	>25 ppm (continuous***)	Shut down treatment system. SSC or PM to immediately notify and consult with McClellan AFB to determine next course of action.
Noise Level (Sound Level Meter)	85 dBA (continuous***)	Continue operations
	>85 dBA, <120 dBA (continuous***)	Continue operations wearing combination of hearing protection (*i.e.*, ear plugs, ear muffs) with noise reduction rating (NRR) sufficient to attenuate noise level to ≤ 85 dBA
	>120 dBA	Continue operations only if hearing protection sufficient to attenuate noise level to 85 dBA; continue to monitor and initiate acoustical control measures (noise buffers, enclosures, etc.)
Particulate Matter/Airborne Dust (Aerosol Monitor)	<1 mg/m^3	Continue operations
	1 to <2 mg/m^3 (continuous)	Continue operations; implement additional dust control measures; monitor continuously.
	>2 to 10 mg/m^3	Require level C; notify McClellan AFB, JV H&S manager and/or office safety coordinator; implement mandatory dust suppression measures, and reduce operational activities
	<10 mg/m^3 (continuous)	Discontinue operations.

*	Readings above background levels taken at the worker's breathing zone.
**	Action levels for unidentified vapor/gas is based on non-methane compounds.
***	Intermittent = less than one minute; continuous = more than one minute.
PID	Photoionization detector
PM	Project manager
ppm	Parts per million
mg/m^3	Milligram per cubic meter
SSC	Site safety coordinator
eV	Electronvolt
dBA	Decibel (A-weighted scale)
DRI	Direct reading instrument

Table 9-9

RADIOLOGICAL MONITORING

Parameter	Monitoring Instrument	Action Level	Response Action
External Beta/Gamma Radiation	Scintillation detector	<1 mR/hr (at 1 foot)	Continue activities
		>1 mR/hr<10 mR/hr (at 1 foot)	Continue activities; Notify McAFB, URS PM, SSC, and FCO
		> 10 mR/hr (at 1 foot)	Stop activities; Notify McAFB, PM, SSC, and FCO
Alpha Radiation on Exterior Surface	Geiger-Muller Detector	> 5,000 dpm/100 cm^2	Stop activities; Notify McAFB, PM, SSC, and FCO

mR/hr = milliRoentgen per hour
dpm = disintegration per minute

9.8 SITE CONTROL

Site control measures, including establishment of work zones (support zone, contamination reduction zone, and exclusion zone) are addressed in the Basewide HSP Subsection 8.7 (included as Attachment D to Appendix A), and the METRIC Comprehensive HSP Section 15.0.

9.8.1 Work Site Access and Security

Access to McClellan AFB and project work sites is controlled at various entry gates (*e.g.*, Peacekeeper or Main Gate, Palm Gate, Bell Avenue Gate) such as depicted on the McClellan AFB Facility Map, included in Attachment D to Appendix A (also see METRIC Comprehensive HSP Figure 3-2). Visitors are required to check in at the entry gate guardhouse and present their license and car registration. Project field personnel will be issued identification badges.

Access to the project work site will be limited to authorized JV and project team, McClellan AFB, state, and federal regulatory personnel. Only visitors who have received prior authorization from appropriate JV project team or McClellan AFB management or supervisory personnel will be permitted entry to the work site.

The SSC or PM will be responsible for coordinating site access control and security during project activities. The SSC will be responsible for securing, issuing, and returning all McClellan AFB identification badges and, if necessary, controlled area badges for authorized visitors. Appropriate warning signs will be posted at the work site to delimit any areas that are "off limits" to non-authorized personnel, and to indicate potentially hazardous conditions, or required precautions (*e.g.*, hard hat area, eye protection required, no smoking). Authorized visitors will be advised of the potential hazards at the work site and will not be permitted entry, unless they meet training/medical qualifications, read the SHSP, and agree to adhere to its requirements.

9.8.2 Site Communications

Cellular telephones will be assigned to project team personnel to ensure that at least one telephone will always be available at a work site.

9.8.3 Work Site Shutdown

The PM, SSC, and FOC are authorized to discontinue project activities and evacuate the work site for several reasons, including but not limited to the following:

- Continuous readings (2 to 5 minutes) in the breathing zone of field personnel with direct-reading monitoring instruments (e.g., PID, OVA, toxic gas /combustible gas indicator) read total organic gases/vapors exceed 100 parts per million by volume (ppmv).
- Detector tubes or other specific chemical measurements in the breathing zone of any member of the field team indicates concentrations 10 times the OSHA Permissible Exposure Limit (see SHSP, WIP Table 9-4).
- Uncontrolled release of radioactive material.
- Combustible gas concentrations greater than 10 percent of the lower explosive limit (LEL).
- Fire at or in close proximity (100 yards) to the work site.
- An explosion occurs in the vicinity.
- Excavation or trenching encounters buried utilities, drums, tanks, or evidence of compressed gas cylinder, or medical waste.
- A severe injury to a member of field team.
- Observation of flagrant noncompliance with the requirements set forth in the SHSP.

When any of these conditions exist, the PM, SSC or FCO will stop and field activities and evacuate the site. The situation will be further assessed by the PM, FCO, and SSC in consultation with McAFB to determine the appropriate action and when reentry may be allowed.

9.9 DECONTAMINATION

Equipment decontamination procedures and requirements for the storage, maintenance, and disposition of operational and investigation-derived wastes are briefly addressed in WIP Sections 6.0 and 7.0, and discussed in further detail in the Decontamination Plan, Appendix D. General decontamination procedures are also addressed in the JV decontamination plan included in Section 13.0 of the METRIC Comprehensive HSP, and the Basewide HSP Subsection 8.8.

Site personnel may become contaminated during the course of project activities. Possible avenues include contacting airborne dust, particulates; splashed materials or walking through puddles or sitting or kneeling on contaminated surfaces; and using contaminated instruments or equipment. Although PPE and good work practices protect field personnel from direct contact and reduce contamination of instruments and equipment, it cannot be completely avoided.

Contaminants can be transferred to clean areas and off-site, potentially exposing unprotected project team and McClellan AFB personnel, and the public. To prevent such occurrences, general and site-specific safety rules, training, and decontamination procedures consistent with the following guidelines will be implemented at project work sites.

The extensiveness of decontamination procedures depends primarily on the nature and extent of contamination at the work site. Hazardous contaminants (*e.g.*, toxic, corrosive, reactive, etc.) require more extensive and thorough decontamination. The extent of the contamination and nature of the treatment system work activities could expose personnel to contaminated soils, sand, sludge, dust, water and surface areas. Consequently, the decon procedures discussed in the following paragraphs will be instituted during initial project activities. As conditions change, the SSC will revise these procedures accordingly.

9.9.1 Personnel Decontamination

Field personnel will decontaminate any reusable PPE and other equipment at the completion of their work shift. All disposable PPE and other equipment will be disposed in plastic trash bags and placed in 55-gallon drums for disposal by McClellan AFB. Any reusable sampling equipment will be decontaminated following sampling in accordance with the provisions specified in the WIP Sampling Plan (see Subsection 7.1.3.6). A system of sequential decon stations will be established if deemed necessary by the SSC. Such a system would be used and consist of individual stations separated by a minimum distance of three (3) feet to reduce the spread of contaminants during decon and doffing of PPE. The following minimum decontamination procedures will be employed at project work sites.

- Boots encrusted or heavily soiled with potentially contaminated dust, dirt, soils or other substances will be cleaned with a stiff brush and wash water. Disposable coveralls and outer gloves will be discarded in a lined trashcan or plastic trash bag for subsequent removal and disposal.
- Rubber boots are to be washed using a scrub brush and detergent water solution followed by a thorough rinse.
- Hardhats and safety glasses will be cleaned with a damp cloth or paper towel and rinsed with clean water.
- Personnel will remove boots, gloves and protective coveralls or other protective outer garments using the inside-out method. All disposable items will be deposited in a lined container.
- All personnel will be encouraged to thoroughly wash hands and face in a wash basin prior to leaving the work site.
- When APRs are used, the following doffing and decon sequence will be followed:

    1. Enter area established for decontamination.
    2. Remove respirator by loosening straps and gently pulling the respirator over the top of the head.
    3. Remove cartridges and dispose in plastic trash bag or lined container.
    4. Place respirator on designated plastic sheet or in plastic bags for subsequent cleaning, disinfection, inspection, and storage.

The SSC will instruct all field personnel to avoid contact with potentially radiologically-contaminated soils, surfaces, and materials as much as possible. Nevertheless, individuals who may have come into direct contact with contaminated soils or other items will be screened by the SSC or RSO for contamination on clothing and skin, and if present, will be subject to decontamination to ensure that contaminants (chemical and radiological) are not transferred away from the work site. Personnel decontamination will consist of the following steps:

- Removal of any gross contamination from outer clothing and boots.
- Removal of PPE (Tyvek® coveralls, gloves, hard hats, boots, respirators) if worn; dispose of coveralls and gloves, and thoroughly wash hard hats and clean or wash boots.
- Thoroughly wash hands and face (respirators, if used to be cleaned, sanitized and placed in plastic storage bags).
- Screen with radiation detection instruments (frisking) prior to exiting work site.

The RSO and SSC will evaluate any positive findings (instrument readings above normal background). Successful decontamination will be confirmed by the RSO. If necessary, individuals not successfully decontaminated to acceptable levels (e.g., 250 dpm/100 cm^3 for alpha, and 1,000 dpm/100 cm^3 for beta-gamma) will be referred to the McAFB Radiation Health Protection Office, city fire department, or the nearest hospital equipped and trained to treat patients who may be radiologically contaminated (U. C Davis Medical Center, 2315 Stockton Blvd. Sacramento).

9.9.2 Equipment Decontamination

Heavy equipment, including treatment system components, trucks and other vehicles, when covered in mud, dirt, or potentially contaminated soil, will be decontaminated prior to leaving the work site. If site conditions result in grossly dirty or contaminated heavy equipment, it may be necessary to use high-pressure spray cleaners. Nevertheless, any dirty or potentially contaminated tires should be cleaned prior to exiting the site. An Equipment Decontamination Plan is included in Appendix D of this WIP.

Reusable equipment should be cleaned or decontaminated either by high-pressure washing or a series of washings using generous amounts of water. Reusable sampling equipment will be decontaminated in accordance with provisions of the WIP Sampling Plan (see Subsection 7.1.3.6) using a decon solution, as necessary, followed by a series of potable or deionized water rinses, and a final ASTM Type II water. Materials and equipment suspected of having been in contact with radiologically-contaminated soils or other materials will be screened by the RSO and SSC. The RSO health physicist will decide based on screening readings (see Table 9-7) and the item itself whether decontamination of items is warranted or if the item should be disposed of as radioactive waste. Equipment decontamination will be conducted at the discretion of the RSO. The process used will be a function of the type of material to be decontaminated, the contamination levels involved, and the available facilities. Field personnel may perform simple decontamination using pre-moistened wipes on low- and medium-contaminated surfaces.

Any vehicles or heavy equipment with detectable contamination will be decontaminated prior to leaving the work site. If the level of contamination anticipated is low, decontamination for heavy equipment and vehicles will be limited to washing of tires and bucket with water. The RSO, FOC, and SSC will determine the best method for decontaminating vehicles and equipment. Decontamination of heavy equipment (e.g., backhoe) will be performed at the completion of each of the excavations. While at the work site, the equipment will be cleaned of gross soil and debris using brushes and scrapers. Following removal of the bulk materials, the equipment will be screened for radioactive contamination using the screening procedures established by the RSO. If further decontamination is required, the equipment will be moved onto a portable, self-contained wash pad and pressure washed to remove residual contamination. Following pressure washing, the equipment will be re-screened to confirm that decontamination has been successful. Residual liquids will be containerized and disposed of along with the solid radiological wastes.

9.9.3 Disposition of Project-Derived Wastes

All disposable PPE, equipment, plastic sheeting and other items will be placed in plastic trash bags for disposal. All hazardous wastes will be properly stored (*e.g.*, 55-gallon drums), labeled, and managed in accordance with Chapter 4 of the McClellan AFB Hazardous Waste Management Plan (SM-SLC-McAFB Instruction 32-2, 1996). The PM will notify the McClellan AFB CO and SM-ALC/EMPC personnel of the type and quantity of hazardous waste expected to be generated. McClellan AFB will provide proper containers and arrange for the proper disposal of the waste. Spent rinse and decontamination water will be collected and stored in 55-gallon drums in compliance with the McClellan AFB Hazardous Waste Management Plan. The project team will label, test and classify the spent water pending pickup by a McClellan AFB contractor for ultimate disposal. The PM, SSC or designee will ensure that wastes are properly containerized, secured, stored, and characterized. Additional requirements for the disposal or disposition of solids and wastewater are provided in WIP Subsections 5.6 and 7.1.3.

9.10 SPILL/RELEASE CONTROL MEASURES

The soil washing and solidification/ stabilization study system will include process interlocks that will store or prevent any possible leaks or spills from reaching overflow situations extending beyond the work site. The SSC, PM, or FOC will ensure that sufficient quantities of sorbent materials, pads, booms or pillows, and other cleanup materials and equipment will be available at the work site to control, neutralize, and clean up small spills. Spill response procedures for chemicals used during the demonstration are provided in the MSDSs. MSDSs are included in Appendix A. A site-specific Spill Control Plan is included in Appendix B.

In the event of a release of hazardous vapors or gases, operations are to be halted and personnel are to immediately evacuate the work site to an upwind location. The McClellan AFB Fire Department is to be immediately notified (dial 9-1-1). The SSC, PM, or FOC will provide every assistance to help McClellan AFB control and stop the release. The SSC will be responsible for monitoring the work site for the presence of any remaining airborne hazards and, in consultation with McClellan AFB and the PM, determine when it is safe for personnel to return to the work site.

9.11 EMERGENCY RESPONSE PROCEDURES

The SSC will post the emergency telephone numbers, included as Table 9-8, and the hospital location maps, included as Figures 9-2 and 9-3, at conspicuous locations in the treatment system trailer and work area. Figure 9-2 depicts and provides directions from the project site to the Bell Ave. gate; Figure 9-3 provides directions from the Bell Ave. gate to Mercy American River Hospital, the nearest emergency medical facility. In the event of an environmental release, personal injury, or adverse event, the McClellan AFB FPM will be notified as quickly as possible (see Table 9-8).

The SSC or PM will evacuate field personnel from the project work site during major incidents or emergencies (*e.g.*, fires, explosions, major chemical releases, injuries, etc.), and immediately notify and request assistance from McClellan AFB and agencies with personnel trained to deal with the specific emergency. This section describes contingencies and emergency response procedures to be implemented at the work site. The procedures are designed to provide field personnel with the guidance necessary to handle most emergency situations.

9.11.1 Emergency Assistance

Table 9-8 provides a list of emergency telephone numbers and contacts. This list along with the hospital access and location maps (Figures 9-2 and 9-3) will be conspicuously posted or maintained near the telephone or other communication network established at the project trailer and work site to identify appropriate emergency assistance personnel and McClellan AFB contacts.

9.11.2 Potential Incidents

Although unlikely, the following situations could potentially occur and would require emergency response actions:

- Sudden release of airborne contaminants (particulates, vapors, combustible gases)
- Uncontrolled releases and spills
- Fire
- Medical emergency
- Acute exposure (inhalation, skin contact, eye contact)

<u>Release of Hazardous Airborne Contaminants.</u> In the event of a sudden release of contaminants (vapors, gases, particulates) constituting a potentially hazardous situation (*e.g.*, adequate respiratory protection is unavailable, IDLH or explosive atmospheres, imminent worker or public safety or health hazard) the PM or SSC will halt operations and evacuate the work site using appropriate emergency signals (air horn, alarm or hand signals) if other personnel are present. The SSC or PM will notify appropriate McClellan AFB emergency response and supervisory personnel identified in Table 9-8 (Fire Department, Emergency Assistance, McClellan AFB FPM, Duty Officer, McClellan AFB Safety Office, etc.). The SSC and PM will assist McClellan AFB or other response personnel to control and stop the release. After the release has been halted, the SSC will be responsible for monitoring the work site for the presence of any remaining airborne hazards and, in consultation with the HSM, project team supervisory personnel, and McClellan AFB, determine when it is safe to restart field activities.

<u>Releases and Spills</u>. The SSC or PM will ensure that sufficient quantities of sorbent materials, pads, booms, or pillows and other cleanup materials and equipment are available at the work site to neutralize spills and provide for a quick, easy, and safe response to any release or spill of fuels, oils or hazardous materials.

<u>Fire</u>. In case of a potentially uncontrollable fire, the PM, SSC or designated on-site supervisor will immediately notify the Fire Department (9-1-1) and determine the extent of the fire, assess the hazard posed to personnel, and whether or not it is safe to attempt to control or extinguish the blaze while waiting for the Fire Department to arrive. Class A:B:C fire extinguishers will be available at the treatment system work site to control or extinguish small or incipient fires. If the fire cannot be controlled, the SSC or designee will evacuate all personnel to a location upwind of the work site. The PM or SSC will advise

the on-site fire chief of the location, nature and types of any hazardous materials, fuels, or other hazards present at the treatment system work site.

Medical Emergency. In the event of a serious injury or illness, field personnel will immediately notify the Emergency Medical Team (EMT) for assistance and an ambulance (9-1-1). The SSC or designee has current certification in first aid or CPR and will be able to provide emergency care before the EMT arrives. Workers with suspected back or neck injuries are not to be moved. If there is evidence of serious trauma or unknown chemical exposure, the employee should be stabilized while awaiting the EMT. A first aid kit will be maintained at work sites for treating minor injuries.

Table 9-10

EMERGENCY TELEPHONE NUMBERS

Richard Beyak, JV, Project Manager	(916) 569-5513
Gary Smith, JV, Site Safety Coordinator	(916) 569-5517 or (916) 717-1623
Jerry Hinck, JV, Office Safety Coordinator	(916) 569-5561
Mark Litzinger, JV, Director of H&S	(206) 674-1800
Jim Lu, McClellan AFB RPM	(916) 643-0830 ext. 466
David Rennie, McClellan AFB Technical Advisor	(916) 643-0830 ext. 410
Paul Bernheisel, McClellan AFB Field Manager	(916) 643-0028 ext. 474
Richard Hight McClellan AFB Safety Officer	(916) 643-6227
Capt. Bob Williams McClellan AFB CO	(916) 643-0741 ext. 338
Emergency Assistance	911 (from a Base phone only until 10/01/2000)
Ambulance	911 (from a Base phone only until 10/01/2000)
McClellan AFB Fire Department	911 (from a Base phone only until 10/01/2000)
McClellan AFB Security Police	911 (from a Base phone only until 10/01/2000)
Duty Officer (Command Post)	(916) 643-2751
McClellan AFB Safety Office	(916) 643-6227
McClellan AFB Medical Clinic (0730 – 1700 hrs, weekdays only)	(916) 643-8420
Unit Environmental Coordinator (UEC)	(916) 643-0228 ext. 358
Utilities (EMCS)	(916) 286-5000
Maintenance Control Center	(916) 643-3780
Off-Base Hospital: Mercy American River Hospital 4747 Engle Road Carmichael, CA 95608	(916) 484-2222
National Response Center (NRC) (Toxic Chemical Releases/Spills)	(800) 424-8802
Regional Poison Control Center (UCD Medical Center – Sacramento)	(916) 734-3692
To telephone McClellan AFB personnel while on base, dial only the last four numbers preceded by a "3" prefix (example: to call 643-6168 dial 3-6168).	

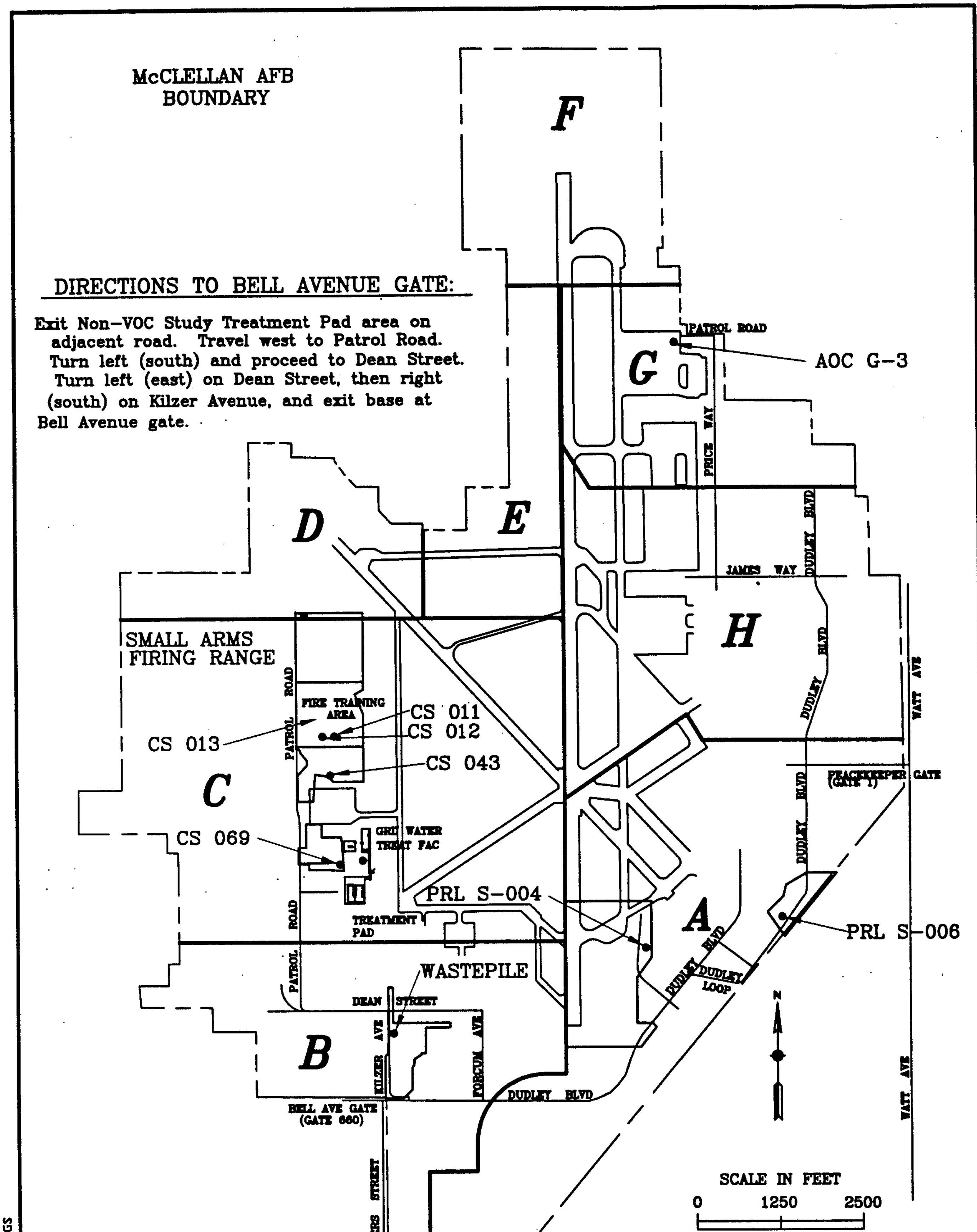
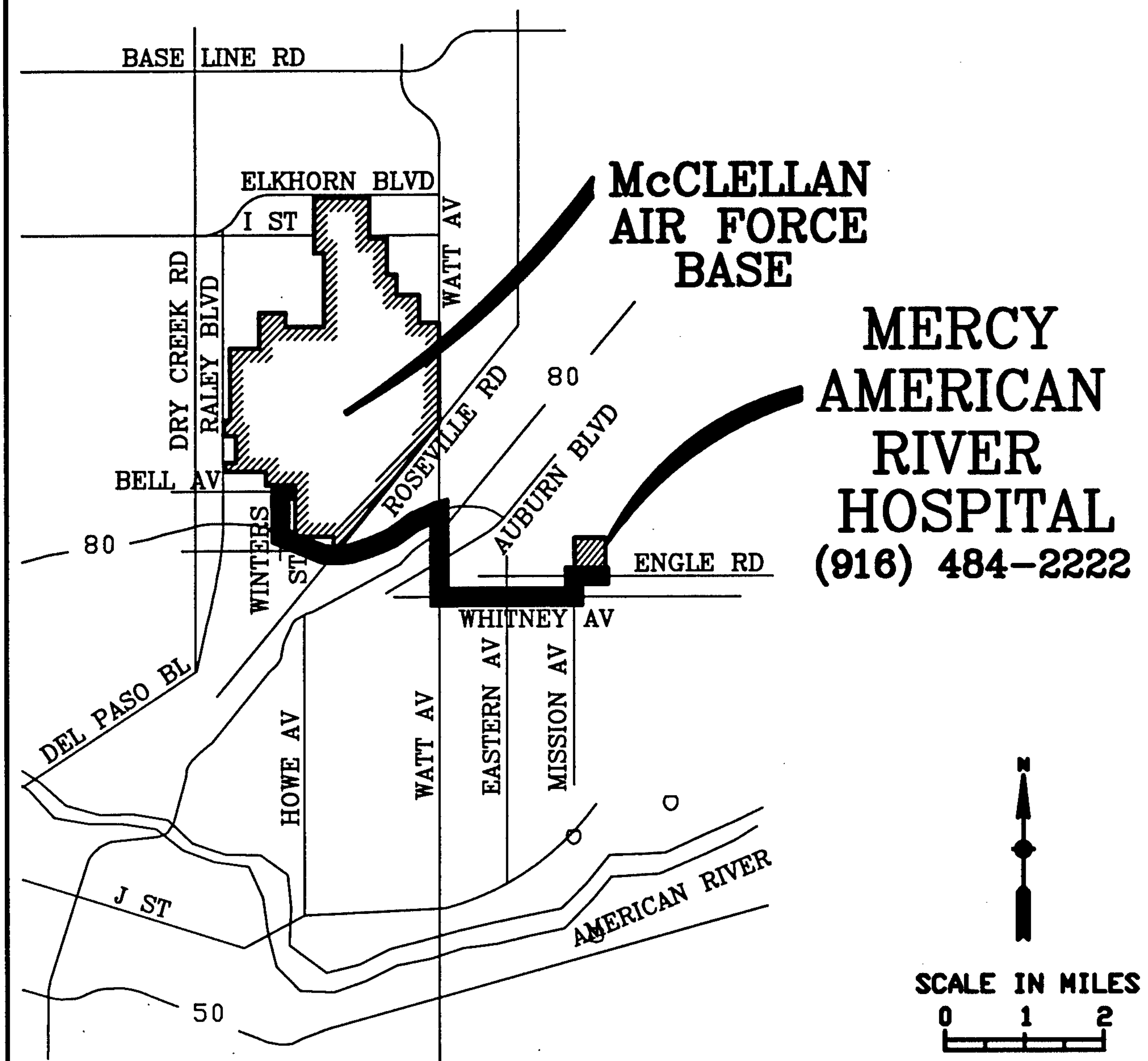


FIGURE 9-2

HOSPITAL ACCESS ROUTE
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

URS Greiner, Inc-Laidlaw

H-AFB\REPORTS\FIGS



Directions To Mercy American River Hospital
4747 Engle Rd., Carmichael

Exit McAFB through the Bell Avenue Gate (Gate 660). Turn left onto Winters St. and continue south to I-80 east bound. Continue on I-80 east to Watt Ave. south. Turn right onto Watt Ave. and travel south to Whitney Ave. Turn left onto Whitney and travel east to Mission Ave. Turn left onto Mission Ave. and continue north to Engle Rd. Turn right onto Engle Rd. and continue east to 4747 Engle Rd.

URS Greiner, Inc-Laidlaw

FIGURE 9-3

HOSPITAL LOCATION MAP
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

M-AFB\REPORT\FIGS

Exposure. In the event of respiratory exposure, dermal or eye contact, or ingestion of a potentially toxic substance, the following procedures will be followed.

Respiratory Exposure (Inhalation). Move to fresh air immediately. Any loss of consciousness or exposure to elevated levels of known toxic substances, even if the individual appears to have fully recovered, requires immediate treatment and/or surveillance by a qualified physician. Transport worker to Mercy American River Hospital or another local medical facility of the worker's choice.

Dermal Contact. Wash/rinse affected area for at least 15 minutes. If an emergency drench system/eye wash is not immediately available or accessible at the project work site, use the available potable water supply provided at each work site. Transport worker to the McClellan AFB Medical Clinic for minor treatment, or, in cases of major injury, to the Mercy American River Hospital or another local medical facility of the worker's choice.

Eye Contact. Flush eye(s) continuously for 15 minutes using the emergency eye wash or available potable water supply, and then transport worker to Mercy American River Hospital or another medical facility of the worker's choice. Follow-up treatment or examination by a qualified physician is required.

Ingestion. Immediately transport to Mercy American River Hospital. The Regional Poison Control Center should be contacted for instructions if the victim cannot be immediately transported to the emergency facility or the emergency facility cannot be contacted.

Burns. A burn first destroys the top layer of skin. If it continues to burn, it injures or destroys the second layer. Burns that break the skin can cause infection and loss of fluid from the body and damage the body's ability to control its temperature. Deep burns can also damage the victim's ability to breathe. A burn that involves only the top layer of skin is the least severe. The skin is red and dry and is painful, but usually heals in 5 to 6 days. Deeper burns are also red, but have blisters that may open and seep clear fluid. These burns are usually painful and the area often swells. Some burns destroy all the layers of skin and the tissues underneath, even bones. These are critical burns. These burns look brown or blackish, and the tissues underneath may appear white. Although they can sometimes be surprisingly pain-free because nerve endings have been destroyed, they can be life threatening and need immediate medical attention. The general care of burns involves the following three basic steps:

Stop the burning. Remove the victim from the source of the burn, and, if necessary put out the flames. Lay severe burn victims down unless the individual is having trouble breathing. Raise the burned area above the level of the heart, if possible. Burn victims chill easily, so protect the victim from drafts.

Cool the burn. Use large amounts of cool water to cool and flush the burned area for several minutes. For chemical burns of the skin or eyes, flush the burn with large amounts of cool running water until the EMS or ambulance arrives and remove any clothes with the chemical on it. Use available potable water or, if available immerse the affected area in water. Do not apply ice or ice water other than on small superficial burns. Ice will cause loss of body heat. Carefully apply soaked towels or cloths to a burned face or other areas of the body that cannot be immersed. Keep cloths cool by adding more water.

Cover the burn. Use dry sterile dressings or a clean cloth to loosely bandage the burn to help keep out air and reduce pain. Covering also prevents infection. If the burn covers a large area, cover with clean, dry cloths. Do not touch the burn with anything except a clean covering; do not try to clean a severe burn; do not remove pieces of cloth that stick to the burned area; do not break blisters; and do not use any kind of ointment on a severe burn.

Emergency medical care is required for any critical burns; burns caused by chemicals, explosions, or electricity; multiple burns; burns on the head, neck, back, hands, feet, or genitals; or the individual is having trouble breathing. Call the EMS or immediately transport the victim to the nearest emergency medical facility.

9.11.3 Communication Network

Cellular telephones will be available to project field personnel. In addition, the PM or SSC will ensure that a communication network is established and in working order at the project work site during initial treatment system start-up.

9.11.4 Adverse Weather Conditions

In the event of adverse weather conditions, the PM or SSC, in consultation with the project team, will determine if field activities can be safely conducted. Some of the conditions posing potential hazards include:

- Dangerous weather-related working conditions (*e.g.*, high winds, heavy rain, smog, etc.).
- Limited visibility.
- Electrical storms.

9.11.5 Notification

In the event of an injury-related accident, hazardous substance release, damage to McClellan AFB property, or emergency situations (existing or imminent), the PM, SSC or designated field personnel must notify appropriate McClellan AFB and project team personnel within 1 to 2 hours. Personnel to be contacted, using the emergency telephone numbers found on Table 9-8, include:

- JV PM, Richard Beyak
- McClellan AFB RPM, Jim Lu
- McClellan AFB FPM, Paul Bernheisel
- McClellan AFB Safety Officer, Richard A. Hight
- McClellan AFB CO, Capt. Bob Williams
- JV OSC, Jerry Hinck

Accidents and incidents will be reported to the OSC, HSM, and McClellan AFB CO, and McClellan AFB FPM on an Accident/Incident Report form within 24 hours of the incident. After an occurrence, the SSC and/or PM will remain at the site until released by the McClellan AFB FPM or CO. Circumstances of the accident/incident and preventative measures will be discussed with the SSC, PM, and project team field personnel prior to resuming regular activities during the next tailgate safety meeting. The SSC or PM will investigate cause(s) and recommend appropriate control measures. The HSM is responsible for reviewing the information and determining if further investigation or corrective measures are required. McClellan AFB will also notify the appropriate state and/or federal agencies of any reportable spills or releases.

Field personnel are responsible for reporting all work-related injuries or illnesses as soon as possible to the SSC, PM, and appropriate company H&S supervisory personnel. Each individual project team member is responsible for documenting and notifying Cal/OSHA of any recordable injuries or illnesses to their employees, and maintaining H&S files, including OSHA logs, training and medical surveillance certificates and records, and worker compensation files. Employee medical files, including records of work-related exposures, accidents/illnesses, are maintained by the project team member's occupational physician.

9.11.6 Exposure/Injury Medical Surveillance

Any project team employee who suffers an illness, injury, or chemical exposure is required to see a physician. Depending upon the extent and type of exposure, illness, or injury, it is critical to perform follow-up testing within 24 to 48 hours. The project team member's H&S supervisory personnel will ensure that appropriate medical follow-up testing is conducted. The physician responsible for conducting the employee's medical surveillance examinations shall be notified and consulted to determine the type(s) of tests required to accurately monitor the employee. A worker may return to work only with the written approval of the attending physician.

9.11.7 Record Keeping

In addition to OSHA and Cal/OSHA record keeping requirements, each JV and project team member will maintain a file of any H&S-related events occurring at the project work site. Any exposure or potential exposures are to be recorded, as well as accidents or incidents that require the filing of an Accident/Incident Report (*e.g.*, injuries, illnesses, accidental damage to property, or "near miss" occurrences that could have resulted in personal injury). A copy of the report is included as Attachment A to Appendix A.

9.12 SHSP APPROVAL, REVIEW AND DOCUMENTATION

Project team personnel will review the SHSP, HSPs, and associated attachments during the initial project work site H&S briefing. Team personnel and visitors entering designated work areas are required to sign the SHSP Acknowledgment of Understanding form. A copy of the form is included in Attachment A to Appendix A. The forms will be maintained by the SSC as part of the project H&S file. The SSC is responsible for informing field personnel of any changes to the SHSP and describing the specific details of the changes during safety meetings. Team field personnel will be informed in writing of the results of any monitoring or sampling conducted during field activities, or any other information indicating possible work site exposure(s). Any data or other documentation indicating possible employee exposure to chemical hazards exceeding PELs will be forwarded to the employee and, upon the employee's request, to his/her personal physician.

This SHSP has been prepared to address known or anticipated work tasks and site conditions at the project work site(s). The SHSP will be revised or modified to reflect significant changes in work site conditions, work site hazards or potential exposures, or the scope of project work tasks.

SHSP Prepared By: Jerry Hinck, Office Safety Coordinator, URSG Sacramento, and Tamara Zielinski, Project Engineer, Field Operations Coordinator, URSG Sacramento
Date: 06/19/00

Approved By: Mark Litzinger, URSG H&S Manager, URSG Seattle

J Hinck for Mark Litzinger Date: 6-28-00

10.0 TECHNOLOGY APPLICATION ANALYSIS REPORT

The TAAR will document the results of a technology application analysis. It will consist of a description of the full-scale remedial strategy along with the associated cost and performance estimates to permanently cleanup non-VOC soil contamination sites. The TAAR will include the following elements:

- Summary of demonstration objectives and how the demonstration met the objectives.
- Brief description of the soil treatment system.
- A description of the site preparation activities.
- Measurement/sampling apparatus and procedures used during the demonstration.
- Soil characterization results and other pre-demonstration measurements including analytical results and laboratory reports.
- Description of demonstration arrangement and pertinent demonstration performance data.
- Relationship of demonstration results to design considerations for full-scale deployment (including possible technical and operational improvements that may be implemented and an implementation plan).
- A review and summary of previous project and demonstration results involving contaminants that are known to be present or known to be similar to those present in soils at McClellan AFB.
- Assessment of the economic performance of the demonstration in regards to energy per ton of treatment, cost per ton, estimated costs of capital equipment and associated operating costs, the estimated maintenance costs and resulting downtime, and secondary waste estimates for full-scale deployment.
- Assessment of the technology performance in regards to rate of treatment and efficiency.
- A review of the risks associated with the treatment system or test setup and a summary of the H&S issues and recommendations for improved H&S and operating parameters for full-scale deployment.
- A data package that contains copies of all analytical results, photographic records, written notes, monitoring data, operational data, and other data that are generated during the project.
- A discussion of how the demonstration results conform to the long-term remediation needs and requirements at McClellan AFB.
- A comparison to baseline lifecycle costs, and a projection of associated savings for full-scale operations.

An outline of the TAAR is presented below.

1.0 EXECUTIVE SUMMARY
- 1.1 Background
- 1.2 Soil Washing and Solidification/Stabilization Study Description
- 1.3 Results
- 1.4 Conclusions
- 1.5 Recommendations

2.0 INTRODUCTION AND BACKGROUND
- 2.1 National Environmental Technology Test Sites
- 2.2 Technology Objectives
- 2.3 Technology Overview
- 2.4 Soil Washing and Solidification/Stabilization Study Scope
- 2.5 Baseline Costs
- 2.6 Document Organization

3.0 SITE DESCRIPTION
- 3.1 Selected Sites

4.0 DEMONSTRATION DESCRIPTION
- 4.1 Technology Principles
- 4.2 Treatment System Installation and Operation
- 4.3 The Two Phases of the Technology Demonstration
- 4.4 Sampling Strategy and Quality Assurance/Quality Control (QA/QC) Results
- 4.5 Sample Designation
- 4.6 Field Quality Control

5.0 TECHNOLOGY PERFORMANCE EVALUATION
- 5.1 Optimization
- 5.2 Remediation Efficiency
- 5.3 Process Flow Efficiency

6.0 OTHER TECHNOLOGY ISSUES
- 6.1 Environmental Regulatory Requirements
- 6.2 Personnel Health and Safety
- 6.3 Community Acceptance

7.0 COST AND SENSITIVITY ANALYSIS
- 7.1 Basis of Cost Analysis
- 7.2 Cost Categories
- 7.3 Results of Cost Analysis

8.0 RECOMMENDATIONS

9.0 CONCLUSIONS

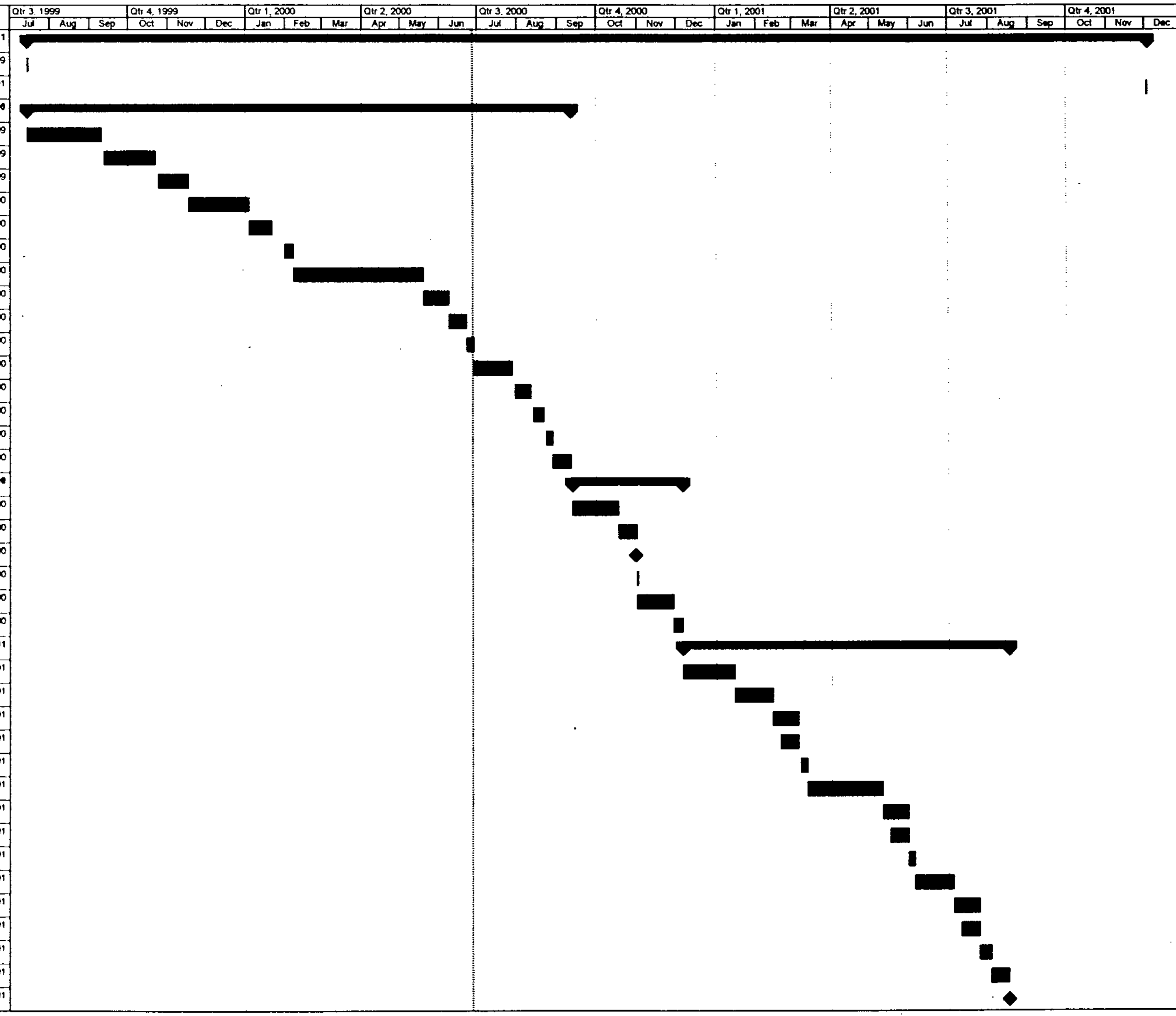
10.0 REFERENCES

11.0 SCHEDULE

The schedule for the technology demonstration, including the time period for pre-soil washing and solidification/ stabilization study activities, milestones, and other critical dates or time periods is presented in Figure 11-1.

SOIL WASHING AND SOLIDIFICATION/STABILIZATION

ID	Task Name	Duration	Start	Finish
1	**Period of Performance**	**623 days**	**Thu 7/15/99**	**Mon 12/3/01**
2	Start	1 day	Thu 7/15/99	Thu 7/15/99
3	End	1 day	Mon 12/3/01	Mon 12/3/01
4	**WIP**	**303 days**	**Thu 7/15/99**	**Tue 9/12/00**
5	Prepare Working Copy of WIP	42 days	Thu 7/15/99	Fri 9/10/99
6	McClellan AFB review and Comment on Working WIP	30 days	Mon 9/13/99	Fri 10/22/99
7	Prepare Revised Working Copy WIP	18 days	Mon 10/25/99	Wed 11/17/99
8	McClellan AFB review/Comment on Working Copy WIP	33 days	Thu 11/18/99	Mon 1/3/00
9	Draft WIP "Ten Day Advance Copy"	14 days	Tue 1/4/00	Fri 1/21/00
10	Receive Comments on Advance Draft/ Prepare Draft WIP	5 days	Tue 2/1/00	Mon 2/7/00
11	Regulator Review and Comments on Draft WIP	102 edays	Mon 2/7/00	Fri 5/19/00
12	Response to Comments Table	20 edays	Fri 5/19/00	Thu 6/8/00
13	Draft Final WIP, advance copy	10 days	Fri 6/9/00	Thu 6/22/00
14	Prepare Draft Final WIP	4 days	Fri 6/23/00	Wed 6/28/00
15	McClellan AFB regulator Review and Comments	30 edays	Wed 6/28/00	Fri 7/28/00
16	Response to Comments Table	10 days	Mon 7/31/00	Fri 8/11/00
17	Final WIP, advance copy	6 days	Mon 8/14/00	Mon 8/21/00
18	Prepare Final WIP	5 edays	Wed 8/23/00	Mon 8/28/00
19	McClellan AFB/ Regulator Approval	14 edays	Tue 8/29/00	Tue 9/12/00
20	**Field Work**	**60 days**	**Wed 9/13/00**	**Tue 12/5/00**
21	Site Preparation	25 days	Wed 9/13/00	Tue 10/17/00
22	Mobilization	10 days	Wed 10/18/00	Tue 10/31/00
23	Period of Performance End	0 days	Tue 10/31/00	Tue 10/31/00
24	Field Audit	1 day	Wed 11/1/00	Wed 11/1/00
25	Testing	20 days	Wed 11/1/00	Tue 11/28/00
26	Demobilization	5 days	Wed 11/29/00	Tue 12/5/00
27	**TAAR**	**182 days**	**Wed 12/6/00**	**Thu 8/16/01**
28	Prepare Working Copy of TAAR	40 edays	Wed 12/6/00	Mon 1/15/01
29	McClellan AFB Review and Comment on Working Copy TAAR	30 edays	Mon 1/15/01	Wed 2/14/01
30	Response to Comments Table	20 edays	Wed 2/14/01	Tue 3/6/01
31	Draft TAAR, advance copy	10 days	Tue 2/20/01	Tue 3/6/01
32	Prepare Draft Results TAAR	5 edays	Wed 3/7/01	Mon 3/12/01
33	Regulator Review and Comments on Draft TAAR	59 edays	Mon 3/12/01	Thu 5/10/01
34	Response to Comments Table	20 edays	Thu 5/10/01	Wed 5/30/01
35	Draft Final TAAR, advance copy	10 days	Thu 5/17/01	Wed 5/30/01
36	Prepare Draft Final Results TAAR	5 edays	Wed 5/30/01	Mon 6/4/01
37	Regulator Review and Comments on DraftTAAR	30 edays	Mon 6/4/01	Wed 7/4/01
38	Response to Comments Table	20 edays	Wed 7/4/01	Tue 7/24/01
39	Final TAAR, advance copy	10 days	Wed 7/11/01	Tue 7/24/01
40	Prepare Final Results TAAR	9 edays	Tue 7/24/01	Thu 8/2/01
41	TAAR Approval by McAFB/Regulator	14 edays	Thu 8/2/01	Thu 8/16/01
42	Project Completion	0 days	Thu 8/16/01	Thu 8/16/01



Project: Soil_wsh(WIP)
Date: Tue 6/27/00

Task	Progress	Summary	Rolled Up Split	Rolled Up Progress	Project Summary
Split	Milestone	Rolled Up Task	Rolled Up Milestone	External Tasks	

S:\Richb\McAFB\Soil Washing\Soil_wsh(WIP)

Last Updated Tue 6/27/00 7:11 PM

12.0 MANAGEMENT AND STAFFING

The JV will conduct the soil washing and solidification/ stabilization study under the oversight of the McClellan AFB Environmental Management (EM) Directorate. Jim Lu, of McClellan AFB EM, is responsible for the oversight of the technical effort and is the senior technology advisor. Captain Bob Williams, also of McClellan AFB, is the CO. Mr. David Rennie and Mr. Tim Chapman will serve as technical advisors to McClellan AFB. Mr. Paul Bernheisel is in charge of the McClellan AFB Field Team. CalTest, a California-certified laboratory will serve as the environmental laboratory for the analysis of the project samples. Diane Anderson is the point-of-contact for the environmental laboratory.

12.1 DEMONSTRATION MANAGEMENT PERSONNEL

The JV will be responsible for the overall field demonstration. Responsibility will be shared among key staff assigned to the project. The qualifications and responsibilities of key personnel are below.

Sarabjit Singh, P.E. will serve as the Program Manager for the project. Mr. Singh is responsible for implementing the contractual aspects of the work and providing sufficient resources to adequately perform the scope of work.

Dave Green, the Air Force Quality Assurance Officer, is assigned the responsibility for QA oversight and is responsible for implementation, maintenance, auditing, and general oversight of the QA System and has the necessary seniority and experience to perform the task.

Richard Beyak, P.E., will serve as the PM. Mr. Beyak's responsibilities will include project oversight, budget control, final report review, and personnel management for the project. Mr. Beyak will be assisted by Tamara Zielinski. Mr. Beyak also currently serves as the program manager for the METRIC and McClellan Remedial Systems Operations and Maintenance Services (MRS OAMS) contracts.

Tamara Zielinski, P.E., will serve as the project engineer. Ms. Zielinski's responsibilities will include scheduling field activities, data reduction, report preparation, and oversight of day-to-day field activities.

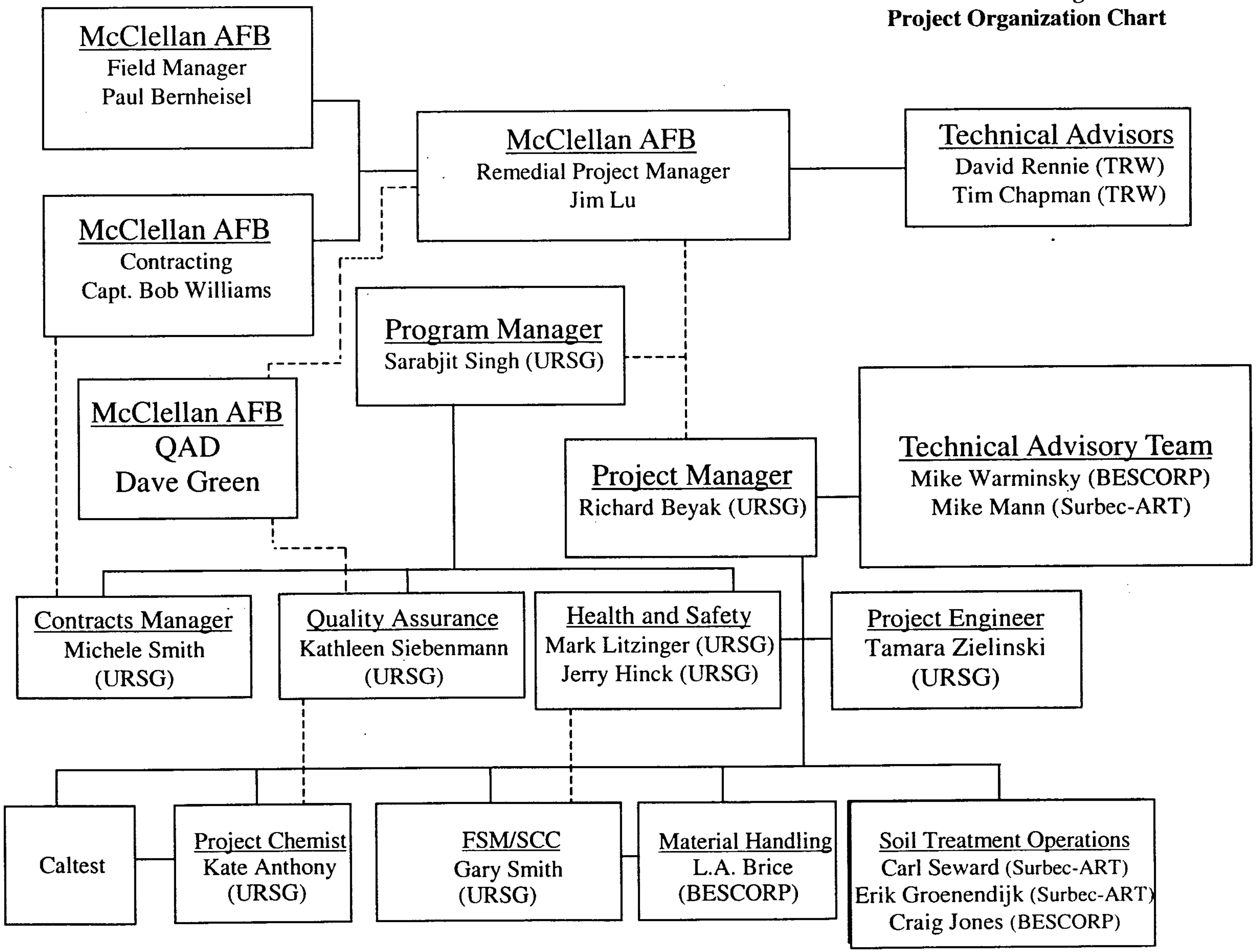
Kathy Siebenmann, as the Contractor Quality Assurance Officer, will be responsible for data quality. Ms. Siebenmann's responsibilities will include overseeing review of all analytical data for completeness and overall data quality.

Gary Smith will serve as the FSM/SSC. Mr. Smith's responsibilities will include performance of day-to-day data gathering, sample gathering, sample shipment, and oversight of field activities during system installation, start-up, and operation.

Kate Anthony, the chemist, will be working directly with the laboratory, Caltest, to assure that data packages are complete and are delivered on schedule.

A project organization chart is illustrated in Figure 12-1. All project personnel are listed in Table 12-1, and demonstration subcontractors are listed in Table 12-2.

Figure 12-1
Project Organization Chart



12.2 SURBEC - ART ENVIRONMENTAL, INC.

Surbec-ART owns and operates full-scale pilot-scale soil washing plants, and maintains its own treatability study laboratory. The company has performed numerous soil washing treatability studies, pilot studies and full-scale remediations, and has done extensive work in developing other treatment technologies for soil remediation.

Michael J. Mann, P.E. will serve as technical liaison and main point of contact for Surbec - ART Environmental, Inc. Mr. Mann and has over 30 years experience in all facets of environmental engineering and holds a B.S. in Civil Engineering and an M.S. in Chemical and Environmental Engineering.

Carl A. Seward will serve as Surbec-ART's technical director for this project. Mr. Seward has 25 years experience in soil treatment technology.

12.3 BRICE ENVIRONMENTAL SERVICES CORPORATION

BESCORP was established by Brice Incorporated, a Fairbanks-based, family-owned construction firm founded in 1961. For more than 38 years, Brice, Inc. has built infrastructure such as roads, runways, and harbors in rural Alaska. Their expertise covers the development and implementation of innovative, cost-effective approaches to on-site treatment in addressing site remediation challenges, with over 1 million cubic yards soil processed to date.

Michael F. Warminsky will serve as technical liaison and main point-of-contact for BESCORP. Mr. Warminsky has over 13 years experience in all facets of environmental engineering and construction and holds a B.S. in Civil Engineering and an M.B.A.

L.A. Brice will serve as BESCORP technical director for this project. Mr. Brice has 38 years experience in soil treatment.

Table 12-1

SOIL WASHING AND SOLIDIFICATION/ STABILIZATION STUDY MANAGEMENT POINTS OF CONTACT

Affiliation	Name/Title	Telephone/Pager
McClellan Air Force Base	Jim Lu Remedial Project Manager	Tel: (916) 643-0830 ext. 466
	Paul Bernheisel Field Team Leader	Tel: (916) 643-0028 ext. 474
	David Rennie Technical Advisor	Tel: (916) 643-0830 Ext. 410
URSG-Laidlaw Joint Venture (JV)	Sarabjit Singh Program Manager	Tel: (916) 929-2346 Pager: (916) 601-6384
	Richard Beyak Project Manager	Tel: (916) 569-5513
	Tamara Zielinski Project Engineer	Tel: (916) 569-5590
	Gary Smith Field Services Manager	Tel: (916) 929-2346 Pager: (916) 601-5886

Table 12-2

DEMONSTRATION SUBCONTRACTORS POINTS OF CONTACT

Affiliation	Name/Title	Telephone/Pager
Surbec – ART	Michael J. Mann	Tel: (813) 264-3571 Fax: (813) 962-0867
BESCORP	Michael F. Warminsky	Tel: (908) 806-3655 Fax: (908) 806-3293 Pager: 1-800-759-8888, PIN# 1335197
CalTest Analytical	Diane Anderson	Tel: (707) 258-4000 Fax: (707) 226-1001

13.0 REFERENCES

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8 CCR §5192. Title 8, California Code of Regulations, General Industry Safety Orders, Part 5192 - Hazardous Waste Operations and Emergency Response.

8 CCR §5155. Title 8, California Code of Regulations, General Industry Safety Orders, Part 5155 - Cal/OSHA Standards Board Permissible Exposure Limits (PELs) for Chemical Contaminants.

22 CCR §12000. Title 22, California Code of Regulations, Safe Drinking Water and Toxic Enforcement Act of 1986. Chemicals Known to the State to Cause Cancer or Reproductive Toxicity.

29 CFR §1910.1000. Title 29, Code of Federal Regulations, Subtitle B - Regulations Relating to Labor, Chapter XVII - Occupational Safety and Health Administration, Department of Labor, Part 1910 -Occupational Safety and Health Standards (Cont'd), Subpart Z - Toxic and Hazardous Substances, Section 1910.1000 - Air contaminants.

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40 CFR Parts 750 and 761, Disposal of Polychlorinated Diphenyls (PCBs). Final Rule. June 29, 1998

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APPENDIX A

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Health and Safety Forms and Attachments

ATTACHMENT A

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Health and Safety Forms

SOIL WASHING AND SOLIDIFICATION/STABILIZATION STUDY
McClellan AFB

Site-Specific Health and Safety Plan
Acknowledgement of Understanding

JV Employee: By signing this document, I acknowledge that I have read the Soil Washing and Solidification/Stabilization Study Project Site-Specific Health and Safety Plan (SHSP). I agree to comply with the health and safety requirements stated in the SHSP, applicable provisions of the METRIC Comprehensive and McClellan AFB Basewide Health and Safety Plans, and requirements established by the Site Safety Coordinator, Project Manager, and Project Team supervisory personnel.

Subcontractor Personnel and Visitors: By signing this document, I acknowledge that I have read the SHSP and/or standard safety procedures prepared by my Company, agency, or organization and agree to comply with all of the health and safety requirements specified therein. I am aware of the potential health and safety hazards present at the Project work site(s) and have completed all required training, am medically qualified, and will wear and use all appropriate personal protective equipment specified by my employer, agency, or organization. I agree to conduct my activities within designated work areas in full compliance with governmental regulations and procedures. Violations of safety requirements will be recorded; serious violations, constituting a potential safety hazard, may result in an immediate shutdown of the work site and notification of McClellan AFB and Joint Venture supervisory personnel.

Name (print)	Signature	Representing (Name of agency, company or organization)	Date

Daily "Tail-Gate" Safety Briefing Summary

Job Name ______________________ Date ________

Site Location ______________________

Type of Work (General) ______________________

Safety Issues

Tasks (this shift) ______________________

Protective Clothing/Equipment ______________________

Chemical Hazards ______________________

Physical Hazards ______________________

Control Methods ______________________

Special Equipment/Techniques ______________________

Special Topics (incidents, actions taken, etc.) ______________________

Nearest Phone ______________________

Hospital Name/Address ______________________

Attendees

Print Name	Sign Name

Meeting conducted by: ______________________

URS #69 2/92

Direct Reading Instrument Monitoring Data Log

PROJECT					
INSTRUMENT INFORMATION	MANUFACTURER	MODEL	SERIAL #	ACCESSORIES	1
CALIBRATION INFORMATION	LAB CALIBRATION DUE DATE	CALIBRATION LAB			
FIELD INSTRUMENT CALIBRATION INFORMATION	STANDARD/SOURCE	INSTRUMENT RESPONSE		DATE	
INSTRUMENT INFORMATION	MANUFACTURER	MODEL	SERIAL #	ACCESSORIES	2
CALIBRATION INFORMATION	LAB CALIBRATION DUE DATE	CALIBRATION LAB			
FIELD INSTRUMENT CALIBRATION INFORMATION	STANDARD/SOURCE	INSTRUMENT RESPONSE		DATE	
INSTRUMENT INFORMATION	MANUFACTURER	MODEL	SERIAL #	ACCESSORIES	3
CALIBRATION INFORMATION	LAB CALIBRATION DUE DATE	CALIBRATION LAB			
FIELD INSTRUMENT CALIBRATION INFORMATION	STANDARD/SOURCE	INSTRUMENT RESPONSE		DATE	
INSTRUMENT INFORMATION	MANUFACTURER	MODEL	SERIAL #	ACCESSORIES	4
CALIBRATION INFORMATION	LAB CALIBRATION DUE DATE	CALIBRATION LAB			
FIELD INSTRUMENT CALIBRATION INFORMATION	STANDARD/SOURCE	INSTRUMENT RESPONSE		DATE	

DIAGRAM WITH SAMPLE LOCATION COORDINATES

FIELD CALIBRATIOR	DATE	SURVEYOR	DATE	DATA REVIEWER	DATE

INJURY/INCIDENT REPORT

ADMINISTRATION INFORMATION:

Project Name: ____________________

Project Number: ____________________

Date/Time of Incident: ____________________

Location: ____________________

____

For Injuries/Illnesses:

Name of Injured Employee:

____

Age: _____ Sex: _____ SSN: ____________

Nature of Injury: ____________________

See a Doctor? ☐ Yes ☐ No

TYPE OF INCIDENT (Check all applicable items)

☐ Illness
☐ Unexpected Exposure
☐ Health and Safety Infraction
☐ Fire, Explosion, Flash
☐ Property Damage
☐ Other (describe) ____________________
☐ Injury
☐ Vehicular Accident

DESCRIPTION OF INCIDENT (Describe what happened and possible cause. Identify individuals involved, witnesses, and their affiliations. Attach additional sheets, drawings, or photographs as needed.)

____

____

____

____

____

Description of Corrective Action: ____________________

____

____

____

REPORTED BY: Print Name: ____________________ Signature: ____________________

Date: ____________________

Reporter must deliver this report to the operating unit health and safety representative within 24 hours of the reported incident for medical treatment cases and within 5 days for other incidents.

REVIEWED BY: ____________________ ____________
Supervisor Date

____________________ ____________
Health and Safety Representative Date

Distribution by HSO:

- Regional Health and Safety Manager
- Corporate Health and Safety Director
- Project Manager
- Human Resources Office (injury/illness cases only)

OSHA Recordable?
☐ Yes ☐ No

HSP Modification Request

Date:

Project::	Job Number:
Location:	
Section of SHSP to be Changed:	
Suggested Change:	
Justification:	

Suggesting Employee:	Date:	Receiving Supervisor:	Date:
Action Taken on Suggestion/Explanation:			
Site Manager:	Date:	Health & Safety Coordinator:	Date:

OVER

Medical Data Sheet

This Medical Data Sheet must be completed by all URS field personnel performing site work. Each person must complete an MDS and present it to the Site Manager prior to working on the site. It is the responsibility of the employee and the Site Manager to ensure that a copy of the MDS is readily available at each job site. The MDS must accompany the employee when medical treatment is needed or transport to a hospital is required.

To be Completed by the Employee

Name: ______________________ Home Telephone: (   ) __________

Office: ______________________ Telephone: (   ) __________

Home Address: ______________________

Person to be notified in case of emergency: ______________________

Telephone: (   ) __________

Name, address, and phone number of personal physician:

____

____

Location of your Occupational Medical Record:

U.C. Davis Medical Group - Rancho Cordova
11000 Olson Drive, Rancho Cordova, CA 95670
(916) 635-4120

Birthdate ___/___/___ Height _____ ft. _______ in. Weight _____ lb.

Do you wear contacts? Yes / No

List allergies: ______________________

List drug sensitivities: ______________________

List all previous illnesses or injuries which may be important for a physician to know.

____

____

____

List any medical conditions or medications being taken which may affect your treatment in an emergency or interact with chemicals which may be present at a work site:

____

____

____

Send all bills and medical reports for URS employees' work related injuries to:

Employers Insurance of Wausau
P.O. Box 5090
Visalia, CA 93278-5090
(800) 321-6609

___/___/___
Date Completed

SUBCONTRACTOR CERTIFICATION

I, ______________________________ as an agent of ______________________________,
do hereby certify that the following employees have successfully completed a 40-hour training course which complies with the provisions of 29 CFR 1910.120, and respiratory protection training which complies with 29 CFR 1910.134. Each employee has successfully completed a medical examination which complies with the above regulations.

Individual copies of certification of successful completion of the required training and medical examinations are attached for each employee.

______________________________ ______________________________

Signature Date

ATTACHMENT B

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Chemical Hazard Guidance
and
Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET

CHEMPLETE INDUSTRIES, INC.
PO BOX 292, HUNTINGTON, NY 11746
(516)462-1660

DATA SHEET NO. 1115
ISSUE DATE 12/1/85
ISSUED BY J.R.

SECTION I

PRODUCT NAME: CITRU CLEAN H-D
CODE: 1115
PRODUCT TYPE: BIODEGRADEABLE ORGANIC DEGREASER
CHEMICAL FAMILY:N/A
FORMULA: N/A

SECTION II - HAZARDOUS INGREDIENTS

COMPONENT(S) CHEMICAL NAME	CAS REG. NO.	%(APPROX)	ACGIH TLV-TWA
CITRUS TERPENE		>1.0%	

SECTION III - PHYSICAL DATA

BOILING POINT(C)	162	SPECIFIC GRAVITY (H2O=1)	.84
VAPOR PRES.(mmHg.)	100 @ 68F	VOLATILES (%)	99
VAPOR DENSITY (AIR=1)	4.5	EVAPORATION RATE(BU-AC =1)	2.6
SOLUBILITY IN WATER	CMP		
APPEARANCE / ODOR	ORANGE LIQUID - ORANGE SCENT		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

		lel	uel
FLASH POINT	114F (TCC)		
FLAMMABLE LIMITS		2	7

EXTINGUISHING MEDIA:COMBUSTIBLE:FOG,FOAM,DRY CHEMICAL CO2
SPECIAL FIRE FIGHTING PROCEDURES NIOSH APPRVD.SELF CONTAINED BREATHING APPARATUS
UNUSUAL FIRE AND EXPLOSION HAZARDS:COOL WITH LARGE QUANITIES OF WATER TO PREVENT CONTAINER RUPTURE

OVER

N/AP=Not Applicable N/AV=Not Available CMP=Complete INF=Infinite

705 North Mountain Road
Newington, Connecticut 06111
Emergency Phone (203) 278-1280
Fax (203) 280-3558

LOCTITE®

MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION		PRODUCT NO.: 609
PRODUCT NAME:	RC™ 609 Retaining Compound General Purpose	Issued: 3/1/92
ITEM NUMBERS:	60905, 60921, 60931, 60941	
PRODUCT TYPE:	Anaerobic	
FORMULA NO.:	Does not apply	

II. COMPOSITION

Ingredients	CAS No.	%
Polyglycol Dimethacrylate	25852-47-5	60-65
Hydroxyalkyl methacrylate	868-77-9	15-20
Coumarone-indene resin	63393-89-5	5-10
Poly(ethyl methacrylate)	9003-42-3	3-5
CUMENE HYDROPEROXIDE*	80-15-9	1-3
SACCHARIN*	81-07-2	1-3
N,N-Dialkyltoluidines	613-48-9	0.1-1

* This component is listed as a SARA Section 313 Toxic Chemical.

III. CHEMICAL AND PHYSICAL PROPERTIES

Vapor Pressure:	Less than 5mm at 80°F
Vapor Density:	Not Available
Solubility in Water:	Slight
Specific Gravity:	1.1 at 80°F
Boiling Point:	More than 300°F
Volatile Organic Compound (EPA Method 24)	34.0%; 374 g/l
Evaporation Rate (Ether = 1)	Not available
pH:	Not Applicable
Appearance:	Green liquid
Odor:	Mild

IV. FLAMMABILITY AND EXPLOSIVE PROPERTIES

Flash Point:	More than 200°F Method: Tag Closed Cup
Estimated NFPA Code:	
Health Hazard:	1
Fire Hazard:	1
Reactivity Hazard:	1
Specific Hazard:	Does not apply
Estimated HMIS Code:	
Health Hazard:	1
Flammability Hazard:	1
Reactivity Hazard:	1
Personal Protection:	See Section X.
Explosive Limits:	
(% by volume in air)Lower	Not Applicable
(% by volume in air)Upper	Not Applicable
Recommended Extinguishing Agents:	Carbon dioxide, foam, dry chemical
Hazardous Products Formed by Fire or Thermal Decomp	Irritating organic vapors
Unusual Fire or Explosion Hazards:	None
Compressed Gases:	None
Pressure at Room Temp.:	Does not apply

V. SPILL OR LEAK AND DISPOSAL PROCEDURES

Steps to be taken in case of spill or leak:	Soak up in an inert absorbent. Store in a partly filled, closed container until disposal.
Recommended methods of disposal:	Incinerate following EPA and local regulations.

VI. STORAGE AND HANDLING PROCEDURES

Storage:	Store below 110°F to preserve shelf life.
Handling:	Avoid prolonged skin contact. Keep away from eyes

VII. SHIPPING REGULATIONS

DOT (49 CFR 172)	
Proper Shipping Name	Unrestricted
Hazard Class or Division	Unrestricted
Identification Number	None
IATA	
Proper Shipping Name	Unrestricted

MATERIAL SAFETY DATA SHEET

PERMATEX INDUSTRIAL CORPORATION
705 North Mountain Road
Newington, CT 06111
Phone: (800) 641-7378

Issued: May 1, 1992

Blue Silicone Form-A-Gasket®

I. PRODUCT IDENTIFICATION

Product Name:
Item No.:
Part No.:
Product Type: Silicone
Formula No.: Does not apply

II. COMPOSITION

Ingredients	CAS No.	%
Dimethyl polysiloxane (No term)	63148-62-9	80-85
SILICA, AMORPHOUS (FUMED)	7631-86-9	10-15
Methyltriacetoxysilane	4253-34-3	1-5

III. CHEMICAL AND PHYSICAL PROPERTIES

Vapor Pressure: Less than 10mm at 80°F
Vapor Density: Not available
Solubility in Water: Polymerized
Specific Gravity: 1.04 at 70°F
Boiling Point: Not Applicable, Polymeric material
Volatile Organic Compound (EPA Method 24): 4.6%, 47.8 grams per liter
Evaporation Rate (Ether = 1): Not available
pH: Does not apply
Appearance: Blue paste
Odor: Acetic acid

IV. FLAMMABILITY AND EXPLOSIVE PROPERTIES

Flash Point: More than 200°F Method: Tag Closed Cup
Estimated NFPA Code:
Health Hazard: 2
Fire Hazard: 1
Reactivity Hazard: 1
Specific Hazard: Does not apply
Estimated HMIS Code:
Health Hazard: 2
Flammability Hazard: 1
Reactivity Hazard: 1
Personal Protection: See Section X.
Explosive Limits:
% by volume in air: Lower Not available
% by volume in air: Upper Not available
Recommended Extinguishing Agents: Carbon dioxide, foam, dry chemical
Hazardous Products Formed by Fire or Thermal Decomp: Acetic acid, formaldehyde, silica fume.
Unusual Fire or Explosion Hazards: None
Compressed Gases: None
Pressure at Room Temp.: Does not apply

V. SPILL OR LEAK AND DISPOSAL PROCEDURES

Steps to be taken in case of spill or leak: Wipe and/or scrape up spilled material. Maintain good ventilation for large spills. Place scrap material in a well ventilated place and allow to cure to rubber.

Recommended methods of disposal: Cured rubber scrap can be incinerated. Follow EPA and local regulations.

VI. STORAGE AND HANDLING PROCEDURES

Storage: Store in a dry area below 90°F to preserve shelf life. Keep container closed when not in use.
Handling: Avoid breathing vapor. Avoid eye or skin contact.

VII. SHIPPING REGULATIONS

DOT (49 CFR 172)
Proper Shipping Name: Unrestricted
Hazard Class or Division: Unrestricted
Identification Number: None
IATA
Proper Shipping Name: Unrestricted
Class or Division: Unrestricted

Blue Silicone Form-A-Gasket®

ITEM NO.	PART NO.	CONTAINER SIZE	ITEM NO.	PART NO.	CONTAINER SIZE
80027	6B	3 oz Tube, Boxed	80022	6BR	3 oz Tube, Carded
81186	81186	11 oz Cartridge	80023	6M	12 oz Tube, Boxed

VII. SHIPPING REGULATIONS (continued)

UN or ID Number: None
IMO
Substance: Not available
Marine Pollutant Status: Not available
Class: Not available
Subsidiary Risk Label: Not available
IMDG Code Page: Not available
UN Number: Not available

VIII. REACTIVITY DATA

Stability: Stable
Hazardous Polymerization: Will not occur.
Hazardous Decomposition Products (non-thermal): None
Incompatability: Polymerized by contact with moisture. Acetic acid liberated.

IX. EMERGENCY TREATMENT PROCEDURES

Ingestion: Do not induce vomiting. Keep individual calm. Obtain medical attention.
Inhalation: Remove to fresh air. Treat symptomatically.
Skin Contact: Wipe off paste with paper towel or cloth. Wash exposed area with soap and water.
Eye Contact: Flush at least 15 minutes with water. Obtain medical attention.

X. PERSONAL PROTECTION

Eyes: Safety glasses or goggles.
Skin: Rubber or plastic gloves.
Ventilation: Provide local ventilation for prolonged use in confined area.

XI. HEALTH HAZARD DATA

Toxicity: Eye and skin irritant. Oral LD50 = 3100 mg/kg.
Primary Routes of Entry: None known
Signs and Symptoms of Exposure: Acetic acid produced during cure irritates eyes, nose, and throat.
Existing Conditions Aggravated by Exposure: Methyltriacetoxysilane: Eye, skin, and pulmonary disorders.

Exposure Limits Ingredients	ACGIH (TLV)	OSHA (TLV)	OTHER
Dimethyl polysiloxane (No term)	None	None	None
SILICA, AMORPHOUS (FUMED)	10mg/m3 TWA	6mg/m3 TWA	None
Methyltriacetoxysilane	None	None	None

Ingredients	Literature Referenced Target Organ and Other Health Effects	Carcinogen NTP	IARC	OSHA
Dimethyl polysiloxane (No term)	FET	NO	NO	NO
SILICA, AMORPHOUS (FUMED)	LUN	NO	N/A	NO
Methyltriacetoxysilane	No Data	NO	NO	NO

Abbreviations

N/A Not Applicable   FET Fetotoxic
LUN Lung

XII. PREPARATION INFORMATION

Prepared By: Stephen Repetto
Title: Research Chemist, Environmental Health & Safety
Company: Loctite Corp., 705 N. Mt. Rd. Newington, CT 06111
(24hr.) Phone: (203) 278-1280
Revision Date: January 07, 1992   Revision: 0017

MSDS # 180

PHYSIOLOGICAL EFFECTS

Effects of Exposure

Acute:

Eyes: Believed to be minimally irritating.

Skin: Believed to be minimally irritating.

Respiratory System: Vapors or mist in excess of permissible concentrations (pg4) may cause irritation (nose/throat), headache, nausea, and drowsiness.

Chronic: See Additional Comments, page 6.

Other:

Sensitization Properties:

Skin: Yes ___ No ___ Unknown X

Respiratory: Yes ___ No ___ Unknown X

Median Lethal Dose (LD$_{50}$ LC$_{50}$)(Species)

Oral: Believed to be >5 g/kg (rat); practically non-toxic

Inhalation: N.D.

Dermal: Believed to be >3 g/kg (rabbit); practically non-toxic

Other: N. D.

Irritation Index, Estimation of Irritation (Species)

Skin: Believed to be <0.5/8.0 (rabbit); no appreciable effect

Eyes: Believed to be <15/110 (rabbit); no appreciable effect

Symptoms of Exposure: None expected other than possible minimal irritation

FIRE PROTECTION INFORMATION

Ignition Temp. °F. N.D.

Flash Point °F. (Method) 425°F (COC)

Flammable Limits (%) Lower N.D. Upper N.D.

Products Evolved When Subjected to Heat or Combustion:

Carbon monoxide, carbon dioxide, aldehydes and ketones, combustion products of calcium, zinc, sulfur, nitrogen, phosphorus and silicon.

Recommended Fire Extinguishing Agents And Special Procedures:

According to the National Fire Protection Association Guide, use water spray, dry chemical, foam, or carbon dioxide.

Water or foam may cause frothing. Use water to cool fire-exposed containers. If a leak or spill has not ignited, use water spray to disperse the vapors and to provide protection for persons attempting to stop the leak.

Unusual or Explosive Hazards:

None.

N.D. - Not Determined   N.A. - Not Applicable

< - Less Than   > - Greater Than

POSITION

Chemical/Common Name	CAS No.	Exposure Limit	Range in %
*Polyalphaolefin mixture	68649127	5 mg/m3 (MIST) Recommended 500 ppm (VAPORS)	20.00 - 34.99
*Calcium phenate in highly refined, severely hydrotreated base oil	64742547	NONE ESTABLISHED	1.00 - 3.99
Solvent-dewaxed heavy paraffinic petroleum distillates	64742650	5mg/m3 ACGIH (MIST) 5mg/m3 OSHA (MIST) 10mg/m3 STEL (MIST)	65.00 - 79.99
Alkenylsuccinimide dispersant	TSCA CBI	None Established	1.00 - 3.99

*Hazardous according to OSHA (1910.1200) or one or more state Right-To-Know lists.

SARA TITLE III

I. Title III Section 302/304 Extremely Hazardous Substance

Component	CAS No.	%	RQ (Lbs)	TPQ (Lbs)
NONE				

II. CERCLA Section 102(a) Hazardous Substance

Component	CAS No.	%	RQ (Lbs)
NONE			

III. Title III Section 311 Hazard Categorization

Acute	Chronic	Fire	Pressure	Reactive	Not Applicable
					X

IV. Title III Section 313 Toxic Chemicals

Component	CAS No.	%
dialkyldithiophosphoric acid, zinc salt	68649423	1.00-3.99

ADDITIONAL COMMENTS

STATE OF MICHIGAN CRITICAL MATERIALS ACT (REVISED 1988)
0.12% zinc

New and used motor oils have been tested for potential carcinogenicity in laboratory mice. Only used gasoline motor oils were shown to cause skin cancer when repeatedly applied to mice without any effort to remove the material between applications. Strict compliance to the Occupational Control Procedures outlined in this data sheet is believed to be adequate protection from such hazards. Used diesel engine oils have NOT been shown to produce a significant incidence of skin cancer in laboratory animals when tested under similar conditions.
WHMIS Classification: Not Regulated

To determine applicability or effect of any law or regulation with respect to the product, users should consult his legal advisor or the appropriate government agency. Texaco does not undertake to furnish advice on such matters.

By M. J. Von Allmen Title Mgr. Product Safety Programs
Date 08-15-89 ☐ New ☒ Revised, Supersedes 08-08-89

N.D. - Not Determined N.A. - Not Applicable
< - Less Than > - Greater Than

THE INFORMATION CONTAINED HEREIN IS BELIEVED TO BE ACCURATE. IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT AS PART OF TEXACO'S PRODUCT SAFETY PROGRAM. IT IS NOT INTENDED TO CONSTITUTE PERFORMANCE INFORMATION CONCERNING THE PRODUCT. NO EXPRESS WARRANTY, OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE IS MADE WITH RESPECT TO THE PRODUCT OR THE INFORMATION CONTAINED HEREIN. DATA SHEETS ARE AVAILABLE FOR ALL TEXACO PRODUCTS. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL TEXACO PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE AND YOU ARE ENCOURAGED AND REQUESTED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

EXPLANATION OF THE INDUSTRIAL HYGIENE, TOXICOLOGY, AND MATERIAL SAFETY DATA SHEET

PRODUCT INFORMATION

Trade Name and Synonyms

Refer to the code number and name under which the product is marketed and the common commercial name of the product.

Manufacturer's Name and Address Self explanatory.

Chemical Name and/or Family or Description

Refer to chemical, generic, or descriptive name of single elements and compounds.

OCCUPATIONAL CONTROL PROCEDURES

(Consult your Industrial Hygienist or Occupational Health Specialist.)

Protective Equipment

Type of protective equipment that is necessary for the safe handling and use of this product.

Ventilation

Normal means adequate to maintain permissible concentrations.
Ventilation: type, i.e. local exhaust, mechanical, etc.

Permissible Concentrations

Indicates worker exposure limits, such as the Threshold Limit Value (TLV) as established by the American Conference of Governmental Industrial Hygienists or standards, promulgated by the Occupational Safety and Health Administration (e.g., PEL).

TLV-Time Weighted Average (TWA) is the concentration in air averaged over an 8 hour daily exposure.

TLV-Ceiling (C) is the ceiling limit on concentration that should not be exceeded during any part of the working day.

"Skin" Notation (ACGIH) indicates that dermal absorption can contribute to overall exposure following direct contact or exposure to airborne material.

Permissible Exposure Level (PEL) is the time weighted concentration in air averaged over an 8 hour daily exposure.

EMERGENCY AND FIRST AID PROCEDURES

Administer first aid and emergency procedures in case of eye and/or skin contact, ingestion and inhalation.

PHYSIOLOGICAL EFFECTS

Acute Exposures (Eye, Skin, Respiratory System)

Refers to the most common effects that would be expected to occur from direct contact with the product.

Chronic

Refers to the effects that are most likely to occur from repeated or prolonged exposure.

Sensitizer

Means a substance which will cause on or in normal living tissue, through an allergic or photodynamic process, a hypersensitivity which becomes evident on reapplication of, or exposure to, the same substance.

Median Lethal Dose or Concentration (LD50,LC50)

Refers to that dose or concentration of the material which will produce death in 50 per cent of the animals. For inhalation, exposure time is indicated.

Irritation Index

Refers to an empirical score (Draize Method) for eye and skin irritation when tested by the method described. If numbers are not available, an estimated score indicates whether or not the material is an irritant.

FIRE PROTECTION INFORMATION

Ignition Temperature

Refers to the temperature in degrees Fahrenheit, at which a liquid will give off enough flammable vapor to ignite and burn continuously for 5 seconds.

Flash Point (Method used)

Refers to the temperature in degrees Fahrenheit, at which a liquid will give off enough flammable vapor to ignite.

Flammable Limits

Refers to the range of gas or vapor concentration (percent by volume in air) which will burn or explode if an ignition source is present. Lower means the lower flammable limit and upper means the upper flammable limit given in percent.

Date Issued: 06/07/91
Supercedes: 03/12/91

TEXACO
MATERIAL SAFETY DATA SHEET

NOTE: Read and understand Material Safety Data Sheet before handling or disposing of product

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATERIAL IDENTITY

Product Code and Name:
00365 TEXACO UNLEADED

Chemical Name and/or Family or Description:
Automotive Lead-Free Gasoline

Manufacturer's Name and Address:
Texaco Refining and Marketing, Inc.
P.O. Box 1404 Houston, TX 77251

Telephone Numbers:
TRANSPORTATION EMERGENCY Company: (914) 831-3400 CHEMTREC: (800) 424-9300
HEALTH EMERGENCY Company: (914) 831-3400
GENERAL MSDS ASSISTANCE (914) 838-7204
TECHNICAL INFORMATION Fuels: (914) 838-7336; Lubricants/Antifreezes: (914) 838-7509
Chemicals: (512) 459-6543

2. COMPOSITION/INFORMATION ON INGREDIENTS

Product and/or Component(s) Carcinogenic According to:	OSHA	IARC	NTP	OTHER	NONE
	X	X	X	X	_

Composition:

Chemical/Common Name	CAS No.	Exposure Limit	Range in %
* Gasoline consists mainly of straight chain and branched paraffinic hydrocarbons, olefins, cycloparaffins and aromatics. The benzene content normally varies from 0.2-3.5% with a typical value of 1.4%. The MTBE content varies from 0-15%.	MIXTURE	300ppm TWA OSHA 500ppm STEL OSHA 300 ppm TWA ACGIH 100 ppm TWA-TEXACO	95.00 - 99.99

Product is hazardous according to OSHA (1910.1200).
* Component(s) is hazardous according to OSHA or one or more state Right-to-Know laws.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW

Appearance and Odor: Light straw to light red liquid

WARNING STATEMENT

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR
VAPOR MAY CAUSE FLASH FIRE
HARMFUL IF INHALED
MAY CAUSE DIZZINESS AND DROWSINESS
MAY CAUSE EYE AND SKIN IRRITATION
MAY BE HARMFUL IF ABSORBED THROUGH SKIN
ASPIRATION HAZARD IF SWALLOWED -- CAN ENTER LUNGS AND CAUSE DAMAGE

ATTENTION! POSSIBLE CANCER HAZARD
MAY CAUSE CANCER BASED ON ANIMAL DATA

HMIS				NFPA			
Health:	2	Reactivity:	0	Health:	1	Reactivity:	0
Flammability:	4	Special:	-	Flammability:	3	Special:	-

N.D. - Not Determined N.A. - Not Applicable N.T. - Not Tested
< - Less Than > - Greater Than

PRODUCT CODE: 00269
PRODUCT NAME: TEXACO UNLEADED

Date Issued: 06/07/91
Supercedes: 03/12/91

4. FIRST AID MEASURES (CONT)

Other Instructions:
NOTE TO PHYSICIAN: Aspiration of this product during induced emesis can result in lung injury. If evacuation of stomach contents is considered necessary, use method least likely to cause aspiration, such as gastric lavage after endotracheal intubation.

Remove and dry-clean or launder clothing soaked or soiled with this material before reuse. Dry cleaning of contaminated clothing may be more effective than normal laundering. Inform individuals responsible for cleaning of potential hazards associated with handling contaminated clothing.

5. FIRE-FIGHTING MEASURES

Ignition Temp. Degrees F.: 850 F
Flammable Limits (%) Lower: 1.4% Upper: 7.6%
Flash Point Degrees F. (method): -40F (COC)

Recommended Fire Extinguishing Agents And Special Procedures:
According to NFPA Guide, use dry chemical, foam, or carbon dioxide. Water may be ineffective on flames, but should be used to cool fire-exposed containers. If a leak or spill has not ignited, use water spray to disperse the vapors and to provide protection for personnel attempting to stop the leak.

When handling, use non-sparking tools, ground and bond all containers.

Unusual or Explosive Hazards:
Gasoline vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back. Flowing gasoline can generate static electricity and cause a fire explosion if a spark occurs in a flammable vapor-air atmosphere. When handling, use non-sparking tools, ground and bond all containers. Consult NFPA 77 for the proper handling precautions.

6. ACCIDENTAL RELEASE MEASURES (Transportation Spills Call: CHEMTREC (800) 424-9300)

Procedures in Case of Accidental Release, Breakage or Leakage:
Eliminate all ignition sources including internal combustion engines and power tools. Ventilate area. Keep people away. Stay upwind and warn of possible downwind explosion hazard. Avoid breathing vapor. Wear self-contained breathing apparatus. Avoid contact with skin, eyes or clothing. Use self-contained breathing apparatus or supplied air mask for large spills or confined areas. Contain spill if possible. Remove with inert absorbent. Prevent entry into sewers and waterways.

7. HANDLING AND STORAGE

Precautions to be Taken in Handling and Storage:
Transport, handle, and store in accordance with OSHA Regulation 1910.106 and applicable DOT Regulations. Ground and bond shipping container, transfer line, and receiving container. Use spark-proof tools. Keep away from heat, sparks, flame and other sources of ignition. Material may be at elevated temperatures and/or pressures. Exercise due care when opening bleeders and sampling ports.

N.D. - Not Determined
< - Less Than
N.A. - Not Applicable
> - Greater Than
N.T. - Not Tested

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Protective Equipment (Type)

Eye/Face Protection:
Chemical-type goggles or face shield recommended to prevent eye contact.

Skin Protection:
Protective clothing such as uniforms, coveralls or lab coats should be worn. Launder or dry-clean when soiled. Gloves and boots resistant to chemicals and petroleum distillates required.

Respiratory Protection:
Airborne concentrations should be kept to lowest levels possible. If vapor, mist or dust is generated, use respirator approved by MSHA or NIOSH as appropriate. Supplied air respiratory protection should be used for cleaning large spills or upon entry into tanks, vessels, or other confined spaces. See below for applicable permissible concentrations.

Ventilation:
Adequate to meet recommended occupational exposure limits (see below)

Exposure Limit for Total Product:
The ACGIH TWA for gasoline is 300ppm; OSHA TWA is 300 ppm, OSHA STEL is 500 ppm; Texaco recommends a TWA of 100 ppm.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Light straw to light red liquid
Boiling Point (Degrees F.): >90
Specific Gravity: 0.7-.77 (H20=1)
pH of undiluted product: N.A.
Vapor Pressure: 465-775 @100°F mmhg
Viscosity: <1.4 cSt @ 100F
Percent VOC: 100
Vapor Density: 3-4.0 Air=1
Solubility in Water: slight
Other: N.D.

10. STABILITY AND REACTIVITY

This Material Reacts Violently With: (If others is checked below, see comments for details)

Air	Water	Heat	Strong Oxidizers	Others	None of These
_	_	Y	Y	_	_

Comments:
None

Products Evolved When Subjected to Heat or Combustion:
Toxic levels of carbon monoxide, carbon dioxide, irritating aldehydes and ketones.

	OCCUR	DO NOT OCCUR
Hazardous Polymerizations:	_	X

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION(ANIMAL TOXICITY DATA)

Median Lethal Dose (LD50 LC50) (Species)

Oral: believed to be > 5 g/kg (rat); practically non-toxic
Inhalation: N.D.
Dermal: believed to be > 3 g/kg (rabbit); practically non-toxic

Irritation Index, Estimation of Irritation (Species)

Skin: believed to be >0.5-3/8.0 (rabbit); slightly irritating
Eyes: believed to be <15/110 (rabbit); no appreciable effect
Sensitization: N.D.

N.D. - Not Determined   N.A. - Not Applicable   N.T. - Not Tested
< - Less Than   > - Greater Than

15. OTHER INFORMATION (CONT)

Texaco Inc.
Manager, Product Safety
P.O. Box 509
Beacon, N.Y. 12508

PLEASE SEE NEXT PAGE FOR PRODUCT LABEL

PRODUCT CODE: 00365
PRODUCT NAME: TEXACO UNLEADED

Date Issued: 06/07/91
Supercedes: 03/12/91

16. PRODUCT LABEL (CONT)

DOT Proper Shipping Name: Gasoline
DOT Hazardous Class : Flammable liquid, UN 1203

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

Manufacturer's Name: Texaco Refining and Marketing, Inc.
P.O. Box 1404 Houston, TX 77251

TRANSPORTATION EMERGENCY Company: (914) 831-3400
CHEMTREC: (800) 424-9300

HEALTH EMERGENCY Company: (914) 831-3400

International Chemical Safety Cards

BENZIDINE

ICSC: 0224

National Institute for Occupational Safety and Health

BENZIDINE
(1,1'-Biphenyl)-4,4'-diamine
4,4'-Diaminobiphenyl
p-Diaminodiphenyl
$C_{12}H_{12}N_2/NH_2C_6H_4\text{-}C_6H_4NH_2$
Molecular mass: 184.2

CAS # 92-87-5
RTECS # DC9625000
ICSC # 0224
UN # 1885
EC # 612-042-00-2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. See Notes. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, carbon dioxide.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION		Closed system and ventilation.	Fresh air, rest. Refer for medical attention.
SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES		Face shield or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

NOTES

Given melting point when anhydrous and rapidly heated, when slowly heated: 115-120°C. Addition of small amounts of a flammable substance or an increase in the oxygen content of the air strongly enhances combustibility.

Transport Emergency Card: TEC (R)-61G11

ADDITIONAL INFORMATION

ICSC: 0224 **BENZIDINE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

BENZO(a)PYRENE

ICSC: 0104

National Institute for Occupational Safety and Health
NIOSH

BENZO(a)PYRENE
Benz(a)pyrene
3,4-Benzopyrene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 50-32-8
RTECS # DJ3675000
ICSC # 0104
EC # 601-032-00-3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!	IN ALL CASES CONSULT A DOCTOR!
INHALATION		Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES		Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work.	Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

ADDITIONAL INFORMATION

ICSC: 0104 **BENZO(a)PYRENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject, The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

National Institute for Occupational Safety and Health NIOSH

BENZO(B)FLUORANTHENE
Benzo(e)acephenanthrylene
2,3-Benzofluoroanthene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 205-99-2
RTECS # CU1400000
ICSC # 0720

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
EYES		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

National Institute for Occupational Safety and Health NIOSH

BENZ(a)ANTHRACENE
1,2-Benzoanthracene
Benzo(a)anthracene
2,3-Benzphenanthrene
Naphthanthracene
$C_{18}H_{12}$
Molecular mass: 228.3

CAS # 56-55-3
RTECS # CV9275000
ICSC # 0385
EC # 601-033-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
EYES		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures. e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.

ADDITIONAL INFORMATION

ICSC: 0385 **BENZ(a)ANTHRACENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

CHLORDANE (TECHNICAL PRODUCT)

ICSC: 0740

For Life on Earth

National Institute for Occupational Safety and Health
NIOSH

CHLORDANE (TECHNICAL PRODUCT)
1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene
1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1H-indene
$C_{10}H_6Cl_8$
Molecular mass: 409.8

CAS # 57-74-9
ICSC # 0740
UN # 2996
EC # 602-047-00-8

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Alcohol-resistant foam, powder, carbon dioxide.
EXPLOSION			
EXPOSURE		PREVENT GENERATION OF MISTS! STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	(see Ingestion).	Breathing protection.	Fresh air, rest. Refer for medical attention.
SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
EYES	Redness. Pain.	Safety goggles, or face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Confusion. Convulsions. Nausea. Vomiting.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rest. Refer for medical attention.

If the substance is formulated with solvent(s) also consult the card(s) (ICSC) of the solvent(s). Carrier solvents used in commercial formulations may change physical and toxicological properties. Belt, Chlor Kil, Chlortox, Corodan, Gold Crest, Intox, Kypchlor, Niran, Octachlor, Sydane, Synklor, Termi-Ded, Topiclor, and Toxichlor are trade names. Also consult ICSC #0743 (heptachlor).

Transport Emergency Card: TEC (R)-61G41c

ADDITIONAL INFORMATION

ICSC: 0740 CHLORDANE (TECHNICAL PRODUCT)

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

Chrysene

<I1001743> **[218-01-9]**

Synonyms: 1,2-Benzophenanthrene; Benzo[a]phenanthrene; 1,2,5,6-Dibenzonaphthalene; 1,2-Benzophenanthracene

$C_{18}H_{12}$
228.29

This picture is a live chemical image

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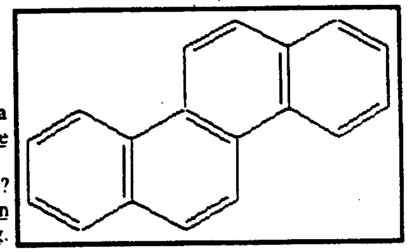

BUY

ACX Number	I1001743	CAS RN	218-01-9
Melting Point (°C)	255.8	Specific Gravity	1.274
Boiling Point (°C)	448	Vapor Density	--
Evaporation Rate	--	Water Solubility	Insoluble. 0.00000018 g/100 mL
Flash Point (°C)	--	EPA Code	K035; K048; K087; U050; K051; K049
DOT Number	--	RTECS	GC0700000
Comments	White crystals. Orthorhombic bipyramidal plates from benzene. MUTAGEN.		

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    Chrysene, 98%
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Australian Atmospheric Exposure Standards
    Information about this particular substance
Australian Hazardous Substances Database

NTP CHEMICAL REPOSITORY (RADIAN CORPORATION, AUGUST 29, 1991)
CHRYSENE

-IDENTIFIERS
===========

*CATALOG ID NUMBER: 000509

*CAS NUMBER: 218-01-9

*BASE CHEMICAL NAME: CHRYSENE

*PRIMARY NAME: CHRYSENE

*CHEMICAL FORMULA: C18H12

*STRUCTURAL FORMULA:

*WLN: L E6 B666J

*SYNONYMS:
1,2-BENZPHENANTHRENE
BENZO (A) PHENANTHRENE
1,2,5,6-DIBENZONAPHTHALENE

-PHYSICAL CHEMICAL DATA
=====================

*PHYSICAL DESCRIPTIONS: Orthorhombic bipyramidal plates from benzene.

*MOLECULAR WEIGHT: 228.28

*SPECIFIC GRAVITY: 1.274 (20/4)

*DENSITY:Not available

*MP (DEG C): 254

*BP (DEG C): 448

*SOLUBILITIES:
WATER : Insoluble. (0.0018mg/kg)

DMSO : Not available

95% ETHANOL : Slightly soluble. (1g/1300ml)

METHANOL : Not available

ACETONE : Slightly soluble.

TOLUENE : Not available

OTHER SOLVENTS:
Carbon disulfide: Slightly soluble.
Toluene: Soluble in hot. (1g/480ml)
ETHER : Slightly soluble.
BENZENE: Soluble in hot.

*VOLATILITY : Not available

*FLAMMABILITY(FLASH POINT): Not available

*LABELS REQUIRED:

*PACKAGING: PASSENGER: PKG. INSTR.: MAXIMUM QUANTITY:
CARGO : PKG. INSTR.: MAXIMUM QUANTITY:

*SPECIAL PROVISIONS:

*USES: Not available

*COMMENTS: Not available

-HANDLING PROCEDURES
==================

*ACUTE/CHRONIC HAZARDS:
Toxic.

*MINIMUM PROTECTIVE CLOTHING:
If Tyvek-type disposable protective clothing is not worn during handling of this chemical, wear disposable Tyvek-type sleeves taped to your gloves.

*RECOMMENDED GLOVE MATERIALS:
Permeation data indicate that neoprene gloves may provide protection to contact with this compound. Neoprene over latex gloves is recommended. However, if this chemical makes direct contact with your gloves, or if a tear, puncture or hole develops, remove them at once.

*RECOMMENDED RESPIRATOR:
Where the neat test chemical is weighed and diluted, wear a NIOSH-approved half face respirator equipped with a combination filter cartridge, i.e. organic vapor/acid gas/HEPA (specific for organic vapors, HCl, acid gas, SO2 and a high efficiency particulate filter).

*OTHER:
Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure.

*STORAGE PRECAUTIONS:
You should protect this material from exposure to light, and store it in a refrigerator.

*SPILLS AND LEAKAGE:
If you spill this chemical, dampen the solid spill material with toluene, then transfer the dampened material to a suitable container. Use absorbent paper dampened with toluene to pick up any remaining material. Your contaminated clothing and the absorbent paper should be sealed in a vapor-tigh plastic bag for eventual disposal. Solvent-wash all contaminated surfaces wit toluene followed by washing with a strong soap and water solution. Do not reenter the contaminated area until the Safety Officer (or other responsible person) has verified that the area has been properly cleaned.

*DISPOSAL AND WASTE TREATMENT:
You should dispose of all waste and contaminated materials associated with this chemical as specified by existing local, state and federal regulations concerning hazardous waste disposal. It is suggested that your contaminated materials should be destroyed by incineration in a special, high temperature (>2000 degrees F),

Weast, R.C. and M.A. Astle, Eds. CRC Handbook of Chemistry and Physics. 56th Ed. CRC Press, Inc. Boca Raton, FL. 1976. PG. C-241.

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Hawley, G.G., Ed. The Condensed Chemical Dictionary. 9th Ed. Van Nostrand Reinhold. New York. 1977. PG. 209.

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International Technical Information Institute. Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal with Toxicity and Hazard Data. International Technical Information Institute. 1978. NOT LISTED.

Sax, N.I. Dangerous Properties of Industrial Materials. 5th Ed. Van Nostrand Reinhold. New York. 1979. NOT LISTED.

Proctor, N.H. and J.P. Hughes. Chemical Hazards of the Workplace. J.B. Lippincott. Philadelphia. 1978. NOT LISTED.

U.S. Environmental Protection Agency, Office of Toxic Substances. Toxic Substances Control Act Chemical Substances Inventory, Initial Inventory. 6 Vols. U.S. Environmental Protection Agency. Washington, D.C. 1979. LISTED.

Steere, N.V., Ed. Handbook of Laboratory Safety. 2nd Ed. CRC Press, Inc. Cleveland, OH. 1971. NOT LISTED.

[610] Clansky, Kenneth B., Ed. Suspect Chemicals Sourcebook: A Guide to Industrial Chemicals Covered Under Major Federal Regulatory and Advisory Programs. Roytech Publications, Inc. Burlingame, CA. 1990. Section 3, p. 62.

[620] United States National Toxicology Program. Chemical Status Report. NTP Chemtrack System. Research Triangle Park, NC. November 6, 1990. Not listed.

International Chemical Safety Cards

DIBENZ(a,h)ANTHRACENE

ICSC: 0431

National Institute for Occupational Safety and Health NIOSH

DIBENZO(a,h)ANTHRACENE
1,2:5,6-Dibenzanthracene
$C_{22}H_{14}$
Molecular mass: 278.4

CAS # 53-70-3
RTECS # HN2625000
ICSC # 0431
EC # 601-041-00-2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
SKIN	Redness. Swelling. Itching.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
EYES	Redness.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0431

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

Dibenzofuran

<I1002923>

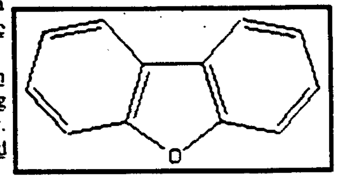
[132-64-9]

Synonyms: DBF; diphenylene oxide

$C_{12}H_8O$
168.19

This picture is a live chemical image

The ChemDraw Plugin lets you search by drawing structures in your web browser. Have you downloaded it yet?



BUY

ACX Number	I1002923	CAS RN	132-64-9
Melting Point (°C)	81-83	Specific Gravity	--
Boiling Point (°C)	285	Vapor Density	--
Evaporation Rate	--	Water Solubility	<0.1 g/100 mL at 20 C
Flash Point (°C)	130	EPA Code	--
DOT Number	--	RTECS	HP4430000
Comments	Colorless crystals		

Add Property

ChemInfo Searching is faster and more powerful. Click Here.

More information about this compound is available from

Add Link

ABCR GmbH&Co KG
  Dibenzofuran, 98%
ATSDR Internet HazDat Site Contaminant Query
  Information about this particular substance
ATSDR Priority List
  This compound in MDL Molfile format
Available Chemicals Exchange
  Information about this particular substance
Biocatalysis/Biodegradation Database
  Information about this particular substance

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **DIBENZOFURAN**

CAS Number: 132-64-9
DOT Number: None

RTK Substance number: 2230
Date: March 1992 Revision May 1998

HAZARD SUMMARY

* **Dibenzofuran** can affect you when breathed in and by passing through your skin.
* Exposure can irritate the eyes, nose, throat, and skin.
* Repeated contact may cause skin growths, rashes and changes in skin color.
* *CONSULT THE NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES HAZARDOUS SUBSTANCE FACT SHEET ON COAL TAR.*

IDENTIFICATION

Dibenzofuran is a white, crystalline (sand-like) powder, which is derived from *Coal Tar*. It is used as an insecticide and to make other chemicals.

REASON FOR CITATION

* **Dibenzofuran** is on the Hazardous Substance List because it is cited by EPA, DEP and HHAG.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.20.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Dibenzofuran**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

* It should be recognized that **Dibenzofuran** can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Dibenzofuran** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Dibenzofuran** to potentially exposed workers.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Dibenzofuran**. Wear protective gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear dust-proof goggles and face shield when working with powders or dust, unless full facepiece respiratory protection is worn.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Engineering controls must be effective to ensure that exposure to **Dibenzofuran** does not occur.
* NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filters and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency, 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.
* If while wearing a filter, cartridge or canister respirator, you can smell, taste, or otherwise detect **Dibenzofuran**, or in the case of a full facepiece respirator you experience eye irritation, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter, cartridge, or canister. If the seal is no longer good, you may need a new respirator.
* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters, cartridges, or canisters to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
* Where the potential for high exposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include <u>dust releasing operations</u> (grinding, mixing, blasting, dumping, etc.), <u>other physical and mechanical processes</u> (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and <u>"confined space" exposures</u> (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. Because of this, and because of exposure of children or people who are already ill, community exposures may cause health problems.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutati** a change in the genetic material in a body cell. Mutations lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administr which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

m-Dichlorobenzene

[541-73-1]

<I1003139>

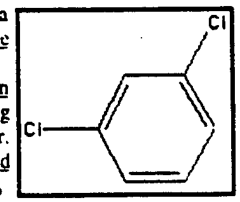
Synonyms: 1,3-dichlorobenzene; m-Phenylenedichloride; m-dichlorobenzol

$C_6H_4Cl_2$

147.00

This picture is a live chemical image

The ChemDraw Plugin lets you search by drawing structures in your web browser. Have you downloaded it yet?



BUY

ACX Number	I1003139	CAS RN	541-73-1
Melting Point (°C)	-24.76	Specific Gravity	1.288
Boiling Point (°C)	173	Vapor Density	--
Evaporation Rate	--	Water Solubility	insoluble. 0.0125 g/100 mL
Flash Point (°C)	67	EPA Code	K085; K096; U071
DOT Number	UN 9255	RTECS	CZ4499000
Comments	Colorless liquid		

Add Property

ChemInfo Searching is faster and more powerful. Click Here.

More information about this compound is available from

Add Link

8(e) TRIAGE Chemical Studies Database
ABCR GmbH&Co KG
    1,3-Dichlorobenzene, 98%
ATSDR Internet HazDat Site Contaminant Query
    Information about this particular substance
ATSDR Priority List
    This compound in MDL Molfile format
Available Chemicals Exchange
    Information about this particular substance
Biodegradation data for chlorinated benzenes and phenols

Common Name: 1,3-Dichlorobenzene
CAS Number: 541-73-1
DOT Number: UN 9255
Date: January, 1989

HAZARD SUMMARY

* 1,3-Dichlorobenzene can affect you when breathed-in and by passing through your skin.
* Exposure to 1,3-Dichlorobenzene can irritate the eyes, nose, and throat.
* Brief high, or prolonged, lower exposures can damage the liver, kidneys and blood cells causing a low blood count (anemia). This can be fatal.
* Exposure can cause you to feel dizzy, lightheaded and severe headache. Higher levels can cause you to pass out.

IDENTIFICATION

1,3-Dichlorobenzene is a colorless liquid. It is used as a fumigant and an insecticide.

REASON FOR CITATION

* 1,3-Dichlorobenzene is on the Hazardous Substance List because it is cited by DOT and EPA.
* Definitions are attached.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer.You have a legal right to this information under OSHA 1910.20.
* If you think you are experiencing any work related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for 1,3-Dichlorobenzene. This does not mean that this substance is not harmful. Safe work practices should always be followed.

It should be recognized that 1,3-Dichlorobenzene can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release.If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to 1,3-Dichlorobenzene and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of 1,3-Dichlorobenzene to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically pump liquid 1,3-Dichlorobenzene from drums or other storage containers to process containers.
* Specific engineering controls are recommended for this chemical by NIOSH. Refer to the NIOSH criteria document: Working Safely with Pesticides #76 147.

Good WORK PRACTICES can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by 1,3-Dichlorobenzene should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to 1,3-Dichlorobenzene.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with 1,3-Dichlorobenzene, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted 1,3-Dichlorobenzene, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where 1,3-Dichlorobenzene is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating or smoking.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with 1,3-Dichlorobenzene.Wear protective gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/ clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear splashproof chemical goggles when working with liquid, unless full face piece respiratory protection is worn.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into area.

FIRST AID
POISON INFORMATION

Eye Contact
* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention.

Skin Contact
* Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing
* Remove the person from exposure.
* Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA
Flash Point: 146oF (63oC)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:
Benzene, 1,3 Dichloro

Other Names and Formulations:
m-Dichlorobenzene; m-Phenylenedichloride.

NEW JERSEY DEPARTMENT OF HEALTH
Right to Know Program
CN 368, Trenton, NJ 08625 0368

ECOLOGICAL INFORMATION

1,3-Dichlorobenzene is a liquid, used as an intermediate for the production of other chemicals; it is also a by-product in the production of 1,2-dichlorobenzene and 1,4-dichlorobenzene. It may enter the environment from industrial discharges or spills.

ACUTE (SHORT-TERM) ECOLOGICAL EFFECTS

Acute toxic effects may include the death of animals, birds, or fish, and death or low growth rate in plants. Acute effects are seen two to four days after animals or plants come in contact with a toxic chemical substance.

1,3-Dichlorobenzene has moderate acute toxicity to aquatic life. Insufficient data are available to evaluate or predict the short-term effects of 1,3-dichlorobenzene to plants, birds, or land animals.

CHRONIC (LONG-TERM) ECOLOGICAL EFFECTS

Chronic toxic effects may include shortened lifespan, reproductive problems, lower fertility, and changes in appearance or behavior. Chronic effects can be seen long after first exposure(s) to a toxic chemical.

International Chemical Safety Car

DIELDRIN

DIELDRIN

1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo-1,4-exo-5,8-dim

3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-,(1aalpha,2ß,2aalpha,3ß,6ß,6aalpha,7ß,7aalpha)-2,

HEOD

$C_{12}H_8Cl_6O$

Molecular mass: 380.9

CAS # 60-57-1
RTECS # IO1750000
ICSC # 0787
UN # 2761
EC # 602-049-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION
FIRE	Not combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	
EXPLOSION		
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!
INHALATION	(see Ingestion).	Ventilation (not if powder).
SKIN	MAY BE ABSORBED! See Ingestion.	Protective gloves. Protective clothing.
EYES		Safety goggles, or face shield.
INGESTION	Convulsions. Dizziness. Headache. Nausea. Vomiting. Muscle twitching.	Do not eat, drink, or smoke during work. Wash hands before eating.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. If the substance is formulated with solvent(s) also consult the card(s) (ICSC) of the solvent(s). Carrier solvents used in commercial formulations may change physical and toxicological properties. Do NOT take working clothes home. Alvit, Dieldrex, Dieldrite, Illoxol, Octalox, Panoram, and Quintox are trade names. Also consult ICSC #0774, Aldrin.

Transport Emergency Card: TEC (R)-61G41b.

ADDITIONAL INFORMATION

ICSC: 0787 **DIELDRIN**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

o-DICHLOROBENZENE

ICSC: 1066

National Institute for Occupational Safety and Health

NIOSH

o-DICHLOROBENZENE
1,2-Dichlorobenzene
ortho-Dichlorobenzene
o-Dichlorobenzol
$C_6H_4Cl_2$
Molecular mass: 147.0

CAS # 95-50-1
RTECS # CZ4500000
ICSC # 1066
UN # 1591
EC # 602-034-00-7

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 66°C explosive vapour/air mixtures may be formed.	Above 66°C use a closed system, ventilation.	
EXPOSURE			
INHALATION	Cough. Drowsiness. Sore throat. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
SKIN	Redness. Burning sensation. Symptoms may be delayed. Blisters.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Redness. Pain.	Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Burning sensation. Diarrhoea. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

[illegible]	persists in the environment.

NOTES

Protective clothing recommended (for more than 8 hours: Viton(TM)).

Transport Emergency Card: TEC (R)-81
NFPA Code: H2; F2; R0;

ADDITIONAL INFORMATION

ICSC: 1066 **o-DICHLOROBENZENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

1,4-DICHLOROBENZENE

ICSC: 0037

National Institute for Occupational Safety and Health
NIOSH

1,4-DICHLOROBENZENE
para-Dichlorobenzene
PDCB
$C_6H_4Cl_2$
Molecular mass: 147

CAS # 106-46-7
RTECS # CZ4550000
ICSC # 0037
UN # 2811
EC # 602-035-00-2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidants.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 66°C explosive vapour/air mixtures may be formed.	Above 66°C use a closed system, ventilation, and explosion-proof electrical equipment.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
INHALATION	Burning sensation. Cough. Drowsiness. Headache. Nausea. Shortness of breath. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
SKIN	Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES	Pain.	Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Burning sensation. Convulsions. Diarrhoea (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Give plenty of water to drink. Refer for medical attention.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. Dichloricide, Paracid, Parazene, Paramoth, Paradow, and Santochlor are trade names.

Transport Emergency Card: TEC (R)-61G12c
NFPA Code: H 2; F 2; R 0;

ADDITIONAL INFORMATION

ICSC: 0037	**1,4-DICHLOROBENZENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

2,6-DINITROTOLUENE

ICSC: 0728

National Institute for Occupational Safety and Health
NIOSH

2,6-DINITROTOLUENE
1-Methyl-2,6-dinitrobenzene
2,6-DNT
$C_7H_6N_2O_4$ / $C_6H_3CH_3(NO_2)_2$
Molecular mass: 182.1

CAS # 606-20-2
RTECS # XT1925000
ICSC # 0728
UN # 2038
EC # 609-007-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	In case of fire: keep drums, etc., cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	
INHALATION	Blue lips or finger nails. Blue skin. Headache. Dizziness. Nausea. Confusion. Convulsions. Unconsciousness.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! (see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES		Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	(See Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. Specific treatment is necessary in case of poisoning with this substance; the appropriate means with instructions must be available. Also consult ICSC # 0465 on the isomer mixture.

Transport Emergency Card: TEC (R)-61G12b
NFPA Code: H3; F1; R3;

ADDITIONAL INFORMATION

ICSC: 0728 | **2,6-DINITROTOLUENE**

di-sec-octyl phthalate [117-81-7]

<I1003752>

Synonyms: DEHP; DOP; bis(2-Ethylhexyl) phthalate; Dioctyl Phthalate; 1,2-Benzenedicarboxylic acid bis(2-ethylhexyl) ester; Octoil; Ethyl hexyl phthalate; 2-Ethylhexyl phthalate; bis-(2-ethylhexyl) 1,2-benzenedicarboxylate; octyl phthalate; phthalic acid dioctyl ester; BEHP; bisoflex 81; bisoflex dop; compound 889; DAF 68; ergoplast fdo; eviplast 80; eviplast 81; fleximel; flexol dop; flexol plasticizer dop; good-rite gp 264; hatcol dop; hercoflex 260; kodaflex dop; mollan o; nuoplaz dop; palatinol ah; pittsburgh px-138; platinol ah; platinol dop; rc plasticizer dop; reomol dop; reomol d 79p; sicol 150; staflex dop; truflex dop; vestinol ah; vinicizer 80; witcizer 312; Benzenedicarboxylic acid, bis(2-ethylhexyl) ester; Union carbide flexol 380; bis (2-Etheylexyl) Phthalate

$C_{24}H_{38}O_4$
390.56

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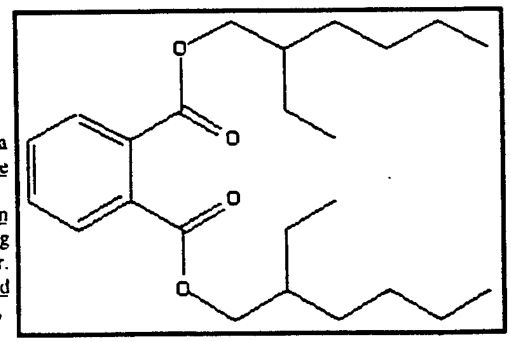

BUY

ACX Number	I1003752	CAS RN	117-81-7
Melting Point (°C)	-50	Specific Gravity	0.9732
Boiling Point (°C)	386.9	Vapor Density	--
Evaporation Rate	--	Water Solubility	Slightly soluble. 0.000034 g/100 mL
Flash Point (°C)	199	EPA Code	K048; K049; K051; K086; U028
DOT Number	--	RTECS	TI0350000
Comments	colorless, oily liquid with almost no odor.		

Add Property

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More information about this compound is available from

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New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **BIS (2-ETHYLHEXYL) PHTHALATE**

CAS Number: 117-81-7
DOT Number: None

RTK Substance number: 0238
Date: August 1992 Revision: July 1998

HAZARD SUMMARY

* **Bis (2-Ethylhexyl) Phthalate** can affect you when breathed in.
* **Bis (2-Ethylhexyl) Phthalate** should be handled as a CARCINOGEN and a TERATOGEN--WITH EXTREME CAUTION.
* It may damage the testes (male reproductive glands).
* Breathing **Bis (2-Ethylhexyl) Phthalate** can irritate the eyes, nose and throat.
* Repeated exposures may affect the liver.

IDENTIFICATION

Bis (2-Ethylhexyl) Phthalate is a light-colored liquid. It is used as a plasticizer for resins, in pesticides, and as a solvent for ink.

REASON FOR CITATION

* **Bis (2-Ethylhexyl) Phthalate** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DEP, NFPA, DOT, NIOSH, HHAG, IARC and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN** and a **TERATOGEN**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.20.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is **5 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit is **5 mg/m^3** averaged over a 10-hour workshift and **10 mg/m^3** not to be exceeded during any 15 minute work period.

ACGIH: The recommended airborne exposure limit is **5 mg/m^3** averaged over an 8-hour workshift.

* **Bis (2-Ethylhexyl) Phthalate** may be a CARCINOGEN and a TERATOGEN in humans. There may be no safe level of exposure to a carcinogen or teratogen, so all contact should be reduced to the lowest possible level.

WAYS OF REDUCING EXPOSURE

* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Bis (2-Ethylhexyl) Phthalate** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Bis (2-Ethylhexyl) Phthalate** to potentially exposed workers.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Bis (2-Ethylhexyl) Phthalate.** Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
* Safety equipment manufacturers recommend *Butyl Rubber* and *Viton* as protective materials.

Eye Protection

* Wear splash-proof chemical goggles and face shield when working with liquid, unless full facepiece respiratory protection is worn.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* For field applications check with your supervisor and your safety equipment supplier regarding the appropriate respiratory equipment.
* Where the potential exists for exposure over **5 mg/m^3**, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
* Exposure to **5000 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **5000 mg/m^3** exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

HANDLING AND STORAGE

* Prior to working with **Bis (2-Ethylhexyl) Phthalate** you should be trained on its proper handling and storage.
* **Bis (2-Ethylhexyl) Phthalate** is not compatible with OXIDIZING MATERIALS (such as PERMANGANATES, NITRATES, PEROXIDES, CHLORATES and PERCHLORATES); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and ALKALIES (such as SODIUM HYDROXIDE).
* Store in tightly closed containers in a cool, well-ventilated area away from HEAT.
* Sources of ignition, such as smoking and open flames, are prohibited where **Bis (2-Ethylhexyl) Phthalate** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. Because of this, and because of exposure of children or people who are already ill, community exposures may cause health problems.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air.. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Naphthalene

<I1001294> [91-20-3]

Synonyms: Naphthene; Camphor tar; white tar; Mothballs; Moth Flakes; tar camphor; mighty 150; mighty rd1

$C_{10}H_8$
128.17

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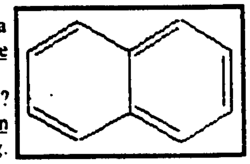

BUY

ACX Number	I1001294	CAS RN	91-20-3
Melting Point (°C)	80.6	Specific Gravity	0.997
Boiling Point (°C)	218	Vapor Density	4.42
Evaporation Rate	--	Water Solubility	Slightly soluble. 0.0031 g/100 mL
Flash Point (°C)	78	EPA Code	K001; K048; K049; K052; K060; U051; U165
DOT Number	UN 1334 ORM-A; UN 2304	RTECS	QJ0525000
Comments	Colorless to brown solid with an odor of mothballs. HYGROSCOPIC.		

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8(e) TRIAGE Chemical Studies Database
82 structural descriptors for NTP compounds
ABCR GmbH&Co KG
  Naphthalene, 98%
Air Pollution Exposure Distributions of Adult Urban Populations in Europe
ATSDR Internet HazDat Site Contaminant Query
  Information about this particular substance
ATSDR Priority List
  This compound in MDL Molfile format

New Jersey Department of Health and Senior Services

NEW JERSEY DEPARTMENT of HEALTH and SENIOR SERVICES

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **NAPHTHALENE**

CAS Number: 91-20-3
DOT Number: UN 1334 (Crude or Refined)
UN 2304 (Molten)

RTK Substance number: 1322
Date: January 1986 Revision: March 1998

HAZARD SUMMARY

* **Naphthalene** can affect you when breathed in and by passing through your skin.
* Exposure to **Napthalene** can irritate the skin, eyes, nose and throat.
* Very high levels can cause headache, fatigue, confusion, nausea and vomiting.
* Repeated exposure can cause clouding of the eye lens (cataract), which may damage vision.
* **Napthalene** may cause a skin allergy. If allergy develops, very low future exposures can cause itching and a skin rash.
* **Napthalene** may damage the kidneys, liver and the red blood cells.

IDENTIFICATION

Naphthalene is a white crystalline flake or solid which is shipped as a molten (melted) solid with a strong odor like mothballs. It is used in making dyes, explosives, plastics, lubricants and as a moth repellent.

REASON FOR CITATION

* **Naphthalene** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, NIOSH, DOT, DEP, HHAG, NFPA and EPA.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting air samples. Under OSHA 1910.20, you have a legal right to obtain copies of sampling results from your employer.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.
* **ODOR THRESHOLD = 0.038 ppm.**
* The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is **10 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit is **10 ppm (mg/m^3)** averaged over a 10[illegible] workshift and **15 ppm (mg/m^3)**, not to be exceeded during any 15 minute work period.

ACGIH: The recommended airborne exposure limit is **10 ppm** averaged over an 8-hour workshift and **15 ppm** as a STEL (short term exposure limit).

* The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Naphthalene** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Naphthalene** to potentially exposed workers.

* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Naphthalene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Naphthalene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Naphthalene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Naphthalene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating or smoking.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Naphthalene**. Wear protective gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear dust-proof goggles and face shield when working with powders or dust, unless full facepiece respiratory protection is worn.
* Wear splash-proof goggles and face shield, when working with molten **Naphthalene** unless full facepiece respiratory protection is worn.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Where the potential exists for exposure over **10 ppm**, use a MSHA/NIOSH approved full facepiece respirator with an organic vapor cartridge/canister and a dust prefilter. Increased protection is obtained from full facepiece powered air purifying respirators.
* If while wearing a filter, cartridge or canister respirator, you can smell, taste, or otherwise detect **Naphthalene**, or in the case of a full facepiece respirator you experience eye irritation, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter, cartridge, or canister. If the seal is no longer good, you may need a new respirator.
* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters, cartridges, or canisters to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
* Where the potential for high exposures exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
* Exposure to **250 ppm** is immediately dangerous to life and health. If the possibility of exposure above **250 ppm** exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in continuous flow or other positive pressure mode.

HANDLING AND STORAGE

* Prior to working with **Naphthalene** you should be trained on its proper handling and storage.
* **Naphthalene** must be stored to avoid contact with CHROMIUM (III) OXIDE, DINITROGEN PENTOXIDE, CHROMIC ANHYDRIDE and STRONG OXIDIZERS (such as CHLORINE, BROMINE and FLUORINE) since violent reactions occur.
* Store in tightly closed containers in a cool, well-ventilated area.
* Sources of ignition such as smoking and open flames are prohibited where **Naphthalene** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

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NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

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ChemQuote.Com ChemACX.Com SciStore.Com ChemSell.Com

N-Nitrosodiphenylamine

[86-30-6]

<I1003238>

Synonyms: N-Nitroso-N-Phenylaniline; Diphenylnitrosamine; Redax; N-nitroso-N-phenylbenzenamine; Nitrosodiphenylamine; vulcatard; nitrous diphenylamide; N,N-diphenylnitrosamine; curetard a; delac j; naugard tjb; NDPHA; retarder j; TJB; vulcalent a; vulcatard a; vultrol; diphenyl-N-nitrosoamine

$C_{12}H_{10}N_2O$

198.22

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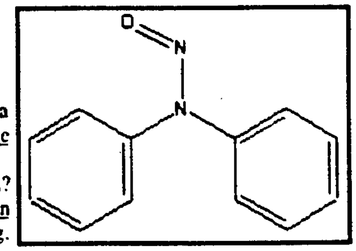

BUY

ACX Number	I1003238	CAS RN	86-30-6
Melting Point (°C)	66.5	Specific Gravity	1.23
Boiling Point (°C)	268	Vapor Density	--
Evaporation Rate	--	Water Solubility	Insoluble. 0.0035 g/100 mL
Flash Point (°C)	--	EPA Code	K022
DOT Number	--	RTECS	JJ9800000
Comments	Yellow to brown or orange powder or flakes		

Add Property

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ATSDR Internet HazDat Site Contaminant Query
Information about this particular substance
ATSDR Priority List
This compound in MDL Molfile format
ATSDR ToxFAQs
Information about this particular substance
Available Chemicals Exchange

Common Name: n-Nitrosodiphenylamine
CAS Number: 86-30-6
DOT Number: None
Date: May, 1989

HAZARD SUMMARY
* n-Nitrosodiphenylamine can affect you when breathed in and by passing through your skin.
* n-Nitrosodiphenylamine should be handled as a CARCINOGEN WITH EXTREME CAUTION.
* High or repeated exposure to closely related chemicals (other nitrosamines) can cause liver damage. It is not known whether n-Nitrosodiphenylamine has this effect.
* Long term effects have not been adequately studied.

IDENTIFICATION
n-Nitrosodiphenylamine is a yellow to green powder or crystalline material. It is used as a chemical intermediate in the manufacture of p Nitrosodiphenylamine and as a rubber processing chemical.

REASON FOR CITATION
* n-Nitrosodiphenylamine is on the Hazardous Substance List because it is cited by DEP and EPA.
* Definitions are attached.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED
* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.20.
* If you think you are experiencing any work related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS
No occupational exposure limits have been established for n-Nitrosodiphenylamine. This does not mean that this substance is not harmful. Safe work practices should always be followed.

It should be recognized that n-Nitrosodiphenylamine can be absorbed through your skin, thereby increasing your expo sure.

WAYS OF REDUCING EXPOSURE
* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to n-Nitrosodiphenylamine and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of n-Nitrosodiphenylamine to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer n-Nitrosodiphenylamine from drums or other storage containers to process containers.

Good WORK PRACTICES can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by n-Nitrosodiphenylamine should change into clean clothing promptly.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to n-Nitrosodiphenylamine.
* On skin contact with n-Nitrosodiphenylamine, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted n-Nitrosodiphenylamine, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where n-Nitrosodiphenylamine is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating or smoking.
* Use a vacuum or a wet method to reduce dust during clean up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing
* Avoid skin contact with n-Nitrosodiphenylamine. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection
* Wear dust proof goggles when working with powders or dust, unless full face piece respiratory protection is worn.

Respiratory Protection
IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA

Nitrosodiphenylamine as a HAZARDOUS WASTE. Contact your state Environmental Program for specific recommendations.

===
FOR LARGE SPILLS AND FIRES immediately call your fire department.
===

HANDLING AND STORAGE

* Prior to working with n-Nitrosodiphenylamine you should be trained on its proper handling and storage.
* Store in tightly closed containers in a cool, well ventilated area.

FIRST AID

POISON INFORMATION

Eye Contact
* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact
* Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing
* Remove the person from exposure.
* Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA

Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:
Benzenamine, n-Nitroso-n-Phenyl

Other Names and Formulations:
Diphenyl; n-Nitrosoamine; NDPA; n-Nitroso-n-Phenylaniline.

NEW JERSEY DEPARTMENT OF HEALTH
Right to Know Program
CN 368, Trenton, NJ 08625 0368

ECOLOGICAL INFORMATION

n-Nitrosodiphenylamine is a solid chemical used in the rubber industry. Its primary use is as a staining retarder for natural and synthetic rubbers. It most likely enters the environment from industrial discharges and spills.

ACUTE (SHORT-TERM) ECOLOGICAL EFFECTS

Acute toxic effects may include the death of animals, birds, or fish, and death or low growth rate in plants. Acute effects are seen two to four days after animals or plants come in contact with a toxic chemical substance.

N-nitrosodipropylamine [621-64-7]
<I1003239>

Synonyms: N-Nitroso-N-propyl-1-propanamine; Dipropylnitrosamine; DPNA; NDPA; Di-n-propylnitrosamine; N-Nitroso di-n-propylamine; Nitrosodipropylamine; N-nitroso-N-dipropylamine; nitrous dipropylamide; DPN

$C_6H_{14}N_2O$
130.19

This picture is a live chemical image

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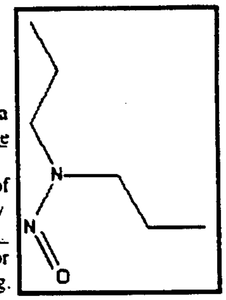

BUY

ACX Number	I1003239	CAS RN	621-64-7
Melting Point (°C)	--	Specific Gravity	--
Boiling Point (°C)	206	Vapor Density	--
Evaporation Rate	--	Water Solubility	Soluble. 0.9894 g/100 mL
Flash Point (°C)	99	EPA Code	U111
DOT Number	--	RTECS	JL9700000
Comments			

Add Property

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ATSDR Internet HazDat Site Contaminant Query
    Information about this particular substance
ATSDR Priority List
    This compound in MDL Molfile format
Available Chemicals Exchange
    Information about this particular substance
Berkeley Carcinogenic Potency Database

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **N-NITROSODI-N-PROPYLAMINE**

CAS Number: 621-64-7
DOT Number: None

RTK Substance number: 1407
Date: March 1989 Revision: October 1995

HAZARD SUMMARY

* **N-Nitrosodi-N-Propylamine** can affect you when breathed in and by passing through your skin.
* **N-Nitrosodi-N-Propylamine** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.

IDENTIFICATION

N-Nitrosodi-N-Propylamine is a yellow liquid. It is used for research purposes.

REASON FOR CITATION

* **N-Nitrosodi-N-Propylamine** is on the Hazardous Substance List because it is cited by NTP, DEP, IARC, HHAG and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN** and **MUTAGEN**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.20.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **N-Nitrosodi-N-Propylamine**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

* **N-Nitrosodi-N-Propylamine** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

It should be recognized that **N-Nitrosodi-N-Propylamine** can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **N-Nitrosodi-N-Propylamine** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **N-Nitrosodi-N-Propylamine** to potentially exposed workers.

* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **N-Nitrosodi-N-Propylamine**.
* On skin contact with **N-Nitrosodi-N-Propylamine**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **N-Nitrosodi-N-Propylamine**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **N-Nitrosodi-N-Propylamine** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating or smoking.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **N-Nitrosodi-N-Propylamine**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Eye protection is included in the recommended respiratory protection.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Engineering controls must be effective to ensure that exposure to **N-Nitrosodi-N-Propylamine** does not occur.
* At <u>any</u> exposure level, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in the positive pressure mode or with a full facepiece, hood, or helmet in the continuous flow mode, or use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include <u>physical and mechanical processes</u> (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and <u>"confined space" exposures</u> (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. Because of this, and because of exposure of children or people who are already ill, community exposures may cause health problems.

Q: Don't all chemicals cause cancer?

A: No. Most chemicals tested by scientists are not cancer-causing.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

International Chemical Safety Cards

PENTACHLOROPHENOL

ICSC: 0069

National Institute for Occupational Safety and Health

NIOSH

PENTACHLOROPHENOL

C_6Cl_5OH

Molecular mass: 266.4

CAS # 87-86-5
RTECS # SM6300000
ICSC # 0069
UN # 3155
EC # 604-002-00-8

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Liquid formulations containing organic solvents may be flammable.	NO open flames, NO sparks, and NO smoking.	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Cough. Dizziness. Drowsiness. Headache. Laboured breathing. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Redness. Blisters (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
EYES	Redness. Pain.	Safety goggles or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal cramps. Diarrhoea. Nausea. Unconsciousness. Vomiting. Weakness (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention. See Notes.

to water organisms. The substance may cause long-term effects in the aquatic environment.

NOTES

The commercial product (which may be in solution) contains very toxic impurities (dioxins). Do not induce vomiting if pentachlorophenol is dissolved in organic solvents. IARC: carcinogen class IIB; CE: carcinogen category 3, R40. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Immediate administration of an appropriate spray, by a doctor or a person authorized by him/her, should be considered. The odour warning when the exposure limit value is exceeded is insufficient.

NFPA Code: H 3; F 0; R 0;

ADDITIONAL INFORMATION

ICSC: 0069 **PENTACHLOROPHENOL**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

POLYCHLORINATED BIPHENYL (AROCLOR 1254)

ICSC: 0939

National Institute for Occupational Safety and Health

NIOSH

POLYCHLORINATED BIPHENYL (AROCLOR 1254)
Chlorobiphenyl (54% chlorine)
Chlorodiphenyl (54% chlorine)
PCB
Molecular mass: 327 (average)

CAS # 11097-69-1
RTECS # TQ1360000
ICSC # 0939
UN # 2315
EC # 602-039-00-4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Irritating and toxic gases may be generated in a fire.		Powder, carbon dioxide.
EXPLOSION			
EXPOSURE		PREVENT GENERATION OF MISTS! STRICT HYGIENE!	
INHALATION		Ventilation.	Fresh air, rest. Refer for medical attention.
SKIN	MAY BE ABSORBED! Dry skin. Redness. Chloracne (further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES	Redness. Pain.	Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Headache. Numbness. Fever.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

and liver effects may be in part due to contaminants of the PCB.

Transport Emergency Card: TEC (R)-914

ADDITIONAL INFORMATION

ICSC: 0939	POLYCHLORINATED BIPHENYL (AROCLOR 1254)

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

2,3,7,8-Tetrachlorodibenzo-p-Dioxin

[1746-01-6]

<I1002670>

Synonyms: 2,3,7,8-tetrachlorodibenzodioxin; Dioxin; TCDD; 2,3,7,8-tcdd; 2,3,7,8-T4CDD; 2,3,7,8-Tetrachlorodibenzo[b,e][1,4]dioxin; TCDBD; dibenzo-dioxin, 2,3,7,8-tetrachlorinated; 2,3,7,8-Tetrachlorodibenzo-1,4-dioxin; tetrachlorodibenzodioxin; tetradioxin; Tetrachlorodibenzo-1,4-dioxin

$C_{12}H_4Cl_4O_2$
321.97

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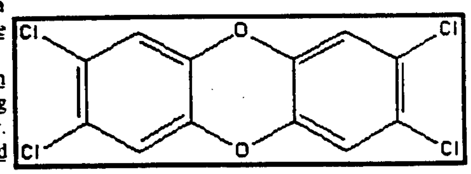

ACX Number	I1002670	CAS RN	1746-01-6
Melting Point (°C)	295	Specific Gravity	--
Boiling Point (°C)	500 (dec)	Vapor Density	--
Evaporation Rate	--	Water Solubility	0.0000000019 g/100 mL
Flash Point (°C)	--	EPA Code	--
DOT Number	--	RTECS	HP3500000
Comments	Colorless to white crystals		

Add Property

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More information about this compound is available from

Add Link

8(e) TRIAGE Chemical Studies Database
82 structural descriptors for NTP compounds
ATSDR Internet HazDat Site Contaminant Query
    Information about this particular substance
ATSDR Priority List
    This compound in MDL Molfile format
Berkeley Carcinogenic Potency Database
California EPA List of Lists
Dioxin Home Page

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **2,3,7,8-TETRACHLORO-DIBENZO-P-DIOXIN**

CAS Number: 1746-01-6
DOT Number: None

RTK Substance number: 1806
Date: February 1988 Revision: September 1996

HAZARD SUMMARY

* **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** can affect you when breathed in.
* **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** should be handled as a CARCINOGEN--WITH EXTREME CAUTION and may be a TERATOGEN.
* Contact can cause skin and eye irritation.
* Exposure can cause headache, weakness and digestive disturbance.
* Exposure can cause a severe acne-like skin rash (*chloroacne*) to develop and may persist for years.
* Exposure to **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** may damage the liver.
* **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** can affect the nervous system with symptoms of weakness, pain in the legs, and numbness.

IDENTIFICATION

2,3,7,8-Tetrachlorodibenzo-p-Dioxin is a colorless, needle-shaped material. It is not manufactured but occurs as an impurity in the manufacture of other chemicals, including herbicides and fungicides. It is also used as a research chemical.

REASON FOR CITATION

* **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** is on the Hazardous Substance List because it is cited by NIOSH, IARC, NTP, HHAG and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN** and a **TERATOGEN**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.20.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

No occupational exposure limits have been established for **2,3,7,8-Tetrachlorodibenzo-p-Dioxin**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

* **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

WAYS OF REDUCING EXPOSURE

* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **2,3,7,8-Tetrachlorodibenzo-p-Dioxin**.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** to potentially exposed workers.

* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **2,3,7,8-Tetrachlorodibenzo-p-Dioxin**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **2,3,7,8-Tetrachlorodibenzo-p-Dioxin**, immediately wash or shower to remove the chemical.
* Do not eat, smoke, or drink where **2,3,7,8-Tetrachloro-dibenzo-p-Dioxin** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
* When vacuuming, a high efficiency particulate absolute (HEPA) filter should be used, not a standard shop vacuum.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **2,3,7,8-Tetrachlorodibenzo-p-Dioxin**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
* Non-absorbent materials are recommended.

Eye Protection

* Eye protection is included in the recommended respiratory protection.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Engineering controls must be effective to ensure that exposure to **2,3,7,8-Tetrachlorodibenzo-p-Dioxin** does not occur.
* At any exposure level, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

International Chemical Safety Cards

ARSENIC

ICSC: 0013

National Institute for Occupational Safety and Health

NIOSH

ARSENIC
Grey arsenic
Metallic arsenic
As
Atomic mass: 74.9

CAS # 7440-38-2
RTECS # CG0525000
ICSC # 0013
UN # 1558
EC # 033-001-00-X

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight if in the form of fine powder or dust when exposed to hot surfaces or flames.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Cough. Diarrhoea. Shortness of breath. Sore throat. Vomiting. Weakness. Grey skin.	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
EYES	Redness.	or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Diarrhoea. Nausea. Sore throat. Unconsciousness. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

NOTES

The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222).

ADDITIONAL INFORMATION

ICSC: 0013 **ARSENIC**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

CADMIUM

ICSC: 0020

National Institute for Occupational Safety and Health

CADMIUM
(powder)
Cd
Molecular mass: 112.4

CAS # 7440-43-9
RTECS # EU9800000
ICSC # 0020
UN # 2570 (cadmium compounds)

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable in powder form. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking. NO contact with heat or acids.	Dry sand. Special powder. No other agents.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Cough. Headache. Symptoms may be delayed (see Notes).	Local exhaust or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
EYES	Redness. Pain.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal pain. Diarrhoea. Headache. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

NOTES

Reacts violently with fire extinguishing agents such as water, foam, carbon dioxide and halons. Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0020 **CADMIUM**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

CHROMIUM

ICSC: 0029

National Institute for Occupational Safety and Health NIOSH

CHROMIUM
Chrome
(powder)
Cr (metal)
Atomic mass: 52.0

CAS # 7440-47-3
RTECS # GB4200000
ICSC # 0029

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible if in very fine powder. Gives off irritating or toxic fumes (or gases) in a fire.	No open flames if in powder form.	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
INHALATION	Cough.	Local exhaust or breathing protection.	Fresh air, rest.
SKIN	Redness.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Redness.	Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth.

ICSC: 0029 CHROMIUM

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

LEAD

ICSC: 0052

National Institute for Occupational Safety and Health

LEAD
Lead metal
Plumbum
(powder)
Pb
Atomic mass: 207.2

CAS # 7439-92-1
RTECS # OF7525000
ICSC # 0052

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Finely divided lead powder is flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking (if in powder form).	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Abdominal cramps. Drowsiness. Headache. Nausea. Vomiting. Weakness. Wheezing. Pallor. Hemoglobinuria. Collapse.	Ventilation (not if powder). Avoid inhalation of fine dust and mist. Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
SKIN			
EYES			
INGESTION	Abdominal cramps (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

NOTES

Explosive limits are unknown in literature. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific lead compounds, e.g., lead chromate (ICSC # 0003), lead(II) oxide (ICSC # 0288).

Transport Emergency Card: TEC (R)-61G12b

ADDITIONAL INFORMATION

ICSC: 0052 **LEAD**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and IDLH values.

ATTACHMENT C

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Standard Operating Procedures

STANDARD OPERATING PROCEDURES

LOCKOUT/TAGOUT GUIDELINES
SOIL WASHING AND SOLIDIFICATION/STABILIZATION
McCLELLAN AFB

The following procedures provide general guidance for implementing lockout/tagout controls at the treatment system and associated work sites.

Lockout/Tagout. As the name implies, lockout/tagout employs a device such as a tag, lock, or fastener to prevent the start up or energizing of powered equipment, pumps, blowers, and other machinery that could move or result in a release of substances (liquids, gases, vapors, etc.) that would put individuals in danger. To prevent any unexpected start up or energizing, a lock is secured to the equipment/machinery power source in a manner that prevents activation of the equipment during servicing, maintenance, or troubleshooting activities.

Lockout/tagout is required whenever maintenance, servicing, troubleshooting or other activities are performed on equipment or machinery whose activation could pose a hazard to personnel. Examples include regular maintenance activities such as checking or replacing belts on blower drive pulleys, turning blower shafts by hand to check motors, changing oil, lubricating bearings which do not require rotating lubrication, and replacing or checking valves.

Lockout will consist of turning the equipment/machinery off and setting the main energy source at the distribution backboard panel in the "safe" or "off" position, and then securing the safe position by placing a padlock on the switch. The energy sources for virtually all powered machinery, pumps, blowers, and other machinery are controlled by switches located on the distribution backboard panel. Padlocks will be number-coded and only authorized operational personnel will be assigned these locks. Lockout/tagout procedures are designed to completely shut down the powered equipment and machinery. The procedures, to be performed only by authorized personnel, will be conducted in the following sequence:

- Preparation for shutdown. Prior to turning off or shutting down the equipment or machinery, identify the type and magnitude of the energy source, hazards of the energy to be controlled, and the method or means to control the energy. Personnel should be aware of the possible hazards that may result from turning off or de-energizing the equipment and to follow specified orderly shutdown procedures (refer to the instructions in the O&M and manufacturers' users manuals). Notify other personnel, if present, of the lockout. A lockout/tagout placard is to be posted in a clearly visible location at the distribution backboard to alert personnel that switches are subject to lockout.

- Equipment/machinery shutdown. Turn off or shut down the equipment by moving the appropriate switch to the "safe" or "off" position.

11.0 CONFINED SPACE SAFETY REQUIREMENTS

11.1 INTRODUCTION

Every enclosed space will be evaluated to determine if it represents a confined space and a permit-required confined space and classified as such in accordance with OSHA (29 CFR §1910.146) and Cal/OSHA (8 CCR §5157 et seq.) confined space safety requirements.

A confined space is defined as a space ~~that~~ all of the following three conditions: 1) large enough and so configured that an employee can bodily enter and perform assigned work tasks; 2) limited or restricted means of entry or exit; 3) is not designed for or unsuitable for continuous human occupancy.

A permit-required confined space, or permit space, is a confined space (as defined above) that has one or more of the following characteristics: 1) contains or has the potential to contain a hazardous atmosphere; 2) contains a material that has the potential for engulfing an entrant; 3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or a floor which slopes downward and tapers to a smaller cross section; or 4) contains any other recognized serious safety or health hazard (e.g., limited ventilation; life threatening atmospheres due to oxygen deficiency or the presence of toxic, flammable, and/or corrosive contaminants. Examples may include, but are not limited to, storage tanks, process/reaction vessels, stacks, pits, basements, silos, vats, degreasers, boilers, ventilation and exhaust ducts, manholes, sewers, tunnels, underground utility vaults, pipelines, and any open top space four feet or more in depth that is not subject to adequate ventilation.

The configuration of the space and the proposed operation to be conducted within that space ultimately determine if a confined space or permit-required confined space condition exists.

General guidance and JV policy for work in confined space is presented in this section. Additional site- or task-specific requirements and provisions will also be presented in the SHSP for any work tasks that may require entry into potential confined spaces at McAFB.

11.2 ENTRY DECISION

Entry into a confined space should only be undertaken where there is no alternative means of obtaining the necessary results or accomplishing the required operation. Thus, confined space entries are a last resort.

11.3 ENTRY PERMIT SYSTEM

Entry into a permit-required confined space (permit space) is by permit only. The permit process, as specified by OSHA (29 CFR §1910.146) and Cal/OSHA (8 CCR §5157) is designed to protect personnel from hazards associated with work within a confined space. The permit, as shown in Attachment 1, serves as written approval and authorization by the SSC for an entry of a specific space for a specific task. The permit certifies that existing and potential hazards have been evaluated by the SSC and

- Hazards associated with confined space operations
- Emergency entry and exit procedures
- Respiratory protection
- Lockout/tagout procedures
- Safety equipment
- Rescue operations
- Permit system
- Safe work practices for confined space operations

Documentation of the training will be forwarded to the OSC and kept in the JV office personnel training file. The training course must be approved by the HSM prior to enrollment.

11.5 AIR MONITORING

Absolutely no entry into a confined space is allowed until appropriate initial testing has been conducted to determine the atmosphere in the confined space. The area must be monitored for oxygen content, combustible gases/vapors, toxic contaminants, and any other tests specified by the SSC. In addition, the area should be monitored continuously while personnel are in the enclosure.

Personnel may enter a confined space only under the following conditions:

- Oxygen concentrations are between 19.5 and 23.5 percent
- Toxicity measurements indicate concentrations of airborne contaminants at levels less than one-half of the OSHA mandated PELs
- Combustible gas/vapor concentrations are less than 10 percent of the lower explosive limit (LEL)

Initial atmospheric samples must be drawn at the following locations:

- Outside the entry point(s)
- Immediately inside the entry point(s)
- At least every 4 feet in depth of the confined space to the surface of the floor or any remaining residues

All initial monitoring results must be recorded on the entry permit.

11.6 PROTECTIVE EQUIPMENT AND CLOTHING

The entry permit must specify the level of protection necessary for entry into a permit space. At a minimum, a hard hat, steel-toed boots and coveralls are required. In addition, employees may be required to wear safety equipment such as eye protection, hearing protection, gloves, safety belts, body harness, or wrist-type harnesses with life lines.

DANGER
THIS EQUIPMENT HAS BEEN
REMOVED FROM SERVICE DUE
TO CONFINED SPACE WORK

AT ____________________

DO NOT OPERATE

Date ____________________

Name ____________________

The confined space must be electrically isolated to prevent accidental activation of moving parts in the space or other electrical equipment. Electrical isolation should be accomplished by lockout of circuit breakers and/or power disconnects in the open (OFF) position by key-type padlock. Each work crew entering the space should have placed a lock on the circuit breaker/disconnect and should maintain possession of the key to the lock. Any circuit breaker/disconnect that is locked out should also be tagged to identify the reason for the lock out. This procedure also applies to pneumatic systems after the pressure has been released.

Moving parts should be isolated by disconnecting linkages or removing the chain or belt drives. Other moving parts should be blocked to preclude accidental rotation. All parts that have been blocked should have tags.

11.7.3 Cleaning

If possible, the confined space should initially be cleaned from the outside. If initial testing shows a flammable atmosphere at or above the LEL, the enclosure should be purged with an inert gas prior to ventilation.

The cleaning process itself may create the following potentially hazardous conditions:

- Excessive heat stress in the confined space if it is steamed cleaned and not allowed to cool down.
- Buildup of toxic materials if a chemical neutralizer is used and ventilation is inadequate, or through increased volatilization caused by the cleaning process .
- Potential for fire and explosion where the automatic ignition temperature of ~~the~~ stored product in the confined space is 120 percent or less of the steam outlet temperature.

11.7.4 Entry Into Confined Space

After initial cleaning, atmosphere evaluation, purging, and isolation of the powered systems, employees may enter the confined space provided that they comply with the following steps:

- Air-activated tools must be used where flammable liquids are present and must be grounded.
- Compressed gas cylinders, except those that are part of SCBA or resuscitation equipment, are not permitted.
- Ladders, scaffolding, and staging must be designed and fabricated to meet OSHA and Cal/OSHA regulations (29 CFR 1910 Subpart D; 8 CCR §1640 et seq.), and COE Work Platform Safety and Health Standards (EM-385-1-1, Section 22).
- Any equipment or instrumentation subject to use where flammable atmospheres may occur must be listed as explosion-proof or intrinsically safe by a recognized testing laboratory.

11.8 RECORD KEEPING

Copies of JV personnel training records and entry permits must be maintained in the METRIC project file.

Work Permit for Confined Space Operations at McAFB

All copies of this permit must remain at the METRIC work site until confined space entry operations are completed.

EXPIRATION DATE:________________

Location of permit-required confined space:________________

____

Description and purpose of task:________________

____

Hazards (i.e., limited access, toxic contaminants, flammable contaminants, oxygen deficiency, restricted ventilation, etc.) ________________

____

Level of protection (A, B, C, or D): ________________

Personnel assigned:

Name:________________	Duties:________________	Training completed:________________
Name:________________	Duties:________________	Training completed:________________
Name:________________	Duties:________________	Training completed:________________
Name:________________	Duties:________________	Training completed:________________
Name:________________	Duties:________________	Training completed:________________

Special equipment required:________________

____

____

First aid equipment location:________________

Safety requirements/procedures:________________

____

____

____

Emergency procedures:________________

____

____

____

Approved by: ________________

JV Site Safety Coordinator

PREPLAN EACH JOB

This confined space entry permit, when properly authorized, allows the person to whom it is issued to enter the specified area. Work must not be started until the indicated signatures have been obtained, all requirements met, and any discrepancies corrected. The permit must be retained in the facility files for one year.

		Yes	No	NA
1(a)	Procedure provided, reviewed, and enforced?	____	____	____
(b)	All job procedures reviewed and understood? Training completed?	____	____	____
(c)	Person on site at all times to enforce all procedures?	____	____	____
(d)	Material safety data sheet (MSDS) reviewed?	____	____	____
2(a)	Welding, cutting, open flames present? Welding permit approved and posted?	____	____	____
3(a)	Confined space isolated?	____	____	____
(b)	Lock-and-tag procedure followed?	____	____	____
(c)	Power sources "OFF"? Locked out?	____	____	____
(d)	Electrical hazards isolated, removed, or tagged?	____	____	____
(e)	Rotating equipment locked out, removed, or disconnected?	____	____	____
(f)	Lines carrying materials to and from confined space blanked off, section removed, or locked by two valves and drained? Drain valve locked open and tagged?	____	____	____
(g)	Contents removed and space flushed?	____	____	____
4(a)	Confined space atmosphere prepared and monitored?	____	____	____
(b)	Purged?	____	____	____
(c)	Flanges/access doors removed? Manholes open?	____	____	____
(d)	Continuous ventilation provided?	____	____	____
(e)	Oxygen level maintained over 19.5 percent but less than 23 percent?	____	____	____
(f)	Continuous air monitoring equipment provided? Operational?	____	____	____
5(a)	Personal protective equipment (PPE) provided? Specific instructions given for use?	____	____	____
(b)	Air lines, self-contained breathing apparatus (SCBA) or other approved respirators provided?	____	____	____
(c)	Safety harness with "D" ring and life line provided?	____	____	____
(d)	Head, hearing, hand, foot, and body protection provided?	____	____	____
(e)	Lighting equipment of approved type provided and grounded?	____	____	____
(f)	Fire extinguishers readily available?	____	____	____
(g)	Walking/working surfaces protected from slippage?	____	____	____
6(a)	Attendant standing outside of space trained and prepared to respond to emergencies as instructed?	____	____	____
(b)	Rescue equipment provided at the confined space?	____	____	____
(c)	Emergency alarms or communications available?	____	____	____

Note. This list of items is not intended to be all inclusive; certain jobs may require additional specifications.

Atmospheric monitoring equipment: ____

____

ATTACHMENT D

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

McClellan AFB Basewide Health And Safety Plan

Section 8.0
McClellan AFB Basewide
Removal Action Work Plan for SVE
Final
April 1998

8.0 HEALTH AND SAFETY PLAN

8.1 INTRODUCTION

The health and safety (H&S) requirements for RA Contractor personnel engaged in field activities and operations at McAFB during this RA are presented in this baseline HSP. Additional H&S requirements, protocols, and procedures for individual work sites are presented as HSP addenda or site-specific HSP (SHSP) in the site-specific RAWPs. Additional site-specific H&S hazards, protocols, and requirements are presented in the H&S procedures Section of the O&M manual prepared for each SVE system work site, or "Plant."

The baseline HSP provides a description of the RA and identifies general H&S issues and requirements to be implemented at all work sites. The HSP includes H&S personnel responsibilities, training and medical surveillance requirements, hazard assessment, personal protective equipment (PPE) and controls, personal monitoring requirements, site control, decontamination protocols, and emergency response procedures.

The SHSP provides additional information unique to each individual work site, and any modifications or clarifications of the H&S requirements presented in this baseline HSP. The SHSP identifies field personnel, and define specific site activities, hazards, personal monitoring, PPE and controls, decontamination, emergency procedures, and site control requirements for the individual SVE system work sites.

Neither the baseline HSP nor SHSP are stand-alone documents providing all of the necessary H&S information and requirements. The documents must be used in conjunction with one another.

This baseline HSP was prepared in accordance with the H&S standards, provisions, and requirements specified in the following regulations and guidance documents:

> Occupational Safety and Health Administration (OSHA) Standards for Hazardous Waste Operations and Emergency Response. Title 29 Code of Federal Regulations (CFR) Part 1910.120 (29 CFR 1910.120)
>
> California Department of Industrial Relations, Division of Industrial Safety (Cal/OSHA), General Industry Safety Orders, Hazardous Waste Operations and Emergency Response. Title 8 California Code of Regulations (CCR) Section 5192 (8 CCR 5192).
>
> OSHA Occupational Safety & Health Standards. 29 CFR Parts 1910 and 1926.
>
> Army Corps of Engineers' Safety and Health Requirements Manual (COE 1992).
>
> OSHA Air Contaminants: Permissible Exposure Limits (PELs). 29 CFR 1910.1000.
>
> Cal/OSHA Standards Board PELs for Chemical Contaminants. 8 CCR 5155.

8.2 PROJECT DESCRIPTION

A description of the project and project setting can be found in Section 1.0.

- Developing and establishing emergency procedures, ensuring appropriate McAFB emergency response personnel are notified in the case of an imminent health risk or other emergency, and coordinating/assisting response personnel as necessary.

- Field team personnel, identified in the SHSP, are responsible for taking all reasonable precautions to prevent injury to themselves, fellow workers, McAFB personnel, and the public. Personnel are required to read and adhere to the provisions of the basewide HSP and SHSP, and report all accidents and any unsafe conditions to the SSC, SM, or other supervisory personnel.

8.4 TRAINING AND MEDICAL SURVEILLANCE REQUIREMENTS

Field personnel working within a hazardous waste site designated work zone, or exclusion zone (EZ) (as discussed in Subsection 8.7), have successfully completed classroom and field training for hazardous waste site operations in accordance with OSHA and Cal/OSHA requirements specified in 29 CFR 1910.120(e) and 8 CCR 5192(e), respectively. Pre-assignment training requirements include successful completion of 40-hour initial H&S training, 3-day (24-hour) field activities training, and annual 8-hour H&S refresher. When this training has not been formally documented, one or more years of active hazardous waste site field experience is considered the equivalent of 24-hour field training. Copies of training certificates or other documentation for RA contractor personnel working in designated work zones will be provided to McAFB prior to start of field activities. It is also recommended that at least one person at each work site have currently valid certification in standard first aid and cardiopulmonary resuscitation (CPR).

Field personnel are required to participate in a medical surveillance program instituted by the RA Contractor in accordance with the requirements specified by OSHA (29 CFR 1910.120[f]) and Cal/OSHA (8 CCR 5192[f]) for cleanup operations at uncontrolled hazardous waste sites. All field personnel potentially exposed to hazardous substances/health hazards, such as those in designated work zones of the work site, must have completed either a baseline or annual medical surveillance physical examination and found to be medically fit and qualified to wear respiratory protective equipment prior to their assignment to a hazardous waste site.

Site-specific training is to be conducted by the SM, SSC, or other designated and qualified individual. The training, at a minimum, is to include a review of the HSP and H&S procedures, hazards, and other requirements unique to the work site and each individual's assigned tasks and duties.

Training and medical surveillance requirements for RA Contractor field personnel working at different levels of participation are presented in Table 8-1.

8.5 HAZARD ASSESSMENT

The H&S hazards that may be encountered by personnel during the course of overseeing the installation of the SVE system, O&M, and monitoring activities are addressed in the following paragraphs. Additional site- and task-specific hazards will be addressed in the SHSP and the H&S procedures specified in the SVE system O&M manuals.

Table 8-1

HEALTH AND SAFETY TRAINING REQUIREMENTS

Requirement			Employee Participation Level			
			Level 1s	Level 1	Level 2	Level 3
Medical	i.	Baseline Medical Examination	▯	▯	▯	▯
	ii.	Annual Medical Examination	▯	▯	▯	
Training	i.	40-hour Initial Health & Safety Training	▯	▯		
	ii.	24-hour Initial Health & Safety Training			▯	▯
	iii.	Qualified for Respirator Use	▯	▯	▯	
	iv.	24-hour Field Activities Training	▯	▯		
	v.	8-hour Field Activities Training			▯	▯
	vi.	Site-Specific Training	▯	▯	▯	▯
	vii.	Annual 8-hour Refresher Training	▯	▯		
	viii.	8-hour Management and Supervisor Training	▯			
	ix.	First Aid *	▯	▯		
	x.	Annual CPR *	▯	▯		

▯ Indicates training requirement

Levels of Participation

Level 1s: On-site supervisory personnel potentially exposed to hazardous substances/health hazards. This level includes SMs, OSCs, SSCs or HSOs, and Assistant SSCs or HSOs.

Level 1: General site workers, including equipment operators and general laborers engaged in hazardous substance removal, sampling or other activities who may, or potentially may, be exposed to hazardous substances/health hazards.

Level 2: Workers on any hazardous waste site for a total not exceeding 30 days per year who remain outside of areas where there may be potential exposure to hazardous materials above permissible exposure limits. These workers may perform support functions, geophysical or land surveying, groundwater monitoring, or other tasks not requiring the use of respirators.

Level 3: Workers regularly on site who work in areas that have been thoroughly monitored to ensure that exposure to hazardous materials do not exceed permissible exposure limits and where there are no known health hazards. These employees' site activities do not require the use of any protective equipment, and their access to the site is restricted to support zones or office areas.

* At least one (1) person at each site shall have currently valid certification.

Table 8-2 (Cont'd)

McAFB SVE REMOVAL ACTION
POTENTIAL CHEMICAL HAZARDS
HEALTH EFFECTS

Chemical Class/Compounds	Uses	Target Organs	Potential Effects	Medical Monitoring
Polynuclear Aromatic Hydrocarbons Polychlorinated dibenzo-p-dioxins (PCDDs) and Dibenzofurans (PCDFs) having one chlorine each in the 2,3,7 and 8 positions such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). 2,3,7,8-TCDD, "dioxin"; and other 2,3,7,8-substituted PCDD or PCDF isomers. (Note: The other 2,3,7,8-substituted isomers are moderately to substantially less potent than "dioxin.")	Defoliant; manufacturing byproduct in the production of 2,4,5-trichlorophenoxy-acetic acid; also found as a constituent of technical grade pentachlorophenol (PCP), fly ash from municipal garbage incinerators and other combustion sources, and a contaminant in some waste oils.	Kidney Liver CNS[(a)] Skin	Although 2,3,7,8-TCDD ("dioxin") is one of the most toxic synthetic substances known for laboratory animals and a proven carcinogen in both mice and rats, conclusive evidence is lacking that it has any serious long-term effects on humans. Epidemiological studies have failed to demonstrate that it causes severe chronic human effects. Acute symptoms include: chloracne, digestive disorders, muscular aches and pains, and transitory effects to the CNS and some enzyme systems.	History and physical exam should focus on the skin and nervous system. Laboratory tests include: Measurement of liver and kidney function, where relevant, and urinalysis.
Corrosives Hydrogen Chloride (HCl) Hydrogen Fluoride (HF) Sodium Hydroxide (NaOH) Chlorine Gas (Cl_2)	SVE system: HCl and HF vapors, and Cl_2 potentially generated by catalytic oxidation of halogenated VOCs; 25% NaOH solution used as the caustic scrubber solution to treat or neutralize HCl and HF.	Eyes Skin Respiratory system	Eye, nose, and throat irritant; possible inflammation and ulceration of respiratory tract; corrosive to all tissues; dermal contact could also result in dermatitis and photosensitization. Note: HF is a colorless gas that is highly irritating, corrosive and poisonous; it can cause severe burns which may not be painful or visible for several hours.	Medical examination with focus on respiratory system, skin, eyes, and for chronic HF exposure, blood (anemia, leukopenia) and bone (osteosclerosis).

Table 8-3
McAFB SVE REMOVAL ACTION
POTENTIAL CHEMICAL HAZARDS
PERMISSIBLE INHALATION EXPOSURE LEVELS

Contaminant	OSHA PEL/STEL	Cal/OSHA PEL/STEL	NIOSH REL/STEL	ACGIH TLV/STEL	IDLH
ORGANICS (ppm unless otherwise indicated)					
Acetone	1000/NE	750/1000; 3000^{C}	250/NE	750/1000	2500 (LEL)
Benzene	1/5	1/5 skin	0.1/1 Ca	10/NE A2	500 Ca
2-Butanone (methyl ethyl ketone)	200/300	200/300	200/300	200/300	3,000
1,3-Butadiene	1,000/NE	1/5	Ca	2/NE A2	2,000 (LEL) Ca
Carbon tetrachloride	10/25^{C}	2/200^{C} skin	NE/2 Ca	5/10 skin A2	200 Ca
Chloroform	2/NE	2/NE	NE/2 (60-min) Ca	10/NE A3	1,000 Ca
Chlorobenzene	10/NE	10/NE	NE	10/NE A3	1,000
Cyclohexane	300/NE	300/NE	300/NE	300/NE	1,300 (LEL)
1,2-Dichlorobenzene (o-dichlorobenzene)	50^{C}	25/50^{C}	50^{C}	25/50 A4	200
1,3-Dichlorobenzene (m-dichlorobenzene)	NA	NA	NA	NA	NA
1,2-Dichloroethane (ethylene dichloride)	50/100^{C}	½; 200^{C}	½ Ca	10/NE A4	50 Ca
1,1-Dichloroethene (vinyldiene chloride)	NA	1/NE	NA Ca	5/20 A3	NA Ca
cis-,trans-1,2-Dichloroethene	200/NE	200/NE	200/NE	200/NE	1,000
Ethyl benzene	100/NE	100/125	100/125	100/125	800
Freon® 11 (trichlorofluoromethane)	1000^{C}	1000^{C}	1000^{C}	NE/1000^{C} A4	2,000

Table 8-3 (Cont'd)

McAFB SVE REMOVAL ACTION
POTENTIAL CHEMICAL HAZARDS
PERMISSIBLE INHALATION EXPOSURE LEVELS

Contaminant	OSHA PEL/STEL	Cal/OSHA PEL/STEL	NIOSH REL/STEL	ACGIH TLV/STEL	IDLH
Total petroleum hydrocarbons (TPH)	NA	300/500 (gasoline)	NA	300/500 (gasoline)	NA
INORGANICS (mg/m^3 or as noted)					
Chromium (Cr; as Cr VI)	0.1^C	0.05/0.1^C	0.001/NE Ca	0.01/NE A1	15 Ca
Chromium (as Cr metal and Cr II, Cr III)	0.5/NE(Cr III) 1.0/NE (Cr metal)	0.5/NE	0.5/NE	0.5/NE A4	25 (Cr III) 250 (Cr II, Cr metal)
Hydrogen Chloride (HCl)	5 ppm^C	5 ppm^C	5 ppm^C	5 ppm^C	50 ppm
Hydrogen Fluoride (HF)	3/6 ppm^C	3/6 ppm	3/6 ppm^C	3 ppm^C	30 ppm
Sodium Fluoride (NaF) as Fluorine	2.5/NE	2.5/NE	2.5/NE	2.5/NE A4	250
Sodium Hydroxide (NaOH)	2^C	2^C	2^C	2^C	10
Nuisance Particulates (dust)	5/NE (respirable) 15/NE (total dust)	5/NE (respirable) 10/NE (total dust)	NE	10/NE (inhalable) 3/NE (respirable	NE
Chlorine Gas (Cl_2)	1 ppm^C	0.5/1 ppm	0.5 ppm^C	0.5/1 ppm A4	10 ppm
Mercury	0.05/0.1^C	0.05/0.1 skin	0.025/NE skin	10 A4	10

Heat Stress Hazards

Field personnel responsible for operating and monitoring the SVE system may be susceptible to heat stress during periods of elevated ambient temperatures or humidity, or during the performance of strenuous activities, particularly if impervious personal protective clothing is worn. Personnel will be monitored for early signs of heat stress, whenever ambient temperatures reach or exceed 85°F; whenever impervious clothing (e.g., Saranex-coated Tyvek coveralls) is worn, personnel will be monitored when temperatures exceed 70°F. Worker rotation schedules will be established as necessary. A digital thermometer will be included in the first aid kit maintained at each work site or field trailer to measure oral temperatures. Workers whose oral temperatures exceed 100°F will not be permitted to continue working until their temperature returns to a normal range (96.8°F to 100°F). Drinking water and electrolyte beverages will be available at each work site and field personnel will be encouraged to drink sufficient fluids to prevent salt loss and dehydration. Field personnel should be cognizant of the early signs of heat stress and the necessary treatment procedures, as summarized below.

Heat Cramps

Symptoms: Muscle cramps, particularly in the legs and abdomen; may also accompany heat exhaustion.

Treatment: Place victim in a cool, covered area and provide water or electrolyte beverage; apply firm pressure and place warm, wet towels over the cramped area for relief.

Heat Exhaustion

Symptoms: Elevated body temperature (100 to 104°F); pale and clammy skin; profuse perspiration; lethargy and fatigue; possible headache, nausea, or fainting.

Treatment: Move victim to cool area and provide water every 15 minutes for 3 or 4 doses; seek medical care in severe cases.

Heat Stroke

Symptoms: Elevated body temperature (may be as high as 106°F); skin is red or flushed, dry, and hot to the touch. There may be nausea, headache, and pulse may be rapid and strong; and possible loss of consciousness, delirium, or coma. These symptoms indicate a potential life-threatening situation: notify emergency medical services (EMS) immediately. The worker's temperature control system has stopped working correctly. The body temperature could rise so high that brain damage and death could result if the body is not cooled quickly.

Treatment: Rapidly cool victim by sponging the body with isopropyl alcohol or cool water, or pour water on the body. Continue to closely observe the victim. If the temperature starts to rise, cool the victim again. Heat stroke requires medical attention, ensure that the victim is transported to the nearest medical facility.

Injuries can be prevented by proper site control measures, safe work practices, and keeping the work site free of obstructions. During SVE system construction, preoperations, and regular field activities, safety briefings will be held prior to each day's activities to identify specific areas of the work site that are of concern (e.g., unstable structures and scaffolding, slippery surfaces, pipes, steep grades, uneven terrain, etc.) and to specify work practices and controls necessary to avoid or deal with these hazards.

Skeleto-Musculature Injury Hazards

SVE O&M and monitoring activities may require some lifting of heavy objects. No one is to attempt to lift large, heavy, or cumbersome objects without assistance. RA Contractor field personnel generally required to do frequent lifting are trained in proper lifting procedures. The SSC and SM will ensure that appropriate material handling equipment (e.g., drum trucks, hand carts, drum cradles, dollies, etc.) are available at the work site as needed.

Tool and Equipment Hazards

RA Contractor field personnel are trained in proper handling and maintenance requirements for tools and equipment commonly used at hazardous waste sites. Hand-held power tools should be held firmly. Electrical cords must be checked for broken insulation and potential exposure to water or other liquids. Safety glasses and hearing protection will be worn while operating power tools or equipment.

Confined Spaces

Entry into any confined space is strictly prohibited unless a Work Permit for Confined Space Operations in accordance with OSHA and Cal/OSHA (29 CFR 1910.146; 8 CCR 5156 et seq.) is obtained and McAFB confined space permit requirements are met. The work permit will prepared by the SSC and approved by the RA Contractor HSM prior to any entry into a confined space. A confined space for the purposes of this HSP includes: manholes, sewers, pipelines, storage tanks, process/reaction units, stacks, pits, basements, tunnels, and any spaces or enclosures that have limited ventilation and openings for entry or egress, or are not meant for human occupancy.

Biological Hazards

Possible biological hazards that may be encountered at a McAFB work site consist primarily of insects and spiders. Individuals with allergies to insects (e.g., bee or wasp stings) should remember to note this fact on the Medical Data Sheet they are required to complete, and to remind the SSC prior to the start of field activities. A first aid kit will be available at each site to treat minor skin irritations, stings, and bites.

Of concern are poisonous spiders. Although most spiders are harmless, there is one species quite common in the Sacramento and northern California area that is poisonous, the black widow (Latrodectus mactans). A black widow bite, although rarely fatal, is quite painful. Symptoms include severe pain in the area of the bite, profuse sweating, nausea, abdominal cramps, and difficulty breathing and speaking. Field personnel are reminded to exercise extreme caution when lifting well vaults or other covers and when working in dark, dank, enclosed areas of the work site, since black widows are typically found in these microenvironments.

First aid procedures for minor insect bites and stings include: cold applications, use of soothing lotions (e.g., calamine); and for a bee sting, removal of the venom, stinger, and venom sac. If the bite or

Sufficient access and working space (no less than 3 feet) will be provided about all live parts of electrical equipment. Live parts of electric equipment 50 volts or more will be guarded against accidental contact by limiting access or by partitioning or screening. An emergency shut-off for all powered units will be installed in a readily accessible location at the motor control center and clearly labeled or marked.

The SVE system is operated under vacuum to prevent releases of VOCs into the atmosphere; in addition, it is also designed to limit VOC levels within the system to less than 25 percent LEL. The only ignition source potentially in contact with elevated VOC levels is the vacuum blower system. The totally enclosed fan-cooled blower motor selected for any of the SVE systems must meet federal, state, and McAFB (see COE 1992) requirements for Class I, Division 2 locations (i.e., locations in which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation and which might become hazardous through failure or abnormal operation of the ventilating equipment).

Another safety concern is the unexpected start-up (energizing) of equipment, or the release of stored energy or material causing injury to personnel working on or near powered equipment or machinery. The SSC and SM will determine if machinery or equipment pose a potential hazard and should be locked or tagged out during some SVE system operations. Lockout/tagout procedures, in accordance with applicable state and federal regulatory requirements and Section 12 of the Corps of Engineer's Safety and Health Requirements Manual (COE 1992), will be developed for each SVE system work site and included in the SHSP and O&M Manuals. The SSC and SM will assist in defining and implementing the procedures by locating all energy isolating controls to be certain which switch(es), valve(s), or other devices may need to be locked or tagged out. The lockout/tagout procedures will be submitted to McAFB personnel for approval as part of the SHSP or O&M Manual.

8.6 PERSONAL PROTECTIVE EQUIPMENT AND CONTROLS

The following discussion identifies the appropriate PPE, engineering and administrative control measures, and monitoring/sampling procedures to be employed at SVE system work sites to limit the risk of exposure to potential hazards. Any variations or modifications to these requirements, or additional PPE/controls required to meet site- and task-specific hazards, will be identified in the SHSP.

8.6.1 Engineering/Administrative Control Measures

Field personnel will be reminded during safety briefings to be aware of potential chemical and physical hazards and to immediately inform the SSC, PE, SM or other supervisory personnel of any unsafe conditions or new hazards they may encounter. The SSC is responsible for ensuring that site control measures are implemented (e.g., marking, warning signs, placards, erecting barriers, securing and controlling access) and informing field personnel of specific work site hazards.

All hazardous materials will be stored in appropriately marked/labeled containers, in accordance with the manufacturer's recommendations, and, as approved by McAFB, stored in secured areas of the work site that are accessible only to authorized personnel. All containers will be regularly checked for leaks, and must be clearly labeled, tagged, marked (e.g., signs, labels, Department of Transportation [DOT] placards, etc.) indicating the name/type of hazardous chemical(s) and the H&S hazards. All MSDSs for hazardous materials used on-site will be available at the work site field trailer.

Table 8-4

GENERAL SAFETY RULES

- Personnel and authorized visitors entering SVE system work sites will be required to sign in at the field trailer located in the contractor's trailer lot, or on-site control center. Visitor access within the work site will be limited to areas outside of designated SVE system work zones, or exclusion zone (EZ). Personnel authorized to work in the EZ will be required to meet training/medical surveillance requirements, read and fully understand the site health and safety plan (HSP) and SHSP, and agree (in writing) to comply with its requirements.
- Eating, drinking, chewing gum or ~~tobacco~~, or smoking is prohibited except in designated work site areas.
- Personal protective equipment (PPE) will be used at the work site at the protective level specified by the site safety coordinator (SSC) or site manager (SM). The SSC will ensure that personnel are medically qualified and trained in the use of the PPE, and that the PPE is tested/inspected and found to be clean and in good working order.
- Authorized personnel with facial hair (i.e., over one day's growth) will not be allowed in the EZ whenever respiratory protection is required.
- Personnel and authorized visitors shall remove and discard all disposable PPE prior to leaving the work site.
- All personnel shall be trained in the site-specific emergency procedures, including the location of emergency telephone numbers and hospital route maps.
- Personnel must use the "buddy system" at all times while working within the EZ. The individual within the EZ must be in visual or verbal contact (e.g., cellular phone or two-way radio) with another authorized field team member.
- Equipment shall be kept in proper working order and shall be kept free of accumulated lubricants, contaminants or other hazardous or flammable substances.
- Safety briefings will be held daily, or as needed, by the SSC, SM, or project engineer (PE).
- Field activities are to be conducted during daylight hours whenever possible. Any work conducted during evening or nighttime hours in the EZ or work areas will require a minimum light intensity of 30 foot-candles.

- Disposable chemical-resistant (e.g., butyl rubber, nitrile, viton, PVC) gloves when handling corrosives or contaminated wastes (groundwater, spent carbon, sediment), heavy work gloves may be worn over the chemical-resistant gloves to provide additional abrasion resistance, but if contaminated they must be discarded.

Table 8-5

MONITORING EQUIPMENT ACTION LEVELS

Equipment	Reading[(a)]	Action
Explosimeter	≤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 work site until the readings are below 10% LEL.
O_2 Meter/Explosimeter	19.5-21% O_2	Continue operations.
	Needle deflects 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	Halt operations, Level B PPE required.
	>21% O_2	Halt operations and evacuate the area until readings are approximately 20% O_2.
PID (with 10.2eV or 11.7 eV lamp) or OVA[(b)]	<1 ppm	Continue operations in Level D PPE.
	>1, <5 ppm (intermittent)**	Attempt to identify VOC with color detector tubes and attempt to locate source; monitor continuously with PID or FID.
	>5 ppm, <10 ppm (intermittent)**	Requires Level C PPE. Continue operations and implement engineering controls; continuously monitor area with PID/OVA and color detector tubes.
	>5 ppm, <25 ppm (intermittent)**	Halt operations. SSC, in Level C, to identify source, attempt control, and monitor continuously.
	>25 ppm (continuous)***	Discontinue site activities. Level B or Level A may be required.
Sound Level Meter	≤85 dBA	Continue operations.
	>85 dBA	Continue operations wearing combination of hearing protection (i.e., ear plugs, ear muffs) with NRR sufficient to attenuate noise level to ≤85 dBA.
	>120 dBA	Continue operations only if hearing protection sufficient to attenuate noise level to ≤85 dBA; continue to monitor and initiate acoustical control measures (noise buffers, enclosures, etc.).

(a) Readings are above background and taken in the breathing zone of field personnel.

(b) If the OVA is used, the action levels are based on nonmethane compounds. The charcoal filter will be used to distinguish between methane and nonmethane compounds.

(c) Color detector tubes will be used to monitor for HCl, HF, and Cl_2, per Subsection 5.2.4

~~(d)~~ Color detector tubes for VOCs must be collected whenever PID or OVA readings are greater exceed 1 ppm.

ppm	parts per million	SM	Site manager
O_2	Oxygen	PID	Photoionization detector
<	Less than	eV	Electronvolt
>	Greater than	OVA	Organic vapor analyzer
PPE	Personal protective equipment	dBA	Decibels (A-weighted scale)
NRR	Noise reduction rating	SSC	Site safety coordinator
HF	Hydrofluoric acid	FID	Flame ionization detector
HCl	Hydrochloric acid	VOCs	Volatile organic compounds

8.7 SITE CONTROL

8.7.1 Work Site Access and Security

Access to McAFB is controlled at various entry gates, such as the ones depicted on the McAFB Facility Map provided in Figure 8-1 (e.g., Peacekeeper or Main Gate, Palm Gate, Roseville Road Gate, Bell Avenue Gate). Visitors are required to check in at the entry gate guardhouse and present their license and car registration. RA Contractor field personnel will be issued identification badges which will be available during the course of field activities.

Access to an SVE system work site will be limited to authorized McAFB, EPA, DTSC, RA Contractor and subcontractor personnel. Only visitors who have received prior authorization from appropriate project management or supervisory personnel to enter the work site will be permitted entry.

The SSC or SM will be responsible for coordinating site access control and security during field activities. The SSC will be responsible for securing, issuing, and returning all McAFB identification badges and, if necessary, controlled area badges. A fence will be constructed to secure the work site and the fence posted with appropriate warning signs to indicate the presence of any hazards. Authorized visitors will be advised of the potential hazards at the work site and will not be allowed to enter designated SVE system work zones, or EZs, unless they meet ~~all~~ required training/medical qualifications, read the HSP and SHSP, and agree to adhere to its requirements. A visitor log will be maintained at the work site and visitors required to sign in before entering.

8.7.2 Work Zones

Each work site requires appropriate siting coordination and approval of the Base civil engineer. The SSC will establish appropriate work zones within the work site. An EZ will be established to enclose the entire SVE system work zone (AWS, blowers, CatOx, quenching venturi and caustic scrubbers, scrubber stack, caustic tank, and other appurtenant facilities and equipment). The EZ represents the area of the work site where there is the greatest likelihood of exposure to physical or chemical hazards. The size and shape of the EZ will be determined by the SSC based upon potential hazards, site-specific conditions, site limitations, and the nature of SVE system operations. The outer boundary of the EZ will be clearly marked by an appropriate combination of barriers, signs, hazard tape, fences, or traffic cones, and entry will be limited to appropriately trained, qualified, and authorized field personnel. Visitors must supply their own PPE.

A contamination reduction zone (CRZ), will be established, if deemed necessary by the SSC, to provide a buffer zone where personnel will conduct personal and equipment decontamination. The support zone (SZ) will constitute the clean safe area used for work site support and administrative activities, including the central field trailer located south of Building 685 in the designated contractor's lot. The SZ, if possible, should be located in an area of the work site that is upwind of the EZ and CRZ. Sanitary facilities (portable chemical toilets) will be available at the work site for subcontractor and field personnel during SVE system construction. Permanent sanitary facilities will be available at the field trailer for the duration of RA activities.

8.7.3 Buddy System

Personnel working within the EZ must use the "buddy system" at all times. The individual within the EZ must be in visual or verbal contact (e.g., cellular phone or two-way radio) with another authorized field team member located at the work site. The use of the "buddy system" will ensure field team members have the assistance of a partner able to observe symptoms of chemical exposure, illness, secure emergency assistance, notify management or response agencies in the event of an emergency, and provide any other assistance that may be necessary. Enforcement of the buddy system will be the responsibility of the SSC.

If approved by the SSC, based on a review of work area conditions and operational activities, verbal contact with another authorized field team member located at McAFB but outside or away from the work site (e.g., field trailer, other RA or SVE system work sites) may be sufficient to satisfy the "buddy system" requirement and permit routine SVE system O&M activities within the EZ to be conducted by one individual.

8.7.4 Site Communications Plan

A telephone will be available throughout RA activities in the field trailer. Cellular telephones will be assigned to field personnel to ensure that at least one cellular telephone will be present at each work site. In addition, the SSC will establish emergency signals during the initial site safety briefing prior to start-up of the SVE system; examples include:

- **EMERGENCY, NEED HELP**: grasping throat with hand.
- **LEAVE AREA IMMEDIATELY**: grasping other employee's wrist.
- **OK, I UNDERSTAND**: thumbs up.
- **EMERGENCY, EVACUATE Work site**: continuous blast on compressed air horn or alarm.
- **ALL CLEAR**: two short blasts on air horn or alarm.

8.8 DECONTAMINATION PLAN

How extensive decontamination is depends primarily on the nature and extent of contamination at RA or SVE system work sites. Potential contact with hazardous substances or wastes (e.g., toxic, corrosive, reactive, etc.), require more extensive and thorough decontamination. The extent of the contamination and nature of field activities will vary at different work sites, but Level D PPE is expected to be adequate. Consequently, only minimal decon procedures are likely to be necessary. If the level of protection is upgraded to Level C PPE, more extensive decon procedures will be implemented. The SSC can modify procedures, as necessary, thereby adapting them to actual site conditions (e.g., changes in the nature and extent of contamination, PPE level, work tasks, etc.).

8.8.3 Disposition of Investigation/Operation-Derived Waste

System Residuals and other operation-derived waste will be sampled and disposed of in accordance with the procedures defined in Sections 5 and 9. The SSC, or designee, will ensure waste is properly containerized, secured, stored, and characterized, in accordance with the provisions of the McAFB Hazardous Waste Management Plans, EPA guidance, and requirements of the McAFB FTL and RPM. McAFB, as the generator responsible for completing and signing the hazardous waste manifest, will dispose of all hazardous wastes generated during this RA.

8.9 EMERGENCY RESPONSE PROCEDURES

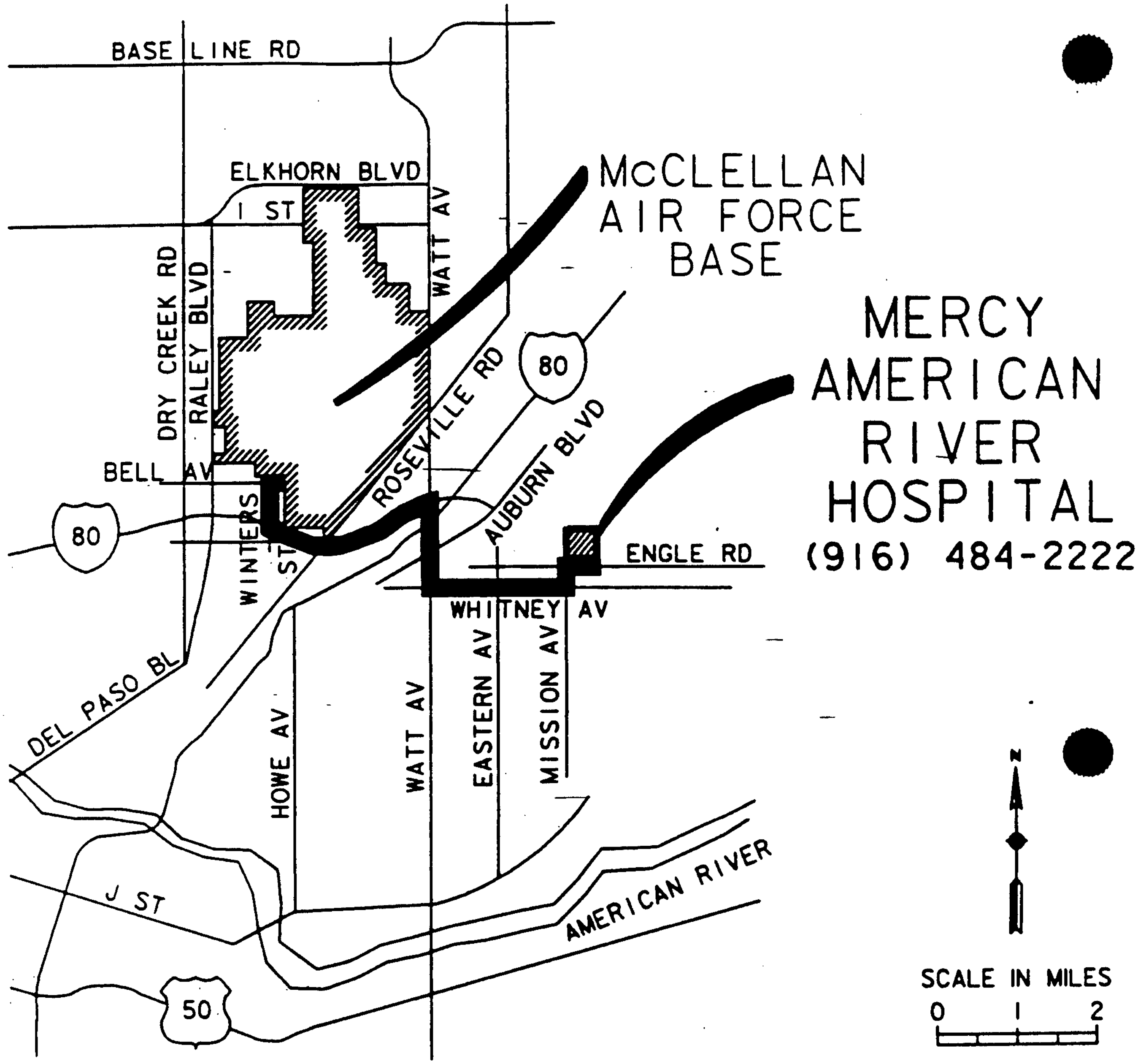
The RA Contractor will evacuate field personnel from a work site during major incidents or emergencies (e.g., fires, explosions, major chemical releases, injuries, etc.), and immediately notify and request assistance from agencies with personnel trained to deal with the specific emergency. This Section describes contingencies and emergency response procedures to be implemented at the work site. The procedures are designed to provide field personnel with the guidance necessary to handle most emergency situations.

8.9.1 Emergency Assistance

Table 8-6 provides a list of emergency telephone numbers and contacts. This list will be conspicuously posted or maintained near the telephone or other communication network established at the work site to identify appropriate emergency assistance personnel and McAFB contacts. In addition, maps indicating the location of the nearest emergency medical facilities on- and off-base will also be maintained at each work site throughout SVE installation and operations. Figure 8-1, McAFB Facility Map (see Subsection 8.7.1), and Figure 8-2, Hospital Location Map, identify the location and route to Mercy American River Hospital.

Directions to hospital (Figure 8-2):

> Exit McAFB through the main gate at Watt Avenue. Turn right at Watt Ave. and continue south to Whitney Avenue. Turn left onto Whitney and travel east to Mission Ave. Turn left onto Mission Ave. and continue north to Engle Rd. Turn right onto Engle Rd. and continue east to 4747 Engle Rd.



Directions To Mercy American River Hospital
4747 Engle Rd., Carmichael

Exit McAFB through the Bell Avenue Gate (Gate 660).
Turn left onto Winters St. and continue south to I-80 east bound. Continue on I-80 east to Watt Ave. south.
Turn right onto Watt Ave. and travel south to Whitney Ave.
Turn left onto Whitney and travel east to Mission Ave.
Turn left onto Mission Ave. and continue north to Engle Rd. Turn right onto Engle Rd. and continue east to 4747 Engle Rd.

URS Consultants, Inc.

FIGURE 8-2

SITE LOCATION MAP

M-AFB\IC-1\HOSPITAL

arrive. If there is evidence of serious trauma or unknown chemical exposure, the employee should be stabilized while awaiting EMS or rescue personnel.

A first aid kit will be maintained at the work site and/or field trailer for treating minor injuries.

Exposure. In the event of respiratory exposure, dermal or eye contact, or ingestion of a potentially toxic substance, the following procedures will be followed.

Respiratory Exposure (Inhalation). Move to fresh air immediately. Any loss of consciousness or exposure to elevated levels of known toxic substances, even if the individual appears to have fully recovered, requires immediate treatment and/or surveillance by a qualified physician.

Dermal Contact. Wash/rinse affected area for at least 15 minutes. An emergency drench system/eye wash will be permanently located at each SVE system work site. Transport worker for treatment to Mercy American River Hospital, or another local medical facility of the worker's choice.

Eye Contact. Flush eye(s) continuously for 15 minutes using the emergency eye wash, then transport worker to Mercy American River Hospital, or another medical facility of the worker's choice. If the work site has not been hooked up to a potable water source, use the emergency eye-wash solution included in the first aid kit to flush the eyes, then transport the victim to the nearest potable water source or emergency medical facility (Mercy American River Hospital), whichever is closest. Follow-up treatment or examination by a qualified physician is required.

Ingestion. Immediately transport to the nearest available emergency medical facility (Mercy American River Hospital). The Regional Poison Control Center should be contacted for instructions if the victim cannot be immediately transported to the emergency facility or the emergency facility cannot be contacted.

Emergency telephone numbers are provided in Table 8-6. The location of Mercy American River Hospital is provided in Figure 8-2.

8.9.3 Communication Network

As discussed in Subsection 8.7, a telephone or cellular telephone will be available at the work site. The SM or SSC will ensure that a functioning communication network is established and in working order prior to the start of field activities.

8.9.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SM, PE, or SSC will determine if field activities can be safely continued. Some of the conditions posing potential hazards include:

- Extremely high temperatures and humidity (i.e. potential for heat stress).
- Dangerous weather-related working conditions (e.g., high winds, rain, smog, etc.).
- Limited visibility.

8.9.7 Recordkeeping

In addition to OSHA and Cal/OSHA recordkeeping requirements, the RA Contractor will maintain a file of any H&S-related events occurring at RA work sites. Any exposure or potential exposure is to be recorded, as well as accidents or incidents that require the filing of an Accident/Incident Report (e.g., injuries, illnesses, accidental damage to property, or "near miss" occurrences that could have resulted in personal injury).

8.10 HSP APPROVAL, REVIEW AND DOCUMENTATION

RA Contractor field personnel will review the HSP and SHSP during site-specific training and initial project briefing. Each field team member working in a designated work zone, or EZ, must sign the HSP Acknowledgment of Understanding form. The forms will be maintained by the SSC as part of the project H&S file.

The SSC is responsible for informing all site personnel of any changes to the HSP or SHSP and describing the specific details of the changes during safety meetings.

Field personnel will be informed in writing of the results of any monitoring or sampling conducted during RA field activities and SVE system operations, or any other information indicating possible RA work site exposure(s). Any data or other documentation indicating possible employee exposure to chemical hazards exceeding PELs will be forwarded to the employee, the RA Contractor occupational physician, and upon the employee's request, to his/her personal physician.

This HSP has been prepared for anticipated RA work site conditions, hazards, and tasks associated with the SVE systems at McAFB. The HSP and SHSP must be modified if these conditions change substantially.

HSP Prepared By: Jerry Hinck, Office Safety Coordinator, URSG Sacramento Date: ______
(name/title/office)

Approved By: Mark Litzinger, URSG H&S Manager, URSG Seattle Date: ______
(name/title/office)

Modified By: Jerry Hinck, Office Safety Coordinator, URSG Sacramento Date: ______
(name/title/office)

Modifications Approved By: ______________________________ Date: ______
(name/title/office)

ATTACHMENT E

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Chemical Hazard Guidance And Toxicity Profiles

CambridgeSoft | ChemFinder.Com | ChemStore.Com | ChemNews.Com | ChemClub.Com
ChemQuote.Com | ChemACX.Com | SciStore.Com | LabEquip.Com | ChemSci.Com

Enter a chemical name, CAS Number, molecular formula, or molecular weight

New Search

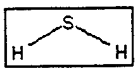
Or choose: Substructure Query with Plug-In or Structure Query with Java

Hydrogen Sulfide [7783-06-4]

Synonyms: hepatic acid; Stink Damp; Sulfureted Hydrogen; Hydrosulfuric acid; sulfur hydride; Sewer gas; Sour gas; Sulfuretted hydrogen; H2S; Hydrogen Sulfide ;

H_2S

34.0758



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Save in CDX format

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VIEW CHEM3D MODEL

ACX Number	X1003092-1	CAS RN	7783-06-4
Melting Point	-85.4	Specific Gravity	
Boiling Point	-60.3	Vapor Density	1.189
Refractive Index		Vapor Pressure	
Evaporation Rate		Water Solubility	437 mL in 100 mL of water at 0 C; 186 mL in 100 mL of water at 40 C.
Flash Point	-82.4	EPA	U135
DOT	UN 1053 Flammable gas	RTECS	MX1225000

Comments Colorless gas with a stong odor of rotton eggs detectable at 0.001 to 0.1 ppm; liquid at high pressure, low temperature. Present in coal pits, gas wells, sulfur springs, decaying organic matter

ADD CHEMFINDER.COM LINK

Biochemistry

Ligand Chemical Database for Enzyme Reactions

Information about this particular compound

Biocatalysis/Biodegradation Database

Information about this particular compound

Health

ATSDR Internet HazDat Site Contaminant Query

Information about this particular compound

NTP Chemical Health and Safety Data

NTP CHEMICAL REPOSITORY (RADIAN CORPORATION, AUGUST 29, 1991)
HYDROGEN SULFIDE

-IDENTIFIERS

*CATALOG ID NUMBER: 001210

*CAS NUMBER: 7783-06-4

*BASE CHEMICAL NAME: HYDROGENSULFIDE

*PRIMARY NAME: HYDROGEN SULFIDE

*CHEMICAL FORMULA: H2S

*STRUCTURAL FORMULA:

*WLN: ..H2.S

*SYNONYMS:
SULFUR HYDRIDE
STINK DAMP
SULFURETTED HYDROGEN

-PHYSICAL CHEMICAL DATA

*PHYSICAL DESCRIPTIONS: Literature:
Repository: Colorless gas

*MOLECULAR WEIGHT: 34.08

*SPECIFIC GRAVITY: 1.539 g/L @ 0 C @ 760 mm

*DENSITY: 1.19 relative to air

*MP (DEG C): -85.5 C

*BP (DEG C): -60.7 C

*SOLUBILITIES:

WATER	Not available
DMSO	Not available
95% ETHANOL	Not available
METHANOL	Not available
ACETONE	Not available
TOLUENE	Not available

OTHER SOLVENTS:
Water: soluble
Alcohol: Soluble
Glycerol: Soluble
CS2 : Soluble
ETHER : Soluble

*VOLATILITY :

Vapor Pressure: 20 atm. 25.5 C
Vapor density: 1.18

*FLAMMABILITY(FLASH POINT):
Flash point: 260 C degrees. Flammable. Fires involving this chemical should extinguished with water, dry chemical, or halon extinguishers.
The autoignition temperature is 260 C (500 F).

*UEL: 46%   LEL: 4.3%

*REACTIVITY:
Reacts violently with Na2O2, NI3, NCl3, NF3, OF2, HNO3, PbO2, F2 , Cu, CrO3, ClF3, ClO, BrF5, acetaldehyde, Na, hydrated iron oxide and absorbed Oxygen.

*STABILITY: Not available
Auqeous solutions are not stable.

*OTHER PHYSICAL DATA:
Freezing point: -83.8 C
Characteristic odor of rotten eggs
Odor threshold is 0.0002 ppm

-TOXICITY
========

*NIOSH REGISTRY NUMBER: MX1225000

*TOXICITY:

typ. dose	mode	specie	amount	unit	other
LCLO	ihl	hmn	600	ppm/30M	
LC50	ihl	rat	444	ppm	
LC50	ihl	mus	673	ppm/1H	
LCLO	ihl	gpg	1	mg/m3/8H	
LCLO	ihl	man	800	ppm/5M	

*AQTX/TLM96: Not available

*SAX TOXICITY EVALUATION:
THR: High irritant to eyes and mucous membrane and via inhalation route.
H2S is both an irritant and an asphyxiant.

*CARCINOGENICITY: Not available

*MUTAGENICITY: Not available

*TERATOGENICITY: Not available

*STANDARDS, REGULATIONS & RECOMMENDATIONS:
OSHA: Federal Register (1/19/89) and 29 CFR 1910.1000 Subpart Z
Transitional Limit: Ceiling Limit 20 ppm; Peak 50 ppm/10M [610]
Final Limit: PEL-TWA 10 ppm; STEL 15 ppm [610]
ACGIH: TLV-TWA 10 ppm; STEL 15 ppm [610]
NIOSH Criteria Document: Recommended Exposure Limit to this compound-air:
Ceiling Limit 10 ppm/10M [610]
NFPA Hazard Rating: Health (H): 3
Flammability (F): 4
Reactivity (R): 0
H3: Materials extremely hazardous to health but areas may be entered with extreme care (see NFPA for details).
F4: Very flammable gases or very volatile flammable liquids (see NFPA for details).
R0: Materials which are normally stable even under fire exposure conditions

and which are not reactive with water (see NFPA for details).

*OTHER TOXICITY DATA:
Review: Toxicology Review-2
Status: "NIOSH Manual of Analytical Methods" Vol. 1 126, Vol. 2 S4
Reported in EPA TSCA Inventory, 1980

-OTHER DATA (Regulatory)
======================

*PROPER SHIPPING NAME (IATA): Hydrogen sulphide, liquefied

*UN/ID NUMBER: UN1053

*HAZARD CLASS: 2 SUBSIDIARY RISK: 6.1, 3 PACKING GROUP:

*LABELS REQUIRED:

*PACKAGING: PASSENGER: PKG. INSTR.: Forbidden MAXIMUM QUANTITY: Forbidden
CARGO : PKG. INSTR.: Forbidden MAXIMUM QUANTITY: Forbidden

*SPECIAL PROVISIONS: A2

*USES:
In the manufacturing of chemicals, in metallurgy; as analytical reagent. Purification of hydrochloric and sulfuric acids; A source of sulfur.

*COMMENTS: Not available

-HANDLING PROCEDURES
===================

*ACUTE/CHRONIC HAZARDS:
Fire hazard: Very dangerous when exposed to heat, flame or oxidizers. Explosion hazard: Moderate. May travel considerable distance to source of ignition and flash back.

*MINIMUM PROTECTIVE CLOTHING:
If Tyvek-type disposable protective clothing is not worn during handling of this chemical, wear disposable Tyvek-type sleeves taped to your gloves.

*RECOMMENDED GLOVE MATERIALS: Not available

*RECOMMENDED RESPIRATOR:
When working with this chemical, wear a NIOSH-approved full face positive pressure supplied-air respirator or a self-contained breathing apparatus (SCBA).

*OTHER: Not available

*STORAGE PRECAUTIONS:
You should store this chemical in a freezer and away from all mineral acids and bases.

*SPILLS AND LEAKAGE:
Gas leakage - pass through $FeCl_3$ solution with a trap in line for prevention of siphoning back. Place cylinder in or near hood and leave to bleed off.

*DISPOSAL AND WASTE TREATMENT:
You should dispose of all waste and contaminated materials associated with this chemical as specified by existing local,

state and federal regulations concerning hazardous waste disposal. It is suggested that your contaminated materials should be destroyed by incineration in a special, high temperature (>2000 degrees F), chemical incinerator facility.

-EMERGENCY PROCEDURES
===================

*SKIN CONTACT:
CAUTION: Exposure of skin to compressed gases may result in freezing of the skin. Treatment for frostbite may be necessary.

Remove the victim from the source of contamination. IMMEDIATELY wash affected areas gently with COLD water (and soap, if necessary) while removing and isolating all contaminated clothing. Dry carefully with clean, soft towels.

Call a hospital or poison control center IMMEDIATELY even if no symptoms (such as inflammation or irritation) develop.

Be prepared to transport the victim to a hospital for treatment after washing the affected area if advised to do so by a physician.

*INHALATION:
IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop.

Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Respirator Recommendation.

*EYE CONTACT:
First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center.

Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician.

IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

*INGESTION:
This compound is a gas, therefore inhalation is the first route of exposure.

*SYMPTOMS:
Extremely hazardous. Collapse, coma and death from respiratory failure may come within a few seconds after one or two inspirations. Insidious poison, since of smell may be fatigued and fail to give warning of high concentrations Low concentrations produce irritation of conjuntiva and mucous membranes. Headaches, dizziness, nausea, lassitude may appear after exposure.

*FIREFIGHTING:

-SOURCES
=======

*SOURCES:
Occupational Safety and Health Administration. Tentative OSHA Listing of Confirmed and Suspected Carcinogens by Category. Occupational Safety and Health Administration. Washington, DC. 1979. Not listed

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Oak Ridge National Laboratory. Environmental Mutagen Information Center (EMIC), Bibliographic Data Base. Oak Ridge National Laboratory. Oak Ridge, TN. Listed

Steere, N.V., Ed. Handbook of Laboratory Safety. 2nd Ed. CRC Press, Inc. Cleveland, OH. 1971. p. 778-9, 562

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Proctor, N.H. and J.P. Hughes. Chemical Hazards of the Workplace. J.B. Lippincott. Philadelphia. 1978. p. 293

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International Technical Information Institute. Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal with Toxicity and Hazard Data. International Technical Information Institute. 1978. p. 279, 347

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[610] Clansky, Kenneth B., Ed. Suspect Chemicals Sourcebook: A Guide to Industrial Chemicals Covered Under Major Federal Regulatory and Advisory Programs. Roytech Publications, Inc. Burlingame, CA. 1990. Section 3, p. 121.

[620] United States National Toxicology Program. Chemical Status Report. NTP Chemtrack System. Research Triangle Park, NC. November 6, 1990. Not listed.

CambridgeSoft ChemFinder.Com ChemStore.Com ChemNews.Com ChemClub.Com
ChemQuote.Com ChemACX.Com SciStore.Com LabEquip.Com ChemSell.Com

Enter a chemical name, CAS Number, molecular formula, or molecular weight

New Search

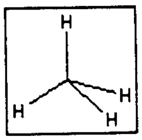
Or choose: Substructure Query with Plug-In or Structure Query with Java

Methane [74-82-8]

Synonyms: natural gas; Methyl Hydride; Marsh Gas; Biogas; fire damp; r 50 (refrigerant); methane, various grades;

CH_4

16.0426



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ACX Number	X1003162-8
Melting Point (°C)	-182.47
Boiling Point (°C)	-161.45
Refractive Index	
Evaporation Rate	
Flash Point (°C)	-187.7
DOT Number	UN 1971 Flammable gas; UN 1972 Flammable gas; UN 2034
Comments	colorless, odorless gas.
CAS RN	74-82-8
Density	0.466
Vapor Density	0.555
Vapor Pressure	
Water Solubility	slightly soluble. 3.5 mL/100 mL at 17 C
EPA Code	
RTECS	PA1490000

ADD CHEMFINDER.COM LINK

Biochemistry

Ligand Chemical Database for Enzyme Reactions

Information about this particular compound

Biocatalysis/Biodegradation Database

Information about this particular compound

Chemical Online Order

Available Chemicals Exchange

Information about this particular compound

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **METHANE**

CAS Number: 74-82-8
DOT Number: UN 1971 (compressed gas)
UN 1972 (liquefied)

RTK Substance number: 1202
Date: February 1989 Revision: October 1996

HAZARD SUMMARY

* **Methane** can affect you when breathed in.
* Very high levels can cause suffocation from lack of *oxygen*.
* Skin contact with liquid **Methane** can cause frostbite.
* **Methane** is a HIGHLY FLAMMABLE GAS and a DANGEROUS FIRE and EXPLOSION HAZARD.

IDENTIFICATION

Methane is an odorless, colorless gas, or liquid under pressure. It is used as a fuel and in the manufacture of organic chemicals. *Acetylene, Hydrogen Cyanide, and Hydrogen.*

REASON FOR CITATION

* **Methane** is on the Hazardous Substance List because it is cited by ACGIH, DOT and NFPA.
* This chemical is on the Special Health Hazard Substance List because it is **FLAMMABLE**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.20.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No exposure limits have been determined for **Methane**.

The health effects caused by exposure to **Methane** are much less serious than its fire and explosion risk.

Large amounts of **Methane** will decrease the amount of available *oxygen*. *Oxygen* content should be tested to ensure that it is at least 19% by volume.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective gloves and clothing to avoid contact with cold, liquid **Methane**.
* Wear protective clothing made of material that does not generate static electricity.
* Permanently installed analyzers can be used to monitor for dangerous release of **Methane** gas.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Methane** to potentially exposed workers.

This Fact Sheet is a summary source of information of <u>all</u> <u>potential</u> and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Methane**:

* Very high levels can cause suffocation from lack of *oxygen*.
* Skin contact with liquid **Methane** can cause frostbite.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Methane** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Methane** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Methane** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **Methane** has not been tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

There is no special test for this chemical. However, if illness occurs or overexposure is suspected, medical attention is recommended.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are <u>not</u> a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.20.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted [illegible] a hazardous substance. **ENGINEERING CONTROLS** [illegible] most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Before entering a confined space where **Methane** is present, check to make sure that sufficient *oxygen* (19%) exists.
* Before entering a confined space where **Methane** may be present, check to make sure that an explosive concentration does not exist.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
* Where exposure to cold equipment, vapors, or liquid may occur, employees should be equipped with special clothing designed to prevent freezing of body tissues.

Eye Protection

* Wear gas-proof goggles, unless full facepiece respiratory protection is worn.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* DO NOT USE CHEMICAL CARTRIDGE OR CANISTER RESPIRATORS.
* Exposure to **Methane** is dangerous because it can replace *oxygen* and lead to suffocation. Only MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in positive pressure mode should be used in *oxygen* deficient environments.

HANDLING AND STORAGE

* Prior to working with **Methane** you should be trained on its proper handling and storage.
* Procedures for handling, use, and storage of **Methane** cylinders should be in compliance with OSHA 1910.101 (Compressed gases) and Subpart M-Compressed Gas and Compressed Air Equipment (1910.169 to 171) and follow the recommendations of the Compressed Gas Association.
* Methane must be stored to avoid contact with OXIDIZERS (such as OXYGEN, CHLORINE, BROMINE, PERCHLORATES, PEROXIDES, NITRATES and PERMANGANATES) since violent reactions occur.
* Sources of ignition such as smoking and open flames are prohibited where **Methane** is handled, used, or stored.
* Use only non-sparking tools and equipment, especially when opening and closing containers of **Methane**.
* Wherever **Methane** is used, handled, manufactured, or stored, use explosion-proof electrical equipment and fittings.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. Because of this, and because of exposure of children or people who are already ill, community exposures may cause health problems.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Disease and Injury Services
Trenton, NJ 08625-0360
(609) 984-1863

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call a Department of Health and Senior Services physician who can help you find the services you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **METHANE**
DOT Number: **UN 1971 (compressed gas)**
UN 1972 (liquefied)
NAERG Code: : **115**
CAS Number: **74-82-8**

Hazard rating	NJ DOH	NFPA
FLAMMABILITY	-	4
REACTIVITY	-	0
CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

* **Methane** is a FLAMMABLE GAS.
* CONTAINERS MAY EXPLODE IN FIRE.
* THE FLAME MAY BE INVISIBLE.
* Stop the flow of gas.
* Use water spray to disperse the vapors.
* For small fires use dry chemical or *carbon dioxide* extinguishers.
* For large fires use water spray, fog or foam.
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Methane** is leaked, take the following steps:

* Restrict persons not wearing protective equipment from area of leak until clean-up is complete.
* Remove all ignition sources.
* Ventilate area of leak to disperse the gas.
* Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
* Use water spray to reduce vapor.
* It may be necessary to contain and dispose of **Methane** as a HAZARDOUS WASTE. Contact your Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

==

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: (609) 292-7172

==

HANDLING AND STORAGE (See page 3)

FIRST AID

__In NJ, POISON INFORMATION 1-800-962-1253__

Skin Contact

* Immerse affected part in warm (not hot) water. Seek medical attention.

Breathing

* Remove the person from exposure.
* Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA

Flash Point: -306°F (-188°C)
Water Solubility: Slightly soluble

OTHER COMMONLY USED NAMES

Chemical Name:
Methyl Hydride
Other Names:
Natural Gas; Marsh Gas; Biogas

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
CN 368, Trenton, NJ 08625-0368
(609) 984-2202

GUIDE 115 GASES - FLAMMABLE (Including Refrigerated Liquids)

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **EXTREMELY FLAMMABLE.**
- Will be easily ignited by heat, sparks or flames.
- Will form explosive mixtures with air.
- Vapours from liquefied gas are initially heavier than air and spread along ground.
- Vapours may travel to source of ignition and flash back.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

HEALTH

- Vapours may cause dizziness or asphyxiation without warning.
- Some may be irritating if inhaled at high concentrations.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire may produce irritating and/or toxic gases.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- Isolate spill or leak area immediately for at least 50 to 100 metres (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.
- Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 800 metres (1/2 mile).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 metres (1 mile) in all directions; also, consider initial evacuation for 1600 metres (1 mile) in all directions.

EMERGENCY RESPONSE

FIRE

- **DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.**

Small Fires

- Dry chemical or CO2.

Large Fires

- Water spray or fog.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank.
- ALWAYS stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Use water spray to reduce vapours or divert vapour cloud drift.
- Do not direct water at spill or source of leak.
- Prevent spreading of vapours through sewers, ventilation systems and confined areas.
- Isolate area until gas has dispersed.

CAUTION: When in contact with refrigerated/cryogenic liquids, many materials beco[me] brittle and are likely to break without warning.

FIRST AID

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- Clothing frozen to the skin should be thawed before being removed.
- In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

- Water spray or fog.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank.
- ALWAYS stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

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- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Use water spray to reduce vapours or divert vapour cloud drift.
- Do not direct water at spill or source of leak.
- Prevent spreading of vapours through sewers, ventilation systems and confined areas.
- Isolate area until gas has dispersed.

CAUTION: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning.

FIRST AID

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- Clothing frozen to the skin should be thawed before being removed.
- In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

Menu | TOC | CANUTEC | Search | Comments

- Air-activated tools must be used where flammable liquids are present and must be grounded.
- Compressed gas cylinders, except those that are part of SCBA or resuscitation equipment, are not permitted.
- Ladders, scaffolding, and staging must be designed and fabricated to meet OSHA and Cal/OSHA regulations (29 CFR 1910 Subpart D; 8 CCR §1640 et seq.), and COE Work Platform Safety and Health Standards (EM-385-1-1, Section 22).
- Any equipment or instrumentation subject to use where flammable atmospheres may occur must be listed as explosion-proof or intrinsically safe by a recognized testing laboratory.

11.8 RECORD KEEPING

Copies of JV personnel training records and entry permits must be maintained in the METRIC project file.

ATTACHMENT F

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

URS Safety Management Standards

SMS 13 Excavation Safety
SMS 17 Hazardous Waste Operations
SMS 19 Heavy Equipment Operations
SMS 42 Respiratory Protection
SMS 43 Personal Monitoring

URS CORPORATION SAFETY MANAGEMENT STANDARD

EXCAVATION SAFETY

1.0 Applicability

This procedure applies to projects where URS Corporation controls trenching and excavation activities, and/or where URS Corporation employees are exposed to hazards associated with trenching and excavation activities.

2.0 Purpose and Scope

This procedure is intended to protect personnel from the hazards associated with excavation entry activities.

3.0 Implementation

Field Operations - Implementation of this program is the responsibility of the Project Manager.

4.0 Requirements

A. Competent Person

Appoint an Excavation Competent Person when URS Corporation controls excavation activities. The Excavation Competent Person:

1. Is responsible for conducting daily inspections of excavation, adjacent areas, and protective systems prior to each shift.
2. Is responsible for inspection after every rainstorm or other hazard.
3. Must have knowledge of soils and soil classification.
4. Understands design and use of protective systems.
5. Has authority to stop work and take corrective actions when conditions change.
6. Has the ability to recognize and test hazardous atmospheres.
7. Has formal documentation of training as an Excavation Competent Person.
8. Is physically located at the excavation while work is in progress.

B. Soil Classification

Soil classifications must be conducted in accordance with Attachment 13-1. For the purposes of this standard all soils will be classified as type C unless otherwise designated in writing by a Registered Professional Engineer with experience in soils classification.

C. Protective Systems

Protect employees in excavations deeper than 4 feet by means of properly designed protective systems. All protective systems must comply with 29 CFR 1926 Subpart P Appendices B, D, and E.

1. Sloping and Benching

   See Attachment 13-2.

2. Timber Shoring for Trenches

   Timber shoring for trenches must be designed and stamped by a Registered Professional Engineer in accordance with 29CFR Subpart P, Appendix C.

3. Aluminum Hydraulic Shoring for Trenches

   Aluminum hydraulic shoring for trenches must be approved by a Registered Professional Engineer in accordance with 29CFR 1926 Subpart P, Appendix D.

4. Alternatives to Timber Shoring

   Trench shields and boxes must be either premanufactured with listed load ratings or designed, stamped and constructed under the direction of a Registered Professional Engineer.

5. Protective systems designed to protect employees in excavations deeper than 20 feet must be designed and stamped by a Registered Professional Engineer.

D. Permit Authorization and Inspections

1. Use the Exacvation Authorization Form (Attachment 13-3) of this procedure that requires the following issues to be addressed:

   a) Employee training/briefings.
   b) Electrical safety.
   c) Surface encumbrances.
   d) Underground installations and utilities.
   e) Protective systems.
   f) Access and egress.
   g) Exposure to vehicular traffic.
   h) Exposure to falling loads.
   i) Warning systems for mobile equipment.
   j) Testing for hazardous atmospheres.
   k) Emergency rescue equipment.
   l) Protection from hazards associated with water accumulation.
   m) Stability of adjacent structures.
   n) Protection of employees from loose rock.
   o) Inspections.
   p) Fall protection.

2. Require daily inspections of excavations to be conducted by Competent Person using Attachment 13-4.

E. Training/Briefings

Conduct daily safety briefings for all employees associated with excavation activities and document on Attachment 13-3. Discuss excavation hazards, protective measures, and work practices that will be applicable to the day's activities.

5.0 Documentation Summary

Records required for the Project Safety File:

A. Competent person qualifications.

B. Excavation Authorization Form.

C. Daily Competent Person inspections.

D. Daily worker briefing documentation.

E. Daily inspection records.

6.0 Resources

A. U.S. OSHA Standard - Excavations - 29 CFR 1926, Subpart P
(http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1926_SUBPART_P.html)
   1. Appendix B - Sloping and Benching
   (http://www.osha-slc.gov/OshStd_data/1926_SUBPART_P_APP_B.html)
   2. Appendix C - Timber Shoring
   (http://www.osha-slc.gov/OshStd_data/1926_SUBPART_P_APP_C.html)
   3. Appendix D - Aluminum Hydraulic Shoring
   (http://www.osha-slc.gov/OshStd_data/1926_SUBPART_P_APP_E.html)

B. U.S. OSHA Technical Links - Trenching and Excavation
(http://www.osha-slc.gov/SLTC/trenchingexcavation/index.html)

C. US Army Corp of Engineers EM 385-1-1, Section 23
(http://www.usace.army.mil/inet/usace-docs/eng-manuals/em385-1-1/toc.htm)

URS Corporation

URS Corporation Health & Safety Program
Soils Classification

"Type A" soils

are cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater.

Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A.

However, no soil is Type A if:

(i) The soil is fissured; or
(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
(iii) The soil has been previously disturbed; or
(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V)or greater; or
(v) The material is subject to other factors that would require it to be classified as a less stable material.

"Type B" soils are:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.
(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
(v) Dry rock that is not stable; or
(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

"Type C" soils are:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
(ii) Granular soils including gravel, sand, and loamy sand; or
(iii) Submerged soil or soil from which water is freely seeping; or
(iv) Submerged rock that is not stable, or
(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

URS Corporation

URS Corporation Health & Safety Program

SIMPLE SLOPES

MAXIMUM ALLOWABLE SLOPES
SOIL OR ROCK TYPE
MAXIMUM ALLOWABLE SLOPES (H:V)[1]
FOR
EXCAVATIONS LESS THAN 20 FEET DEEP[3]

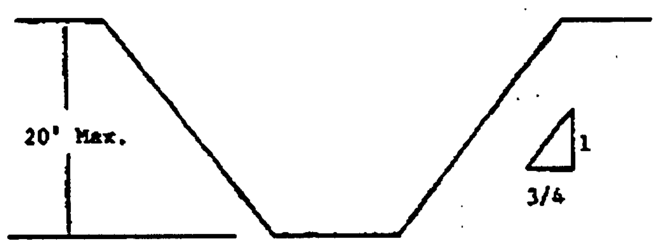
STABLE ROCK	VERTICAL (90 Deg.)
TYPE A[2]	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

[1] *Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.*
[2] *A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than12 feet (3.67 m) in depth shall be 3/4H:1V (53 degrees).*
[3] *Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.*

Slope Configurations (All slopes stated below are in the horizontal to vertical ratio)

Excavations made in Type A soil.

All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.

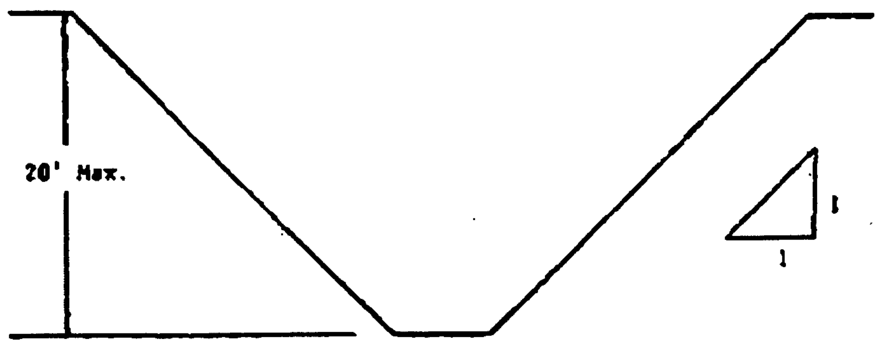


SIMPLE SLOPE - GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1.

Excavations Made in Type B Soil

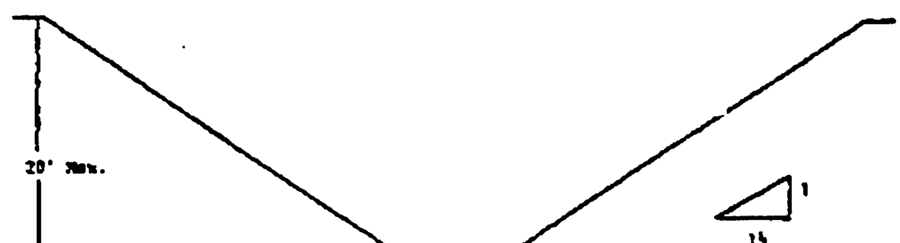
All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



SIMPLE SLOPE

Excavations Made in Type C Soil

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.



SIMPLE SLOPE

URS Corporation

EXCAVATION/TRENCHING AUTHORIZATION

POST AT LOCATION

(GOOD FOR ONE WEEK ONLY)

Authorization No. ______________________ Authorization From ______________ To ______________

Competent Person: ___________________________

Project Name: ______________________________ Project Location: ____________________________

Description or Job or Special procedures: ____

____

____

EMPLOYEE TRAINING AND PRE-EXCAVATION BRIEFING

Circle Answer

1. Safe Excavation and Rescue Training Conducted on: DATE:			
2. Mandatory pre-excavation briefing conducted on: DATE:			
3. Does this job require special training?	YES	NO	

ELECTRICAL SAFETY

1. Are all electrical devices grounded, double insulated, or GFCI protected?	YES	NO	N/A
2. Have all power cords and tools been visually inspected?	YES	NO	N/A

SURFACE ENCUMBRANCES

1. Have all surface encumbrances that are located so as to create a hazard to employees been removed or supported, as necessary, to safeguard employees?	YES	NO	N/A

UNDERGROUND INSTALLATIONS

1. Have the estimated locations of all underground installation been determined prior to excavation?	YES	NO	N/A
2. Have utility companies been contacted and advised of proposed work?	YES	NO	N/A
3. Are underground installations protected, supported or removed while excavations are open?	YES	NO	N/A

PROTECTIVE SYSTEMS

1. Excavation slopes comply with Type C Soil Classification?	YES	NO	N/A
2. If no to question 1, has soil been examined and been determined to be other than Type C soil by a Registered Professional Engineer?	YES	NO	N/A
3. If protective measures beyond sloping are required, do they meet OSHA Appendix standards?	YES	NO	N/A
4. If no to question 3, has the protective system been designed and stamped by a Registered Professional Engineer?	YES	NO	N/A

MEANS OF EGRESS FOR TRENCHES DEEPER THAN 4 FEET

1. Are stairways, ladders, or ramps provided every 25 feet?	YES	NO	N/A

ACCESS AND EGRESS

1. Are structural ramps that are used solely by personnel as a means of access or egress from excavations designed by a competent person?	YES	NO	N/A
2. Are ramps and runways constructed so structural members are connected to prevent displacement?	YES	NO	N/A
3. Are structural ramps that are used for access and egress of equipment designed by a competent person qualified in structural design and constructed in accordance with the design?	YES	NO	N/A
4. Are structural members used for ramps and runways of uniform thickness?	YES	NO	N/A
5. Are cleats used in connecting runway structural members attached in a manner to prevent tripping?	YES	NO	N/A
6. Are structural ramps used in lieu of steps provided with cleats or other surface treatment to prevent slipping?	YES	NO	N/A

EXPOSURE TO VEHICULAR TRAFFIC

1. Are personnel exposed to public vehicular traffic wearing reflectorized or high visibility vests?	YES	NO	N/A

EXPOSURE TO FALLING LOADS

1. Are employees prohibited from standing underneath loads handled by lifting or digging equipment?	YES	NO	N/A
2. Are employees prohibited from standing next to vehicles being loaded or unloaded?	YES	NO	N/A

WARNING SYSTEMS FOR MOBILE EQUIPMENT

1. Are warning systems such as barricades, hand or mechanical signals, or stop logs utilized when mobile equipment is operated adjacent to or at the edge of an excavation?	YES	NO	N/A

TESTING FOR HAZARDOUS ATMOSPHERES

1. Are the atmospheric hazards that can be reasonably expected to exist in excavations greater than 4 feet deep tested and controlled?		YES	NO	N/A
	READING:		TIME:	INITIAL:
2. Test for Oxygen Content:	________	% 02 (19.5% Minimum)	________	________
3. Test for Flammable Concentrations:	________	% LEL (10% Maximum)	________	________
4. Test for Toxic Concentration:	________	PPM of ________	________	________
5. Is testing conducted as often as necessary to ensure safety personnel?		YES	NO	N/A

EMERGENCY RESCUE EQUIPMENT

1. Is emergency rescue equipment such as SCBA, safety harness and line, or basket stretcher readily available and attended when hazardous atmospheric conditions exist?	YES	NO	N/A
2. Are employees who enter bell-bottom pier holes or other similar deep and confining excavations wearing a body harness with a life-line?	YES	NO	N/A

PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

1. Are employees prohibited from entering excavations that have accumulated water?	YES	NO	N/A
2. Is water being controlled or prevented from accumulating in excavation by the use of water removal equipment?	YES	NO	N/A
3. Is water control equipment operation being monitored by a competent person?	YES	NO	N/A
4. Are diversion ditches, dikes, or other suitable means used to prevent surface water from entering excavation?	YES	NO	N/A
5. Are excavations subjected to run-off from heavy rain immediately re-inspected by a competent person?	YES	NO	N/A

PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

1. Is adequate protection provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face?	YES	NO	N/A
2. Are employees protected from excavated or other material and equipment by placing this material a minimum of two (2) feet from the edge of excavations or by the use of retraining devices?	YES	NO	N/A

STABILITY OF ADJACENT STRUCTURES

1. Are support systems such as shoring, bracing, or underpinning provided to ensure stability of adjoining structures (i.e., buildings, walls) endangered by excavation activities?	YES	NO	N/A
2. Has any excavation below the level of the base or footing of foundations or retaining walls been:			
- Provided with a support system such as under pinning to ensure the safety of employees and stability of the structure?	YES	NO	N/A
- Performed in stable rock?	YES	NO	N/A
- Determined by a registered professional engineer that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity?	YES	NO	N/A
- Determined by a registered professional that the excavation work will not pose a hazard to employees?	YES	NO	N/A
3. Is the undermining of sidewalks and pavement structures prohibited?	YES	NO	N/A

INSPECTIONS

1.	Are daily inspections of excavations where employee exposure can be reasonably anticipated being done by the competent person?	YES	NO	N/A
2.	Are inspections being performed by a competent person after every rainstorm or other hazard increasing occurrence?	YES	NO	N/A
3.	Are employees removed from the excavation if the competent person finds evidence at any time of a situation that could result in a possible cave-in, protective system failure, hazardous atmosphere or other hazardous condition?	YES	NO	N/A

FALL PROTECTION

1.	Are standard guardrails provided on walkways and bridges that cross over excavations?	YES	NO	N/A
2.	Are all remotely located excavations adequately barricaded or covered?	YES	NO	N/A
3.	Are temporary wells, pits, shafts and similar exploratory operations backfilled upon completion?	YES	NO	N/A

I have inspected the excavation described in this authorization:

SIGNATURE OF COMPETENT PERSON ____________________ DATE ____________________

URS Corporation

URS Corporation Health & Safety Program
DAILY EXCAVATION/TRENCH INSPECTION REPORT

Competent Person: ______________________ Date: ______________________

Project Name: ______________________ Project Location: ______________________

Weather Conditions: ______________________ Rainfall Amounts 24 hours Previous: ____________

"I hereby attest that the following conditions existed and that the following items were checked or reviewed during this inspection".

Circle Y for YES; N for NO: N/A for NOT APPLICABLE. If comment is required, circle the number.

1.	Are barricades or covers in place and in good condition?	Y	N	N/A
2.	Have any tension cracks observed along top on any slopes?	Y	N	N/A
3.	Is surcharge located the proper distance from the toe of slopes?	Y	N	N/A
4.	Are slopes cut at design angle of repose?	Y	N	N/A
5.	Is any water seepage noted in trench walls or bottom?	Y	N	N/A
6.	Are pumps in place or available if needed?	Y	N	N/A
7.	Is bracing system installed in accordance with design?	Y	N	N/A
8.	Is there evidence of significant fracture planes in soil or rock?	Y	N	N/A
9.	Is there any evidence of caving or sloughing of soil since the last inspection?	Y	N	N/A
10.	Are there any zones of unusually weak soils or materials not anticipated?	Y	N	N/A
11.	Are there any noted dramatic dips or bedrock?	Y	N	N/A
12.	Are all short-term trench(s) covered within 24 hours?	Y	N	N/A
13.	Have non-compliance items been photographed?	Y	N	N/A
14.	Are hydraulic shores pumped to design pressure?	Y	N	N/A
15.	Is shoring being used secure?	Y	N	N/A
16.	Does plan include adequate safety factor for equipment being used?	Y	N	N/A
17.	Is traffic adequately away from trenching operation?	Y	N	N/A
18.	Are barricades up and secure?	Y	N	N/A
19.	Are there trees, boulders or other hazards in area?	Y	N	N/A
20.	Is vibration from equipment or traffic to close to trenching operation?	Y	N	N/A

Project Name: ______________________ Project Location: ______________________

21.	Are trench box(s) certified?	Y	N	N/A
22.	Are GFCI's used on ALL temporary electrical cords?	Y	N	N/A
23.	Is access and egress located every 25 feet?	Y	N	N/A
24.	Is hazardous testing done on a regular basis?	Y	N	N/A
25.	Is confined space permit renewed daily?	Y	N	N/A
26.	Has rescue procedure been established and is equipment immediately available?	Y	N	N/A

Comments: Place circled number in front of applicable comment.

URS CORPORATION SAFETY MANAGEMENT STANDARD

HAZARDOUS WASTE OPERATIONS

1.0 Applicability

This standard applies to URS Corporation field operations involving the investigation or remediation of sites impacted with hazardous wastes or hazardous materials including those associated with underground storage tanks.

Investigation projects for real estate transactions conducted to confirm that a site is "clean" are not covered under this standard. Reference related Safety Management Standards for such operations.

2.0 Purpose and Scope

The purpose of this standard is to provide guidance designed to minimize hazardous chemical exposures to URS Corporation personnel while URS Corporation is conducting hazardous waste field operations.

Investigation techniques included under this standard include, but are not limited to, hand auger, soil gas evaluation, test pits, and all types of power drilling, including direct push. Remediation techniques included under this standard include, but are not limited to, excavation, groundwater treatment, soil gas treatment, containment, and landfarming and similar insitu methods.

3.0 Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4.0 Requirements

A. Project Evaluation

Assess the technical and field aspects of every hazardous waste site project to evaluate:

1. Risk of exposure to hazardous chemicals, with particular attention to suspected or known human carcinogens.
2. Personal protective equipment requirements.
3. Air monitoring requirements.

4. Emergency services requirements.

5. Hazards addressed by other URS Corporation Safety Management Standards.

6. Logistical considerations, such as access, distance from population centers.

7. Other safety and health hazards associated with site operations.

B. Client/Contract Evaluation

1. Review contract documents to determine whether the client has any special internal or regulatory requirements for hazardous waste site operations.

2. Implement client requirements in addition to those of this standard. Those requirements that are the most protective (e.g., most stringent) will be used.

C. Site-specific Health and Safety Plan

1. Prepare a site-specific Health and Safety Plan (HSP) for every project under this standard. HSPs must be written or reviewed by a URS Corporation Health and Safety Program Representative.

2. Evaluate client and agency requirements prior to preparing the HSP, particularly if the client or an agency will approve the HSP prior to implementation.

3. Preparation of Military Site-Specific HSPs and complex HSPs must be conducted by a URS Corporation Health and Safety Program Representative.

D. Training

1. Verify that each assigned URS Corporation employee has completed required training. In general, the following are required for operations within North America:

   a) 40-hours of initial training from an approved training provider.
   b) 3-days of on-the-job training.
   c) 8-hours of refresher training completed within 12 months of the initial or subsequent refresher training.
   d) 8-hours of Site Safety Officer (Supervisor) training for directing the activities of any other URS Corporation employee.
   e) Additional training for the Site Safety Officer as described below.

2. For operations outside North America refer to the Health and Safety Training matrix in SMS 50, "Health and Safety Classification".

E. Site Safety Officer

1. Appoint a Site Safety Officer (SSO) with appropriate qualifications for the specific hazardous waste project.

2. Assure that the SSO for complex projects, such as those with complicated remediation activities, has no duties other than site safety and health.

3. Verify that the SSO has completed basic SSO training, and has additional required training and experience as applicable:

   a) Advanced respiratory protection training is required for projects where supplied air respirators may be used.
   b) Heavy equipment/construction safety.
   c) Personal air monitoring.

F. Exposure Monitoring

Require that exposure monitoring is conducted in accordance with the HSP on all hazardous waste projects.

G. Project Equipment

1. Provide all health and safety equipment as described by the project Health and Safety Plan.

2. Provide all personal protective equipment as described by the project Health and Safety Plan.

H. Medical Surveillance

Verify that each URS Corporation employee assigned to the project meets the minimum requirements of the URS Corporation Medical Surveillance Program. This typically includes:

1. Baseline examination.

2. Annual examination.

3. Site specific protocol as determined by the Regional Medical Surveillance Administrator.

4. Appropriate clearance for respirator use.

5.0 Documentation Summary

A. In the Project Safety File:

1. Completed Health and Safety Plan.
2. Completed and signed HSP approval form.
3. Signed HSP acceptance form.
4. Completed H&S field forms that are included in each HSP.
5. Training and Medical Surveillance Clearance documentation for project personnel.

6.0 Resources

A. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities - NIOSH 85-115
(http://www.cdc.gov/niosh/85-115.html)

B. U.S. OSHA Technical Page - Hazardous Waste Operations
(http://www.osha-slc.gov/SLTC/hazardouswaste/index.html)

C. USACE EM 385-1-1 - Hazardous, Toxic and Radioactive Waste
(http://www.usace.army.mil/inet/usace-docs/eng-manuals/em385-1-1/toc.htm)

URS CORPORATION SAFETY MANAGEMENT STANDARD

HEAVY EQUIPMENT OPERATIONS

1.0 Applicability

This procedure applies to URS Corporation field projects where heavy equipment is in operation.

2.0 Purpose and Scope

The purpose of this procedure is to require that heavy equipment is operated in a safe manner, that the equipment is properly maintained and that ground personnel are protected.

3.0 Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4.0 Requirements

A. Authorized Operators

1. Evaluate operators through documentable experience (resume) and a practical evaluation of skills.

2. Allow only qualified operators to operate equipment.

3. Prohibit equipment from being operated by any personnel who have not been specifically authorized to operate it.

4. Maintain a list of operators for the project and the specific equipment that they are authorized to operate.

5. Require operators to use seat belts at all times in all equipment and trucks.

6. Brief operators on the following rules of operation:

   a) Operators are in control of their work area.

   b) Equipment will be operated in a safe manner and within the constraints of the manufacturers Operation Manual.

c) Operators will stop work whenever unauthorized ground personnel or equipment enter their work area and only resume work when the area has been cleared.

B. Ground Personnel

1. Require that ground personnel on the site have received training and comply with the following rules of engagement:

   a) All ground personnel must wear orange protective vests when in work areas with any operating equipment.

   b) Ground personnel will stay outside of the swing zone or work area of any operating equipment.

   c) Ground personnel may only enter the swing or work area of any operating equipment when:

      (1) They have attracted the operators attention and made eye contact.
      (2) The operator has idled the equipment down and grounded all extensions.
      (3) The operator gives the ground personnel permission to approach.

   d) Ground personnel shall never walk or position themselves between any fixed object and running equipment or between two running pieces of equipment.

C. Equipment

1. Maintain operations manuals at the site for each piece of equipment that is present on the site and in use.

2. Require that operators are familiar with the manual for the equipment and operate the equipment within the parameters of the manual.

3. Require that all equipment is provided with roll-over protection systems (ROPS). Tracked excavators are exempt from ROPS requirements but must have a cab which provides protection from overhead hazards.

4. Verify that seatbelts are present and functional in all equipment.

5. Prohibit the use of equipment which has cab glass which is cracked, broken or missing.

6. Require that backup alarms are functional on all trucks and equipment. Tracked excavators must have bidirectional alarms or the operator must be provided with a spotter whenever tracking in either direction.

7. Require all extensions such as buckets, blades, forks, etc. to be grounded when not in use.

8. Require brakes to be set and wheels chocked (when applicable) when not in use.

D. Inspection and Maintenance

1. Require daily inspections of equipment by operators using Attachment 19-1.

2. Prohibit use of equipment deemed to be unsafe as a result of daily inspection until required repairs or maintenance occur.

3. Conduct maintenance as prescribed by the manufacturer in the Operations Manuals for each piece of equipment.

4. During maintenance/repair, require that:

   a) Motors are turned off.
   b) All extensions are grounded or securely blocked.
   c) Controls are in a neutral position.
   d) Brakes are set.

5.0 Documentation Summary

File the following documents in the Project Health and Safety File.

1. List of authorized operators.

2. Operator qualifications.

3. Daily Equipment Inspection Logs.

4. Site Briefing documentation for operator rules and ground personnel "rules of engagement".

6.0 Resources

A. U.S. OSHA Standard - Motorized Vehicles and Mechanized Equipment - 29 CFR 1926, Subpart O.
(http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1926_SUBPART_O.html)

B. National Association of Demolition Contractors – Safety Manual
(http://www.demolitionassn.com/)

C. Queensland Workplace Health and Safety -
Competency Standard for Users & Operators of Industrial Equipment
(http://www.detir.qld.gov.au/hs/applied/industry/report03.pdf)

URS Corporation

DAILY HEAVY EQUIPMENT SAFETY INSPECTION CHECKLIST

EQUIPMENT ID NO.: ____________________ DATE: ____________________

EQUIPMENT NAME: ____________________ INSPECTOR'S NAME: ____________________

BEG HOURS: __________ END HOURS: __________ EMPLOYEE NO.: ____________________

ITEM INSPECTED	✔IF SATISFACTORY	COMMENTS
Falling Object Protective Structure (FOP)		
Roll-Over Protection Structure (ROP)		
Seat Belts		
Operator Seat Bar(s)		
Side Shields, Screens or Cab		
Lift Arm Device		
Grab Handles		
Back-up Alarm - Working		
Lights		
Guards		
Horn		
Anti-Skid Tread Clear of Mud		
Safety Signs; i.e., counterbalance swing area		
Fire Extinguisher		
General Condition		
Fuel Connection		
Oil (full and no leaks)		
Clear of Extra Materials		
Controls Function Properly		
Damaged Parts		
Hydraulic System (full and no leaks)		
Parking Brake		
Lift Arm and Bucket		
Tires/Tracks		
Steering		
Breathing Air System		
Blast Shields		
Operator Signature:		
Gallons of Fuel Added		
Quarts of Oil Added		

INSTRUCTIONS: Each shift inspect all applicable items indicated. If an unsatisfactory condition is observed, suspend operation of the equipment and report the unsatisfactory condition to the site supervisor immediately.

URS CORPROATION SAFETY MANAGEMENT STANDARD

RESPIRATORY PROTECTION

1.0 Applicability

This program defines responsibilities and procedures and is applicable to URS Corporation operations that may require the use of respiratory protection including Immediately Dangerous to Life and Health (IDLH) and emergency conditions. This program also addresses the voluntary use of respirators.

2.0 Purpose and Scope

The purpose of this procedure is to protect those employees performing operations for which exposures can not be controlled by use of conventional engineering or administrative controls and prior to establishing a negative air exposure assessment, and to require that respiratory protective equipment is selected, used, maintained, and stored in accordance with acceptable practices.

3.0 Implementation

Laboratory/Office/ Shop Locations -	Implementation of this program is the responsibility of the Office Manager.
Field Activities -	Implementation of this program is the responsibility of the Project Manager.
Program Administration-	URS Corporation Health and Safety Manager is responsible for the development and annual review of this program.

URS Corporation Health and Safety Program Representatives are responsible to:

- Assist responsible employees in the implementation of the program.
- Assessing local compliance with the program.

4.0 Requirements

A. Determine if respirators are needed or going to be used for hazardous jobs before assigning that job to an employee.

1. If the determination is that a potential for respiratory hazards exists with any portion of that job activity then, complete Attachment 42-1.

2. Contact a URS Corporation Health and Safety Program Representative if any of the questions in Attachment 42-1 are checked "yes."

3. Follow instructions in Attachment 42-2 for employees who wish to voluntarily use dust masks.

4. Follow all the requirements of this procedure for employees who wish to voluntarily use tight-fitting (e.g., air purifying) respirators.

B. Select the proper respirator for the job.

1. For those jobs identified in Attachment 42-1, contact a URS Corporation Health and Safety Program Representative for assistance in respirator selection.

2. URS Corporation Health and Safety Program Representative will fill out Attachment 42-3 and return it to you for guidance in selecting and purchasing respirators.

3. Contact a URS Corporation Health and Safety Program Representative for follow up if there are any problems implementing the recommendations made.

C. Require employees who will use respirators to be medically qualified before assigning them a respirator.

1. Contact the Regional Health and Safety Manager to arrange for medical surveillance for those employees performing the activities identified in Attachment 42-1 if they are not medically cleared to wear a respirator.

2. Require that employees are in the proper health and safety classification (e.g., HAZWOP, Asbestos, etc). If necessary, require that a revised classification form be sent to the Regional Health and Safety Manager.

3. Obtain a copy of the employee's medical clearance from the Company's Medical Surveillance Administrator. Employees cannot be assigned respirators unless they are medically cleared for respirator use.

D. Require respirator users to receive appropriate training.

1. All respirator users must be trained:

   a) Before they are assigned a respirator.
   b) Annually thereafter.
   c) Whenever a new hazard or job is introduced.
   d) Whenever employees fail to demonstrate proper use or knowledge.

2. Training must address, at a minimum, the following:

   a) Why the respirator is necessary, and what conditions can make the respirator ineffective.
   b) What the limitations and capabilities of the respirators are.
   c) How to use respirators effectively in emergency situations.
   d) How to inspect, put on and remove, and check the seals of the respirator.
   e) What the respirator maintenance and storage procedures are.
   f) How to recognize medical signs and symptoms that may limit or prevent effective use of the respirator.

E. Require respirator users to be fit tested.

1. Any employee who has been assigned a reusable respirator must be fit tested either on an annual basis (no more than one year may elapse between fit tests), or when an employee is assigned a respirator of a different make, type or size from that previously tested.

2. Fit testing can be performed by contract or in house personnel.

3. Obtain a signed written copy of the fit test results. The fit test results should include:

   a) Employee's name and social security number.
   b) Respirator brand, model and size fitted for.
   c) Date fit tested.
   d) Method of fit testing used.
   e) Name and signature of fit tester.
   f) Statement that fit test protocol met the requirements of 29 CFR 1910.134.
   g) Manufacturer and serial number of fit testing apparatus.

   A fit test results form is available at Attachment 42-5.

F. Provide qualified employees with respirator(s) and adequate amounts of parts and cartridges.

1. Assign employees whose duties require respirators their own respirator for which they have been fit tested.

2. Provide special eyeglass inserts designed for the respirator if an employee must wear eyeglasses with a full facepiece respirator. Contact lenses may be worn when wearing a full facepeice respirator.

G. Require respirators to be used properly.

1. Prohibit facial hair where the respirator-sealing surface meets the wearer's face.

2. Require employees to perform a positive and negative fit check every time the respirator is put on.

3. Employees will leave the area where respirators are being used:

a) Before removing the facepiece for any reason.
b) To change cartridges.
c) If any of the following is detected:

(1) Vapor or gas breakthrough.
(2) Leakage around the facepiece.
(3) Changes in breathing resistance.

4. Use cartridges with End of Service Life Indicators or determine the respirator cartridge changeout schedule. See Attachment 42-4 for Guidance.

H. Require respirators to be cleaned and stored properly.

1. Clean and disinfect respirators after each use.

2. Store respirators in a plastic bag or case and in a clean location.

3. Inspect respirators before use and after each cleaning.

I. Address issues associated with special use respirators (self-contained breathing apparatus; air supply respirators; emergency use respirators).

1. Self Contained Breathing Apparatus

Inspect self-contained breathing apparatus and other emergency use respirators monthly and after each use in accordance with manufacturer's instructions.

2. Air Supplied Respirators

a) Air used for atmosphere-supplying respirators must meet or exceed the requirements for Type 1 - Grade D breathing air. Never use oxygen.

(1) A certificate of analysis must accompany bottled air.
(2) Compressors used to supply breathing air must:

(i) Prevent entry of contaminated air into the air supply.
(ii) Minimize moisture content.
(iii) Have suitable in-line sorbent beds and filter to provide appropriate air quality.
(iv) Have a high carbon monoxide alarm that sounds at 10 ppm.

b) Couplings on air hose lines must be incompatible with other gas systems.

J. Require follow up training and medical surveillance to be provided as directed.

1. Provide follow-up physicals as directed by the Regional Medical Surveillance Administrator.

2. Provide annual refresher training.

3. Provide annual fit testing.

5.0 Documentation Summary

A. Laboratory

1. File these records in the Laboratory Safety Filing System

a) Completed forms:

(1) "Identifying When A Respirator Is Needed" - Attachment 42-1; and,
(2) "Respirator Standard Operating Procedure" - Attachment 42-3.;

b) Employee Medical Clearances for Respirator Use;
c) Employee Fit Test Records; and,
d) Employee Respirator Training Records.

2. Send a copy of the following records to the Regional Health and Safety Manager:

a) Completed "Voluntary Use of Respirators" form - Attachment 42-2;
b) Employee Fit Test Records; and,
c) Employee Respirator Training Records.

B. Field

1. File these records in the Project Health and Safety File:

a) Completed forms:

(1) "Identifying When A Respirator Is Needed" - Attachment 42-1; and,
(2) "Respirator Standard Operating Procedure" - Attachment 42-3.

b) Employee Medical Clearances for Respirator Use;
c) Employee Fit Test Records; and,
d) Employee Respirator Training Records.

2. Send a copy of the following records to the Regional Health and Safety Manager:

a) Completed "Voluntary Use of Respirators" form - Attachment 42-2;.
b) Employee Fit Test Records; and,
c) Employee Respirator Training Records.

6.0 Resources

A. U.S. OSHA Standard - Respiratory Protection - 29 CFR 1910.134
(http://www.osha-slc.gov/OshStd_data/1910_0134.html)
B. U.S. OSHA Technical Links - Respiratory Protection
(http://www.osha-slc.gov/SLTC/respiratoryprotection/index.html)
C. ANSI Z88.6, Respirator Use – Physical Qualifications for Personnel, Current Revision
(http://www.ansi.org/cat_top.html)
D. ANSI Z88.2, Respiratory Protection, Current Revision
(http://www.ansi.org/cat_top.html)
E. 3M Cartridge Service Life Interactive Program
(http://www.mmm.com/market/safety/ohes2/html/fservlife.html)
F. NIOSH Respirator Decision Logic
(http:\\222.cdc.gov\NIOSH\87-108.html)

G. NIOSH Guide to Industrial Respiratory Protection
(http:\\www.cdc.gov\NIOSH\87-116.html)
H. AIHA, *The Occupational Environment - Its Evaluation and Control*
(http://www3.issinet.com/aiha/publications/tools.htm)
I. Australian Standard AS/N25 1715 - 1994. Selection, Use, and Maintenance of Respiratory Protection
J. Australian Standards HB98-1994. Occupational Personal Protection.

URS Corporation

URS Corporation Health & Safety Program
IDENTIFYING WHEN A RESPIRATOR IS NEEDED

Site Location:____________________________**Date:**____________________

Name of Person Performing Evaluation:__________________________________

Project:____

Answer the questions below for the jobs you are to perform on site. If a "yes" response is checked, consult with a URS Corporation Health and Safety Professional to determine:

- ***if a respirator is truly needed for the job, as well as,***
- ***the type of respirator needed for the job.***

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
Abrasive Blasting • Abrasive blasting (with any type of grit or material) will be performed. • Employee will fill abrasive blasting pots or perform clean-up activities. • Employee will be in a contained area where abrasive blasting is taking place.			
Acids • Liquid or powder acids will be used in a situation where acid vapors, mists or dust may be breathed.			
Adhesives • Aerosol-propelled adhesives are to be used in areas where there is no or insufficient local exhaust ventilation. • Two-part adhesives (mix part one with two, let set then use) are to be used in areas where there is limited ventilation.			
Alkalis/Bases/Caustics • Powdered alkalis will be used in a situation where an airborne dust may be breathed.			
Asbestos Abatement • Asbestos will be removed, repaired or sampled. • Employees will be inspecting or overseeing areas where asbestos will be removed or disturbed.			

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
Cleaning Compounds • Degreasers or carbon removers will be used in areas where local exhaust ventilation is not provided. • Aerosol propelled cleaning compounds will be used in areas where there is no local exhaust ventilation. • Degreasers or carbon removers will be used in voids, tanks, or other confined spaces.			
Corrosion Preventive Compounds • Corrosion prevention compounds, including chemical conversion compounds and corrosion inhibitors, will be used in areas where there is no local exhaust ventilation.			
Detergents/Soaps • Ammonia based detergents will be used in large quantity (more than five gallons) in areas where local exhaust ventilation cannot be provided. • Large quantities (5 or 55 gallon containers) of high pH powder detergent/soap will be used in a situation where dust may be breathed.			
Fuels (including regular or unleaded gasoline, kerosene, diesel fuel, JP-5) • Employees will be inside unventilated fuel cells or other confined spaces containing fuels.			
Grinding, Cutting, Sanding • Cutting, grinding or sanding surfaces that have coatings containing lead, cadmium, chromium, zinc or beryllium. • Cutting, grinding or sanding surfaces that are concrete or glass without use of ventilation or water.			
Hazardous Waste Sites • Employees will be performing tasks on a hazardous waste site that requires the use of respirator (as indicated in the site safety & health plan). • Employees will be performing site assessments on potential hazardous waste sites.			
Hydraulic Fluids (including petroleum-based fluids, synthetic fire-resistant fluids, and water based fire resistant fluids) • Hydraulic fluids and the vapors generated will not be exhausted using local exhaust ventilation. • Synthetic fire-resistant fluids or water-based fire-resistant fluids will be used in an area where the air is contaminated with visible mist or spray from hydraulic fluids.			

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
Inspection Penetrants (including Flouro-finder, water indicating pastes, and penetrant removers) • An aerosol-propelled inspection penetrant will be used in an area where local exhaust ventilation cannot be provided, or in a situation where the solvent vapors can be breathed.			
Lead Abatement Activities • Lead containing materials will be disturbed, removed or sampled. • Employees will be inspecting or overseeing areas were lead will be removed or disturbed.			
Lubricants/Oils • Aerosol lubricants/oils will be sprayed with no immediate exhaust ventilation.			
Oxidizers (materials that give off oxygen including chlorine laundry bleach, calcium hypochlorite, calcium oxide, oxygen candles, lithium hydroxide, hydrogen peroxide, and sodium dichromate) • Oxidizers containing organic chlorine will be used in a situation where the dusts/vapors may be breathed. • Powdered oxidizers will be used in a situation where airborne dust may be breathed.			
Paint Materials (including paints, primers, thinners, enamels, lacquers, strippers, coatings and varnishes) • Paint materials will be spray applied in areas where there is no local exhaust ventilation. • Two part (mix part a with part b, let set, then apply) polyurethane or epoxy polyamide paints will be brush or spray applied. • Paints containing lead, chromium, cadmium, beryllium, and zinc (refer to the MSDS). • Paint materials will be applied in confined spaces.			
Solvents (including hydrocarbon solvents such as acetone, methyl ethyl ketone, toluene, xylene, and alcohols, as well as mixed solutions like antifreeze, heat transfer fluid, turpene, dope and naphtha thinner) • Local exhaust ventilation will not be provided and work will involve breathing solvent vapors. • Solvents will be used within confined spaces. • Solvents will be applied using aerosols.			
Thermal Insulation (including asbestos & non-asbestos materials like pipe lagging, fiberglass insulation, boiler insulation, packing materials and floor/ceiling tiles) • Insulation will be disturbed, removed or sampled.			

MATERIAL USED OR PROCESS TO BE PERFORMED	YES Respirator may be needed	NO	NOTES
Water Treatment Chemicals (includes corrosive chemicals such as tri-sodium phosphate, hardness buffer, tritrating solution, morpholine, caustic soda, citric acid and nitric acid as well as toxic chemicals such as mercuric nitrate, hydrazine, EDTA and sodium nitrate) • Morpholine, EDTA, or harness buffer/titrating solution is to be used in poorly ventilated spaces. • Powdered water treatment chemicals will be used in a situation where chemical dusts may be breathed.			
Welding/Brazing • Welding will be performed in confined spaces. • Welding galvanized metal or stainless steel. • Brazing with cadmium or lead.			
For Any of The Above Listed Activities • A employee will be in the immediate area - within 10 feet of the job or operation, or • Employee will be inside confined space where activities are taking place, or • Employee will be inside a "controlled area" such as found in asbestos abatement, lead abatement, radiation control area, or a hazardous waste site.			
Material Safety Data Sheets • For any chemical product used, where a respirator is recommended.			
Product Labels • For any chemical or process that indicates respirators should be used.			
Product Use Instructions For any product used, where instructions indicate a respirator should be used.			
Standard Operating Procedures A Standard Operating Procedure indicates the use of a respirator.			

URS Corporation

URS Corporation Health & Safety Program
VOLUNTARY USE OF RESPIRATORS

Instructions: Have the employee that is opting to use a respirator for non-overexposure conditions read this page, then sign on the bottom of the page. Forward a copy of the signed form to the Regional Training Records Administrator, and maintain a copy in the employee's personnel file.

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for employees. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the employee. Sometimes employees may wear respirators to avoid exposures to hazards, even if the amount of the hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your own voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not pose a hazard.

You should do the following:

1. Read and follow all instructions provided by the manufacture on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.

2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety & Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear o the respirator or respirator packaging. It will tell you what the respirator is designed for and how it will protect you.

3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, fumes, smoke or very small solid particles.

4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

5. If you have any health conditions (asthma; high blood pressure; emphysema; heart disease) that could be aggravated by using a respirator, you should check with your doctor before using one.

I have read and understand this information on:______________________________ (date)

Employee's name:____

Employee's signature:____

URS Corporation

URS Corporation Health & Safety Program
RESPIRATOR STANDARD OPERATING PROCEDURE

Job Task Reviewed:____

Date Reviewed:____

Task Reviewed by:____

ADMINISTRATIVE PROCEDURES

1. All respirator users must be medically qualified to use respirators. Point of contact for scheduling is the Regional Medical Surveillance Administrator.
2. Respirator users must be trained annually in respirator use and fit tested annually.
3. Respirator will be used only by the person to whom it was issued.
4. Persons using glasses who are required to use a full-face respirator may use contact lenses or eyeglass inserts designed for the respirator.

GUIDANCE FOR SELECTION OF RESPIRATOR & CARTRIDGES/FILTERS

1. ____ respirators are currently being issued and used for the following job activity: ____.
2. The respirator will be equipped with the following cartridges/filters:____.
3. Filters are to be changed when the breathing resistance increases.
4. Cartridges are to be changed:__________________________________ or when the contaminant you are protecting yourself from can be smelled or tasted.

FIT TESTING & FIT CHECKING

1. Fit testing is required annually. To arrange for fit testing call your local safety representative.
2. Respirator users will "fit check" the respirator every time the respirator is put on:

- **Negative Check** - cover filters/cartridges with palms of hands and breath in, leakage should not be detected around the face seal of the respirator. Do not use if leakage is detected.
- **Positive Check** - cover the exhalation valve cover with palm of hand and blow out slightly, leakage should not be detected around the respirator seal.
- **For Air Supply Respirators** - kink or close off air supply hose and breath in, leakage should not be detected around the face seal of the respirator.

CLEANING & MAINTENANCE OF RESPIRATOR

1. Clean and disinfect respirator after every use.
2. Inspect respirator after every day in use to ensure parts are not missing. Replace missing parts from stock supply.
3. Store clean respirator in labeled plastic bag out of direct sunlight.
4. Do not alter respirator in any way.

URS Corporation

URS Corporation Health & Safety Program
RESPIRATOR CARTRIDGE CHANGE SCHEDULE

A cartridge change schedule must be developed for cartridges or canisters used with air purifying respirators that do not have an End of Service Life Indicator (ESLI). The purpose of this is to prevent contaminants from breaking through the respirator's sorbent cartridge(s), and thereby over-exposing employees. NIOSH has approved ESLIs for only four cartridges or canisters (mercury vapor, carbon monoxide, ethylene oxide, and hydrogen sulfide). Historically we have relied on the warning properties (odor, irritation) of a contaminant to dictate cartridge change. OSHA no longer allows this as the sole basis for changing respirator cartridges. In developing a change schedule the following factors should be considered:

- Contaminants.
- Concentration.
- Frequency of use (continuously or intermittently throughout the shift).
- Temperature and humidity.
- Work rate.
- The presence of potentially interfering chemicals.

The worst case conditions should be assumed to avoid early breakthrough. This must be documented in the project health and safety plan or, in the cases of office or labs, in the site specific Respiratory Protection Program.

Sources of Help

Manufacturers

3M has an interactive "Cartridge Service Life" program that can be downloaded for free (http://www.mmm.com/market/safety/ohes2/index.html)

This program will estimate cartridge service life for 3M products against many contaminants. The program does not evaluate the service life against mixtures (multiple contaminants). Because of the complexity in evaluating mixtures, OSHA offers the following guidance:

- When the individual compounds in the mixture have similar breakthrough times (i.e., within one order of magnitude), service life of the cartridge should be established assuming the mixture stream behaves as a pure system of the most rapidly migrating component with the shortest breakthrough time (i.e., sum up the concentration of the components).
- Where the individual compounds in the mixture vary by 2 odors of magnitude or greater, the service life may be based on the contaminant with the shortest breakthrough time.

Rule of Thumb (*"The Occupational Environment - Its Evaluation and Control)*

- If the chemical's boiling point is >70°C and the concentration is less than 200 ppm you can expect a service life of 8 hours at a normal work rate.
- Service life is inversely proportional to work rate.
- Reducing concentration by a factor of 10 will increase service life by a factor of 5.
- Humidity above 85% will reduce service life by 50%.

OSHA Interpretation

The OSHA inspection procedures for the respiratory protection standard specifies that where contaminant migration is possible, respirator cartridges/canisters should be changed after each work shift where exposure occurs unless there is objective data to the contrary (desorption studies) showing the performance in the conditions and schedule of use/non-use found in the workplace.

URS Corporation

RESPIRATORY PROTECTION
FIT TEST WORKSHEET

Employee Name: ______________________ Employee No: ____________

Office Location: ______________________ SSN: ____________

Last Medical Exam: ______________________ Corrective Lenses? ____________

	Respirator 1	Respirator 2	Respirator 3
Equipment Type			
Manufacturer			
Model			
Size			
Material			

	TEST RESULTS	RESPIRATOR 1	RESPIRATOR 2	RESPIRATOR 3
1	Negative Pressure Check	Pass ❑ Fail ❑	Pass ❑ Fail ❑	Pass ❑ Fail ❑
2	Positive Pressure Check	Pass ❑ Fail ❑	Pass ❑ Fail ❑	Pass ❑ Fail ❑
3	Test Method	Banana Oil ❑ Irritant Smoke ❑ Quantitative ❑	Banana Oil ❑ Irritant Smoke ❑ Quantitative ❑	Banana Oil ❑ Irritant Smoke ❑ Quantitative ❑
4	If Quantitative; Printout/Strip Chart Attached (include mfgr. and serial no. of unit)			

- Briefed on fundamental principles of respiratory protection, use, inspection, cleaning, maintenance, and storage of equipment — Yes ❑ No ❑
- Briefed on the procedure for obtaining a lens kit for use with a full face respirator — Yes ❑ No ❑ N/A ❑

I hereby certify that the subject employee has been FIT tested according to procedures specified in URS Corporation SMS 42, "Respiratory Protection" and in accordance with 29 CFR 1910.134, App. A. The results of the test indicate that the subject employee attains a satisfactory fit on the above respiratory protective equipment.

______________________ ______________________ ____________

Examiner's Name (print) Examiner's Signature Date

______________________ ____________

Employee's signature Date

Distribution: (1) Employee (2) Regional Health and Safety Manager (3) Office Safety Coordinator

APPENDIX B

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Site –Specific Spill Plan

EM REVIEW/APPROVAL:_________

SITE-SPECIFIC SPILL PLAN DATE: 6/28/00 FACILITY NO: Soil Washing and Solidification/ Stabilization Study Treatment Pad, OU C

SITE DESCRIPTION: Soil Washing and Solidification/ Stabilization Study

ON-BASE SPILL DISCOVERY AND NOTIFICATION PROCEDURES

REPORT SPILL OR POTENTIAL RELEASE OF:

-- Any quantity of an extremely hazardous substance (EHS)
-- 1 lb/ 1pint or more of a hazardous substance.
-- Any quantity if fire or health hazard is present.
-- Any quantity of mercury.
-- Any quantity from a pressurized system.
-- Bulging or Abandoned Drums (DANGER -Don't Touch!)

REPORT IMMEDIATELY TO:
McCLELLAN FIRE DEPARTMENT
911 OR 643-6666

ACTIONS TO TAKE:

-- Alert Personnel - Evacuate if necessary.
-- Information to report to Fire Dept.:
-- Your name and phone number
-- Location of spill
-- Substance spilled
-- Estimated amount spilled
-- Extent of spill
-- Other pertinent information (*e.g.*, injuries)
-- Isolate the spill area and follow site-specific procedures.

SITE RESPONSIBLE INDIVIDUALS: NAME ORG. SYMBOL PHONE NO.

Unit Environmental Coordinator:	Richard Beyak URSG-Laidlaw	(916) 929-2346 or (916) 569-5513
Supervisor:	Gary Smith URSG-Laidlaw	(916) 717-1623
Area Monitor:	Gary Smith URSG-Laidlaw	(916) 717-1623

OIL AND HAZARDOUS SUBSTANCE DATA (Indicate if Material (M) or Waste (W)):

Description	Quantity Amount/Unit	Type of Container	Waste Stream No. (if any)
(W) Decontamination Fluids	50 gallons	55-gallon drum	Contaminated Water
(M) Citru Clean H-D	<5 gallons	5-gallon drum	May be in washdown water
(M) Loctite	<1 quart	bottles	None
(M) Motor Oil	<55 gallons	Manufacturer	None
(M) Gasoline	<10 gallons	5-gallon safety can	None
(M) Polymer	Varies	35-gallon drum	None
(M) Surfactant	Varies	35-gallon drum	None
(M) Diesel fuel	<500 gallons	Integral dike/tank	None

MSDS LOCATION: Inside JV Field Trailer

SITE-SPECIFIC SPILL PLAN (continued)	FACILITY NO: Soil Washing and Solidification/Stabilization Study Treatment Pad, OU C

EVACUATION PROCEDURES:

1. Notify all personnel at the soil washing and solidification/ stabilization study area to clear the danger area as necessary to avoid injury.
2. Shutdown all power to the treatment system.
3. Maintain the cleared area until the site is safe.

ON-SITE PERSONAL PROTECTIVE/SAFETY EQUIPMENT:	ON-SITE SPILL CLEANUP KIT:
Protective gloves	Overpack Drum (absorbent storage)
Protective aprons or coveralls	Absorbent
Chemical goggles or face shields	Square point D handle shovel
Rubber boots	Disposal drum
Full and half-face respirators	Push broom

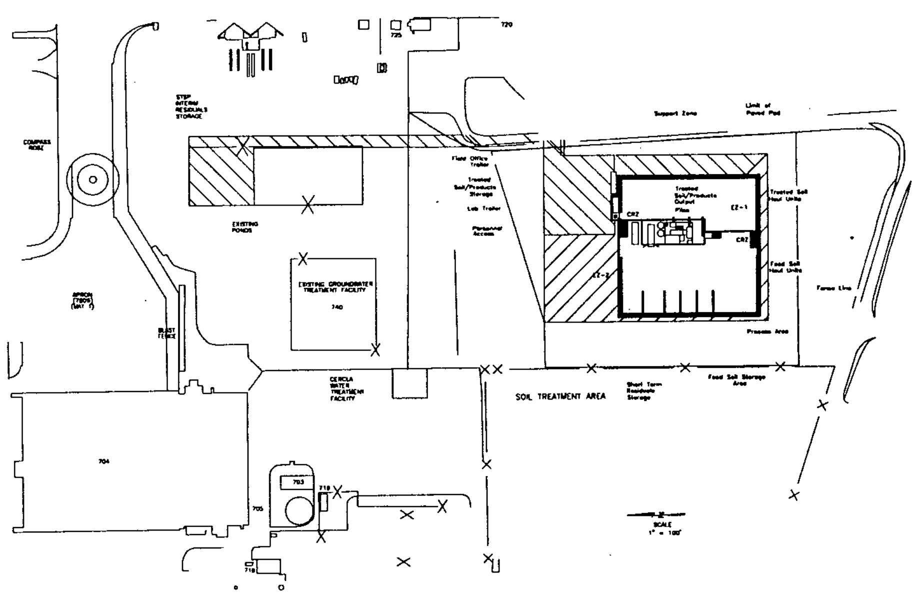
SITE-SPECIFIC PROCEDURES:

1. Alert site supervisor and personnel; evacuate all personnel who are not equipped with personal protective equipment.
2. Notify base fire department, 911 (or 3-6666). Also notify the Maintenance Control Center, LAPRP, 3-3780.
3. Shut off power to treatability pad MCC, eliminate ignition sources, and eliminate all petroleum products.
4. Make spill scene off limits to unauthorized personnel.
5. If advised by the on-site commander, contain/cover spilled liquids with absorbent. Place absorbent, spill residue, and contaminated soil in a disposal drum.
6. Notify the Unit Environmental Coordinator (UEC)/LAPMS (3-0228 x358) to participate in the chemical spill mishap reporting. Obtain from the UEC the recommended preventative action to be taken to avoid future spills. Assure with the UEC that the proper procedures are followed. Initiate AFLC Form 5023, Supervisor's Preliminary Report of Mishap Notification and Reporting, for all spills. Ensure all information has been provided and obtain UEC coordination.
7. Notify the Contracting Officer (Capt. Bob Williams); Field Team Leader (Paul Bernheisel), and the McClellan AFB remedial project manager (Jim Lu).

SECONDARY CONTAINMENT: The entire treatment pad will be enclosed within a curbed area, which can catch spilled materials. Soils may be scooped up and put on the appropriate piles. Water or liquid spills, which would consist of process water or treatment chemicals, will be collected in the pad's sumps and re-routed to the treatment process. Chemicals will be stored within a curbed secondary containment area.

SITE-SPECIFIC SPILL PLAN (continued)	FACILITY NO: Soil Washing and Solidification/Stabilization Study Treatment Pad, OU C
SITE MAP	

Approximate Scale:________ Base Grid Coordinate:_________



APPENDIX C

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Site Management Plans

HAZARDOUS WASTE MANAGEMENT PLAN

SOIL WASHING AND SOLIDIFICATION/ STABILIZATION STUDY McCLELLAN AFB, SACRAMENTO, CALIFORNIA

This site-specific hazardous waste management plan for the soil washing and solidification/ stabilization study covers the following hazardous wastes/wastes to be handled as part of the demonstration:

- Untreated excavated hazardous materials
- Treated materials exhibiting hazardous characteristics
- Process wastewater
- Decontamination water
- Waste Chemicals and Process Equipment

The procedures set forth in the Hazardous Waste Management Plan (SM-ALC-MCAFB Instruction 32-2, 1996) will be followed. The document is incorporated herein by reference, and a copy will be retained in the project trailer. SM-ALC/EMPC, and the contracting officer will be notified of the type and quantity of hazardous waste expected to be generated. Hazardous waste will be managed as specified in Chapter 4 of the previously referenced Hazardous Waste Management Plan. JV is solely responsible for any hazardous waste generated exclusively as a result of its own activity under this contract.

UNTREATED EXCAVATED HAZARDOUS MATERIALS

JV will manage all untreated excavated hazardous materials in accordance with McClellan AFB's Soil Management Plan (McClellan AFB 1991).

JV will direct any questions regarding responsibility for the management of a particular hazardous waste to the CO, whose decision in the matter is final. Under no circumstance shall the contractor remove from the base any hazardous waste for which the Government has management responsibility. JV will handle or move contained hazardous waste to on-base management areas, as directed by the CO. JV will handle and store all hazardous materials in areas approved by the Contracting Officer. JV will be familiar with and comply with McClellan AFB's spill prevention and response requirements and procedures.

TREATED MATERIALS EXHIBITING HAZARDOUS CHARACTERISTICS

Treated materials meeting residential preliminary remediation goals (RPRGs) will be returned to the site and used as backfill. If the material meets industrial PRGs (IRPGs), but not RPRGs, the material will be stockpiled for future containment after clarification of required clean up goals. Materials that meet neither criterion will be appropriately disposed, or contained in a designated area for additional treatment, depending on their classification as hazardous wastes. This classification is based upon results of Soluble Threshold Limit Concentration (STLC) and Total Threshold Limit Concentration (TTLC) determined by the Waste Extraction Test (WET), and Toxic Characteristic Leaching Procedure (TCLP) testing. The deionized water (DI) WET will be used to determine the solidified material classification.

PROCESS WASTEWATER

The treatment process is a net water consumer, and therefore, no process wastewater is anticipated to be generated. Typically, the process water contains only traces of contaminants at low ppm or ppb levels that does not have any significant impacts on the performance of the washing process or the quality of the washed products. If contaminant levels build up to levels such that the water would contribute more than approximately 10 percent of the contaminant load to the washed product, additional water treatment would be integrated into the soil washing process to control contaminant levels in the process water. To avoid cross contamination of sites, the soil will be processed in order from the least contaminated site to the most contaminated site.

Before processing soils from a different site, the water will be analyzed for contaminants of concern. Process water will be sampled from the process water holding tank that receives the clarifier overflow and filter press filtrate. If contaminant levels in the water would contribute a contaminant load of more than approximately 10 percent to the washed soils based on the new site standard, the water will be treated within the process or refreshed prior to processing the soils from a new site. If the process water contributes a contaminant load to the washed soil of less than 10 percent of the new site standard, the water will be considered "clean" and acceptable for reuse.

At the end of the project, 25,000 gallons of process wastewater will be routed to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-compliant treatment plant and/or will be collected, and treated appropriately.

DECONTAMINATION WATER

All decontamination fluids will be containerized in containers provided by McClellan AFB while awaiting discharge into the headworks of the treatment plant or to other appropriate disposal. The contracting officer (CO) will be consulted two weeks prior to disposal to identify the appropriate discharge location, confirm characterization of the fluids, and notify the receiving plant of estimated quantities. McClellan AFB will remove the containerized fluids from the site.

WASTE CHEMICALS AND PROCESS EQUIPMENT

After the field test is complete, all waste chemicals will be disposed in accordance with base regulations, returned to the vendor, or returned to the supplier if appropriate. All residual piping and process equipment will be decontaminated and disposed of in accordance with base regulations.

Any anticipated changes to this plan will be conducted in accordance with the procedures for modifying the Work Implementation Plan (WIP).

DUST CONTROL PLAN

SOIL WASHING AND SOLIDIFICATION/ STABILIZATION STUDY McCLELLAN AFB, SACRAMENTO, CALIFORNIA

McClellan AFB will employ the following dust control measures during excavation, backfilling, transportation or treatment of excavated materials:

- JV will execute all work using methods that minimize raising dust during soil washing and solidification/ stabilization study operations.
- Dust control measures will be employed as required to abate a dust nuisance at the sites during soil washing and solidification/ stabilization study activities and site excavation. Water or polymeric surfactants shall be used as dust control agents. Water for dust control purposes will be derived from on-site sources. Trucks transporting treatment soil will be covered and inspected for external contamination. If excessive soil is found during the inspection, it will be removed prior to transport.
- Every reasonable effort will be made to maintain the sites in a condition, which minimizes fugitive dust generation.
- All stockpiles will be covered at the close of each working day.
- Water applied for dust control purposes will be placed so as to control formation of excessive puddles or runoff.
- Mechanical and electrical equipment and surfaces susceptible to damage by dust will be protected as required.

The following is a list of potential control measures for dust control:

Vehicle use in open areas and vacant lots:

- Install physical barriers such as curbs, fences, gates, posts, and /or signs.

Unpaved haul/access roads:

- Limit vehicle speed to 15 miles per hour or less.
- Apply water, so that the surface is visibly moist.
- Apply a suitable dust suppressant, if necessary.

Disturbed surface areas:

- Pre-water site surface.
- Phase work to reduce the amount of disturbed surface areas at any one time.
- Apply water or other suitable dust suppressant.

Site restoration:

- Selected fill material will be used to restore the sites.

- The imported material will be moisture conditioned to control dust and promote compaction.
- The conditioned fill material will be placed in the site and recompacted.
- The site will be restored to be consistent with existing grades.

Temporary Stabilization (during periods of inactivity, after hours, weekends and holidays):

- Apply suitable dust suppressant, tarps, or plastic.
- Restrict vehicular access to the area.

Bulk material handling operations:

- Cover open stockpiles with tarps, plastic, or other material to prevent wind erosion. Secure covers to prevent strong winds from removing the coverings.
- Apply water during stacking, loading, and unloading operations.
- Loads of contaminated soils will be covered if transferred on open roadways (i.e., those accessible to base tenants or the public.)

Bulk material hauling/transporting:

- Load all haul trucks such that the freeboard is not less than six inches.
- Limit vehicular speeds to 15 miles per hour or less while travelling on the work site.
- Apply water to the top of the load, and cover haul trucks with a tarp or other suitable closure.

Cleanup of spillage, carry-out, and/or track-out:

- If there is much material, remove it with a backhoe, and either return it to the haul truck or appropriate stockpile.
- Small quantities of material within the treatment pad should be swept up manually and returned to the feed stockpile.

At the treatment pad area:

- Dust suppression and other engineering controls commonly instituted to control dust (*e.g.*, misting and watering) will be the primary measures implemented to control airborne particulate emissions at the treatment pad.
- Stockpiles soils will be covered with a polytarp when not in use.
- During soil washing and solidification/ stabilization operations, the only point at which the materials are dry and therefore, the only point at which dust may be generated is during feed soil blending. Water mist application will be used for dust control as required.
- Perimeter dust monitoring will be performed at the treatment pad area, as described in the SHSP, Section 9.0 of this WIP. The results of the monitoring will help to determine the need for additional control measures to suppress dust and particulate emissions at the perimeter of treatment system and within the immediate work area.

- It is possible that trucks may be delivering loads every 1-2 days to deliver/replenish the contaminated soils staging area. This May require trucks entering into the EZ. If they do the tires will be brushed down at the decontamination pad, inspected and released.
- During normal operations of the processing plant, there are not any trucks planned to be in operation. The feed soils will have already been staged, and are moved by dedicated front-end loaders. The loaders will not be leaving the work area. If they do, the loader (or other equipment) tires will be washed down at the decontamination pad, inspected, and released. After operations each day, equipment will be cleaned and staged for processing the next day.

STORMWATER AND EROSION CONTROL PLAN

SOIL WASHING AND SOLIDIFICATION/ STABILIZATION STUDY McCLELLAN AFB, SACRAMENTO, CALIFORNIA

McClellan AFB's contractors will institute field measures to protect the site and surrounding environment from materials that may be transported through erosion or runoff. The Installation Restoration Program, McClellan AFB Storm Water Management Plan (SWMP) is incorporated herein by reference. Although

As appropriate, the following procedures will be employed by McClellan AFB excavation contractors, if and where appropriate, to accomplish this goal:

- Open excavation areas will be protected from run-on using a system of berms derived from the excavation materials and complimented by barriers as required.
- Slope stabilization (per Appendix E of the SWMP) should include mulching or jute netting, given the temporary nature of the excavated areas.
- SWMP-specified soil erosion requirements include sandbag dikes, silt fences, straw-built dikes or equivalent control to be installed where appropriate.
- EPA's BMPs for Construction Activities EPA #832/R-92-005 for this project.

For stockpiled materials on the treatment pad area, JV will adhere to the following procedures:

- Stockpiles of soil materials and aggregates not intended for immediate use will be covered to prevent migration from the stockpiles.
- In the event of severe storm warning or occurrence, JV field staff will check all stockpile covers for integrity and perform maintenance as necessary. In addition, work will be stopped in the event of unusually heavy precipitation.
- All control devices will be maintained throughout soil washing and solidification/ stabilization study operations.
- Good housekeeping practices will be followed to minimize spillage or contamination.
- JV will comply with the requirements of the McClellan SWMP.

SITE SECURITY PLAN

SOIL WASHING AND SOLIDIFICATION/ STABILIZATION STUDY McCLELLAN AFB, SACRAMENTO, CALIFORNIA

Access to McClellan AFB and project work sites is controlled at various entry gates. Visitors are required to check in at the entry gate guardhouse and present their license and car registration. Project field personnel will be issued identification badges. JV's project manager and site managers will provide primary on-site security during working hours. These persons will also be responsible for supervision of any communications systems. JV will make contact with McClellan AFB security personnel describing our activities and requesting additional patrols, if required. Specific security activities include:

a) The project manager will ensure the sites are secure from unauthorized entrance. Only visitors who have received prior authorization from appropriate JV project team or McClellan AFB management or supervisory personnel will be permitted entry to the work site.

b) The sites will be maintained secure during nonworking hours by fencing areas to the maximum extent possible to stage equipment, expendables, and other project materials.

c) Site security personnel will read and be familiar with the terms of the site health and safety plans.

d) Site security personnel will maintain contact with McClellan AFB security and report immediately any incidents of vandalism, theft, or trespassing.

e) Signs will be placed at each site as necessary.

f) The existing fencing and barriers to the entrance will be fully utilized during soil washing and solidification/ stabilization study activities.

g) Site access by vehicles and parking shall be restricted to authorized vehicles and equipment only.

h) If an excavated area is expected to remain unfilled and the excavation is greater than four feet in depth, the area will be cordoned off with construction fencing and signs, as required by the McClellan AFB trenching standard operating procedure (McAFB-012).

Beginning October 1, 2000, the base entry control will stand down. At this time, security measures will be revised at the direction of McClellan AFB.

APPENDIX D

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Equipment Decontamination Plan

STANDARD OPERATING PROCEDURE
EQUIPMENT DECONTAMINATION PLAN

1.0 PURPOSE

The purpose of this plan is to establish the methods and practices employed for the decontamination of the soil washing and solidification/ stabilization study equipment, the support systems, sample preparation equipment, and excavation equipment. The standard protocol is to disassemble major components of the plant and to wash the components with normal detergent and hot water. The entire plant is washed inside and out; the washwater is collected for treatment or disposal. The plant is visually inspected for cleanliness, including successive flushing of inaccessible components such as piping and pumps. Actual samples are not collected. Excavation equipment will be externally decontaminated before it leaves the site and totally decontaminated between sites.

2.0 SCOPE

This procedure applies to all decontamination activities associated with the McClellan AFB soil washing and solidification/ stabilization study, managed and controlled within the designated soil treatment area. This includes excavation of the treatment area sites.

3.0 DEFINITIONS

<u>Clean</u> – For purposes of this procedure, clean is defined as free of all contamination, after having followed all equipment decontamination methods outlined in this procedure.

<u>Cross Contamination</u> – The transfer for contaminated material or contaminants by equipment or personnel, from the contamination source to that of a less contaminated or non-contaminated item or area.

<u>Decontamination</u> – The process of rinsing, high pressure washing or hand wiping to clean the exposed surfaces of equipment, to rid them of contamination, allowing them to be removed from the exclusion zone or contamination reduction zone to the support zone.

All equipment exiting the contamination reduction zone (*e.g.* heavy equipment, air monitoring equipment, etc.) will be decontaminated using a freshwater rinse and brushes (if necessary) for dust removal. If brushing and rinsing do not remove the dust, a soap and water solution will be used to facilitate decontamination.

<u>Soil Washing Equipment</u> – Equipment associated with a soil washing activity, to remove contamination from soil. This includes but is not limited to the equipment found in the process flow diagram, found in Section 3 of this WIP. In addition, jars, bucket, hand tools, and associated equipment will be considered part of the soil wash plant.

<u>Steam Cleaning (High Pressure)</u> – High-pressure washing may be performed as part of the decontamination effort. This process will be used as necessary to perform decontamination on the equipment by removing the site contaminants.

4.0 RESPONSIBILITIES

4.1 Decontamination Personnel

The decontamination personnel will be comprised of treatment system operators, system operation, decontamination and site safety requirements.

4.3 Field Services Manager

The Field Services Manager will be responsible for appraising the decon crew of all known health and safety hazards prior to the start of decon activities. A morning safety/decon meeting will be conducted daily to address all safety related items associated with the tasks to be performed that day.

5.0 SAFETY REQUIREMENTS

All decontamination activities shall comply with the requirements of the site-specific safety document and attachments, area and personnel monitoring, health and safety hazards, and personnel protective equipment.

5.1 Equipment & Materials

Equipment and materials required for decontamination activities must be clean prior to use, and include, but not limited to:

- Brushes
- Rags or towels
- High pressure water sprayer
- Plastic bags
- Protective clothing
- Fresh water, clean for gross decon
- Collection drums, clothing
- Collection drums, waste
- Hose, as needed
- Grinder
- Heavy equipment support
- Decon soap
- Collection basin

5.2 General Decontamination Requirements

- All soil wash plant and support items will undergo a gross decontamination removal through the use of a fire hose.
- A secondary high-pressure water washer will be used to remove all loose contamination.
- If required, fixed contamination will be removed by scrubbing or grinding as applicable.
- Trucks used for the transport of contaminated material will be externally decontaminated before they leave the excavation site.
- Excavation equipment will be totally decontaminated between sites.

6.0 DECONTAMINATION METHODS

6.1 General

The following methods will be used to provide decontamination of the soil wash plant and support equipment, except pumps and motors.

- An initial gross water decon wash will be performed to remove all gross visible contamination.
- A secondary decon effort, more thorough and effective, will be performed using a high pressure water washer to remove contamination caught in cracks and corners.
- A thorough inspection by the treatment system operator will follow this secondary decon effort, to establish any areas where loose or fixed contamination exists.
- Fixed contamination, if any is detected, will first be scrubbed with soapy water. If the contamination is not removed by this procedure, a grinder may need to be used to remove the "hot spot." Contamination is detected by visual inspection.
- After all "hot spots" are removed, a final inspection will be performed.
- Clean items will be removed to a clean area outside the treatment pad and made ready for shipment.
- All equipment will be loaded on trucks with all proper shipping documents in preparation for removal from McClellan AFB.
- To minimize the generation of decontamination water, initially brushes will be used for external decontamination of equipment.
- A high pressure water sprayer will be used for decon between sites.

6.2 Pump & Motors

All of the procedures outlined in Section 6.0, Decontamination Methods, will be followed when decontaminating the exterior of all pumps and motors. In addition to these procedures, the following decontamination and survey techniques will also be performed:

Because all motors are totally enclosed and water proof, the fan shroud will be removed and inspected.

The pumps that have come into contact with contaminated soil or water may be dismantled to allow the internal components the ability to be inspected. The fixed contamination will first be removed by high-pressure water washing.

Any "hot spots" identified during inspection following the high pressure water wash will first be treated by the scrubbing with soap technique. Should the fixed contamination remain, grinding techniques will be employed only as long as the integrity of the pump is maintained. A determination will be made on a case-by-case basis, on the extent of decontamination efforts, and its effects on the component being decontaminated.

7.0 SHIPPING

Cleaned plant and support equipment will be loaded, secured, and shipped offsite following completion of the study.

APPENDIX E

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Excavation Plan

EXCAVATION PLAN

SOIL WASHING AND SOLIDIFICATION/ STABILIZATION STUDY McCLELLAN AFB, SACRAMENTO, CALIFORNIA

The volume for all non-VOC sites potentially requiring treatment is approximately 900,000 cubic yards, to meet residential PRGs (RPRGs), and 800,000 cubic yards to reach industrial PRGs (IPRGs) (CH2M Hill 1999). For this study, approximately 2,404 cubic yards of non-volatile organic compound (VOC) contaminated soils are to be treated. The soil washing and solidification/ stabilization study will use soils from selected sites that contain metals or semivolatile organic compounds (SVOCs) in concentrations at levels exceeding RPRGs. Ten candidate sites have been identified and categorized as either a landfill, SVOC spill site, or metals only site. These sites were prioritized within each category as discussed in Subsection 2.4 of this work implementation plan (WIP).

Based on a review of additional remedial investigation (RI) data and the site walk, the Air Force has narrowed the site selection to four sites: potential release location (PRL) S-4, confirmed site (CS) CS 013, Wastepile, and Small Arms Riring Range (SAFR). These sites are included in this excavation plan. The excavation areas at each of these sites were chosen based on the ease of access (little or no surface or subsurface obstructions) and high potential of contamination. Soil quantities proposed to be treated were based both on providing an adequate amount of material to reach the anticipated treatment output, while allowing for "full" cleanup of several of the smaller candidate sites. Ultimate cleanup determinations will be made in a Record of Decision.

1.0 SITE-SPECIFIC INFORMATION

1.1 SITE SELECTION

Ten non-VOC sites have been identified as possible remediation candidates for this study. In the WIP, these sites have been prioritized. Of the ten candidate sites, two from each category have been selected, as discussed in Section 2.4 of this WIP. At a minimum, the six highest-priority sites, CS 011 and CS 013 (landfills), PRL S-006 (SVOC spill), and PRL S-004, SAFR, and waste pile (metals only) will be sampled. Collection of representative samples would be accomplished by excavating a test pit at each of the six sites. The site selection process will be based on the results of the preliminary treatment study as described in Appendix F.

Figures E-1 through E-4 illustrate the locations and boundaries of the four sites and the location of the proposed excavations within each site. The location of existing buildings, structures, and access roads are also depicted, where applicable.

1.2 SELECTED SITES

<u>**PRL S-004 (Metals Only Site)**</u>

PRL S-004, comprised of approximately 0.68 acres, is located in the northeastern corner of IC 36. IC 36 is situated in the west-central portion of OU A. PRL S-004 is the former location of a storage area and a lube oil storage building. Additionally, sludge drying beds associated with Building 431 may have been located at the site.

At this site, lead is the non-VOC constituent of concern exceeding RPRGs. TPH-D and SVOCs are present, but have been determined not to require remediation. In addition to the non-VOC constituents of concern, TCE has been found in soil gas at this site at 12 feet bgs. The lateral extent of lead contamination is considered to be reasonably well defined in all directions.

The site is now unused and is overgrown grassland. A small patch of asphalt exists where Building 36 was once located. Impacted soils to be included in this study occur at depths from surficial to six feet bgs; deeper soils (10 to 20 feet bgs) did not contain any metals above background concentrations.

CS 013 (Landfill Site)

CS 013 is located in IC 19, within OU C. Approximately 1.2 acres in size; it consists mainly of undeveloped grassland. Contaminants of concern include various metals, PCB-1260, TPH-D, and several SVOCs. The most heavily impacted soils generally occur at depths greater than five feet and extend to approximately 10 feet bgs.

SAFR (Metals Only Site)

The SAFR consists of a 300-foot-long by 100-foot-wide soil berm used as a backstop, Buildings 710 and 712, and several piles of loose soil scraped from the backstop. The soil piles are contaminated with lead and copper fragments as well as cadmium. Some bullets are still visible in the soil. For this project, the soil piles to the south of Building 712 will be removed. The soil piles are approximately four-feet high and cover over 0.15 acres. Based on field observations and areas measured by computer-aided drafting (CAD), initial volume estimates range between 800 and 1,000 cubic yards. The soil piles will be removed and transported to the soil treatment pad for processing. Since the soil piles are on the surface of the ground, no subsurface excavation is required.

Wastepile (Metals Only Site)

The waste pile to be considered for remediation using this soil remediation process is located at IC 7 in OU B. It is approximately 0.15 acre in size, and consisted of dirt, rubble and concrete slabs that have been removed from the sites. The constituents of concern are lead, cadmium and chromium. Impacted soils were found at 6 inches bgs.

Four sites have been selected to include a landfill and three metals only sites. Based on the findings of the initial site walkover, these sites would be most ameanable to soil washing.

2.0 EXCAVATION

Selective excavation will be accomplished at the specified sites. The concept of selective excavation is based on the findings of earlier investigation data and visual inspection during excavation. This soil washing and solidification/ stabilization study is intended to provide information on the applicability of soil remediation at depths typically less than 35 feet bgs. Table E-1 summarizes site characteristics and the potential area and volumes of soils requiring treatment at the six sites. Excavations for this study will not exceed 10 feet bgs.

After a site has been deemed appropriate, based upon the preliminary treatment test, excavation will commence at a given site. The selected portion of the affected site will be excavated and field screened with a mobile screen, if necessary to remove large debris. Debris will remain at the site, while soils that will be treated will be hauled to the stockpile area at the treatment pad. There, the soil will be stockpiled, blended with other soils excavated from the same site, if appropriate based on physical characteristics of the soils, and forwarded to the treatment system.

At SVOC spill sites and the metals-only sites, the constituents of concern are found in shallow soils. Samples collected from those sites will be scraped clean of vegetation where present. The vegetation is not expected to require treatment, and will be stockpiled at the site for future site restoration. Soil to be treated will be obtained from the surface and approximately 1 to 1.5 feet depths using a backhoe.

Excavation areas will be field-located using the aerial photographs shown on Figures E-1 through E-4, and previous RI boring and trenching information.

Also, especially for the landfills, it is important to note that there may be several feet of uncontaminated cover soil, thus if the excavation was shallow, a majority of the soils removed may be clean fill. Therefore, at the landfill site, contamination is present at a greater depth, approximately 6 ½ feet. To avoid the need for shoring excavations greater than four feet will not have scopes that exceed 1.5 H:IV.

2.1 GENERAL EXCAVATION PARAMETERS

The JV will excavate soil from each site. Excavations will be performed in accordance with the Site-Specific Health and Safety Plan (SHSP), Section 9.0 of this WIP, which addresses excavation safety. SOP No. McAFB-012 will be used for trenching in disposal pits and landfills. Prior to departure from the individual sites, the truck will be brushed to remove contaminated soil and the load covered. It is anticipated that the soils will be excavated and transferred to the treatment pad via the most appropriate route.

To minimize spillage, the trucks should be loaded to a height at least six inches below the side walls. The unloading area at the treatment pad is within the paved and bermed area. Any soil spills should be removed from areas other than the designated stockpile areas, and incorporated into the feed stockpile. Should a truck spill any contaminated soils in a clean area, the McClellan AFB field manager will dispatch the appropriate crew and equipment to clean up the spilled soil. This equipment may include a front-end loader for larger spills and hand shovels for small spills.

As required by the SHSP, excavations greater than four-feet deep will not have slopes that exceed 1.5H:1V. This will preclude the need for an engineers evaluation and shoring. A fence or other suitable barricade will be erected to warn of danger and to limit access to the site. Site access restrictions will be maintained, as described in the SHSP, Section 9.0 of this WIP.

In some situations, removal of an appropriate quantity of soils for treatment may remove the entire target soil volume. After the excavation the soils will most likely be reentered after processing, the excavation would then be backfilled, regraded, and restored to its original condition.

2.2 SITE RESTORATION

The excavated sites will be backfilled with “Clean” fill material or treated material that meets the appropriate treatment standards. The soil will be placed and compacted in two foot lifts. The recompacted material will be graded to promote drainage and to restore the site to its original condition. If necessary, the site will be receded with a seed mix compatible with the existing vegetation.

3.0 STOCKPILING

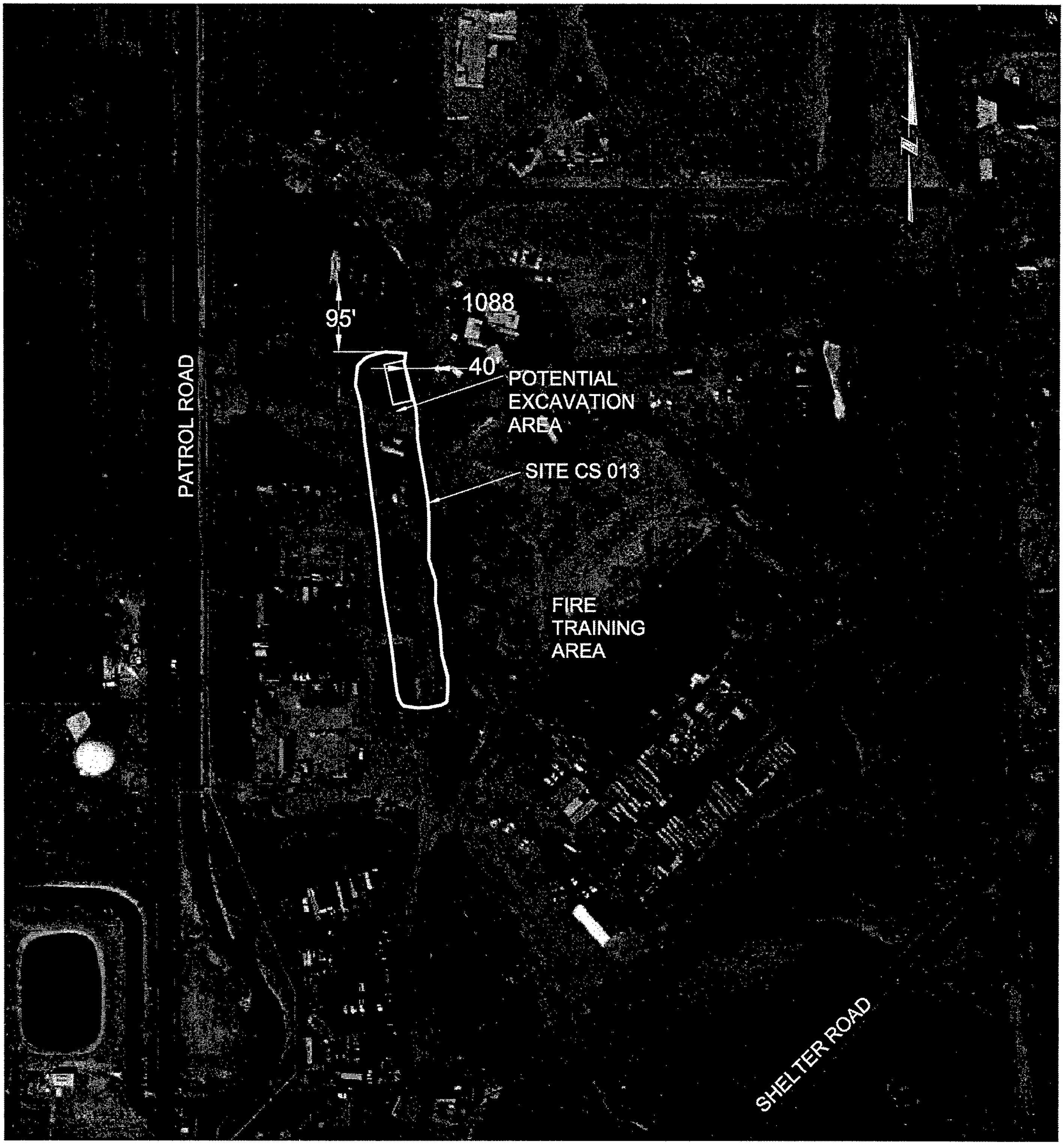
Soils will be tracked from initial stockpiling on the feed soil process pad through final treatment or disposal, as described in Subsection 5.4.8 of this WIP. The feed soil will be stockpiled in discrete piles, on the feed soil storage pad (within the treatment pad). JV will label the soil with the area and date of excavation. Each pile will be covered with a polytarp overnight, or when the pile is not being used. Concrete (Jersey) barriers will be used to delineate individual storage areas on the treatment pad.

Table E-1

QUANTITIES OF SOIL TO BE TREATED

Site Designation	Site Location	Site Category and Priority	Size of Site (acres)	RPRG Target Area* (acres)	Maximum Depth Exceeding RPRGs (ft)	Potential Quantity of Soil Requiring Treatment		
						RPRG Target Volume (cubic yards)	Approximate Excavation Dimensions (L x W x D)	Proposed Volume for this Study (cubic yards)
Small Arms Firing Range (SAFR) (soil piles to south)	OU C	Landfill #1	0.15	0.15	4 feet high	34,500	6,387 square feet x 4-feet high	792
PRL S-004 Non VOC EE/CA site	OU A IC 36	metals only #1	0.68	0.52	6	2,090 (revised - 444)	40' x 40' x 6' + 40' x 50' x 1.5'	467**
CS 013	OU C IC 19	Landfill #2	1.2	1.2	25	61,900	40' x 80' x 6'	711
Waste pile	OU B IC 7	metals only #2	0.15	0.08	0.5	430	95' x 95' x 1.3'	434*
							Total	2,404

Source for table and figures: CH2M Hill, Appendix D, Non-VOC and Landfill Sites Feasibility Study Report, Working Copy, April 1999
Source for revised volumes: CH2M Hill, Site-Specific Non-VOC EE/CA Document and Work Plans for Multiple Sites, Draft, December 1999.
* Excavation and treatment of proposed volume would be expected to allow closure of this site, dependent upon final accepted cleanup goal.
** Excavation and treatment of proposed volume would be expected to allow closure of this site, dependent upon final accepted cleanup goal. Cleanup level used to determine the volume is the Region IX RPRG of 400 mg/l for lead in soil.
Volumes for SAFR are based on field observations and CADD areas.
Note that excavation of landfills and the waste pile may require removal of surficial soil or backfill prior to stockpiling materials for treatment. Depths shown on this table are approximate depths to be excavated, following removal of fill. Therefore, actual excavation depths may be greater than those shown here.



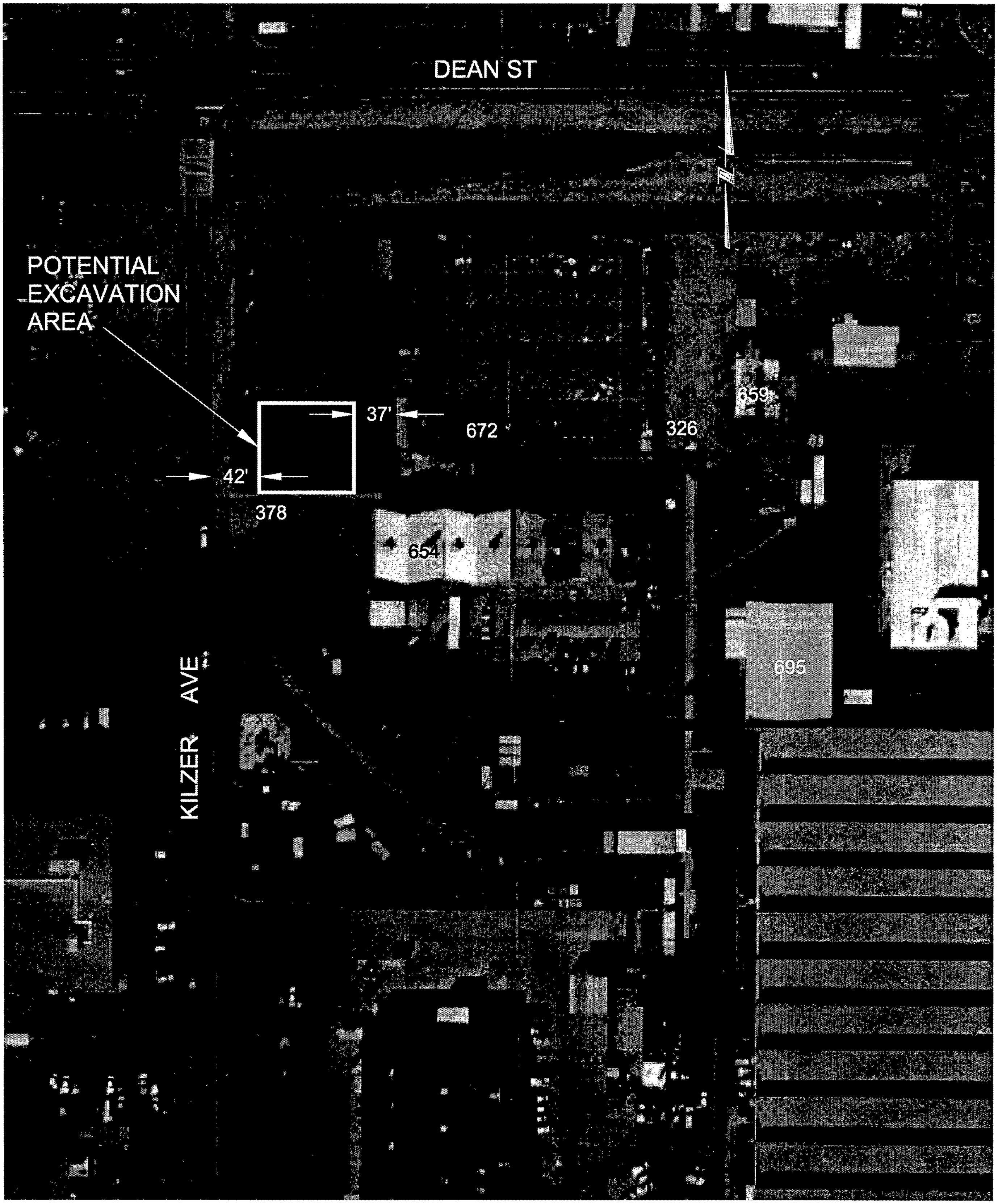
URS Greiner, Inc–Laidlaw

0 120' 200'

APPROX. SCALE
SCALE IN FEET

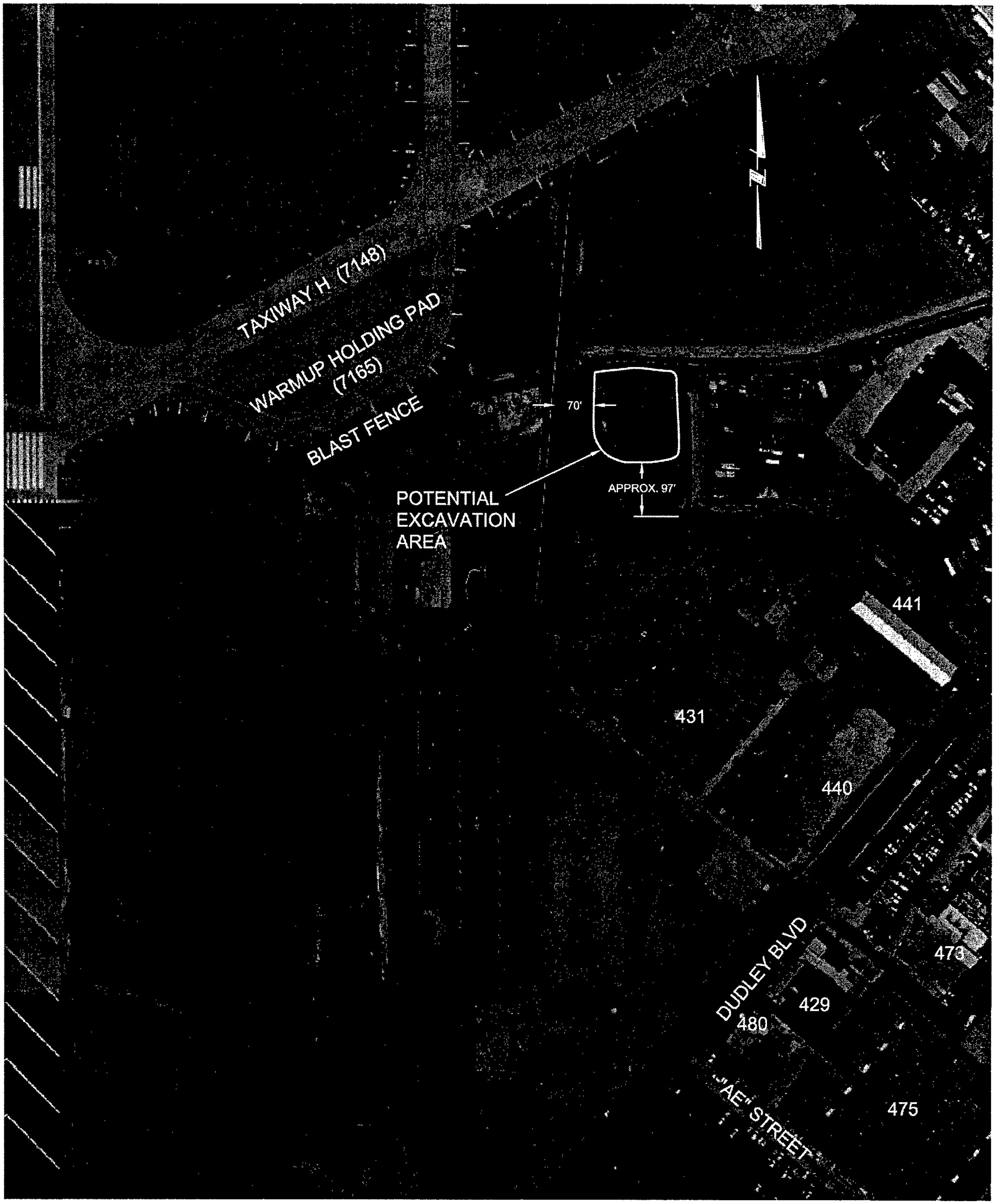
FIGURE E-1
CS 013
POTENTIAL EXCAVATION AREA
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

T:\ENVIRONMENTAL\MCAFBSOILWASHING\TAMARA\PRLS-008.DWG (ETB)



URS Greiner, Inc–Laidlaw	0 60' 120' APPROX. SCALE SCALE IN FEET	FIGURE E-2 WASTEPILE POTENTIAL EXCAVATION AREA Soil Washing and Solidification/ Stabilization Work Implementation Plan McCLELLAN AFB, Sacramento, CA

T:\ENVIRONMENTAL\MCAFBSOILWASHING\TAMARA\PRLS-006.DWG (ETB)



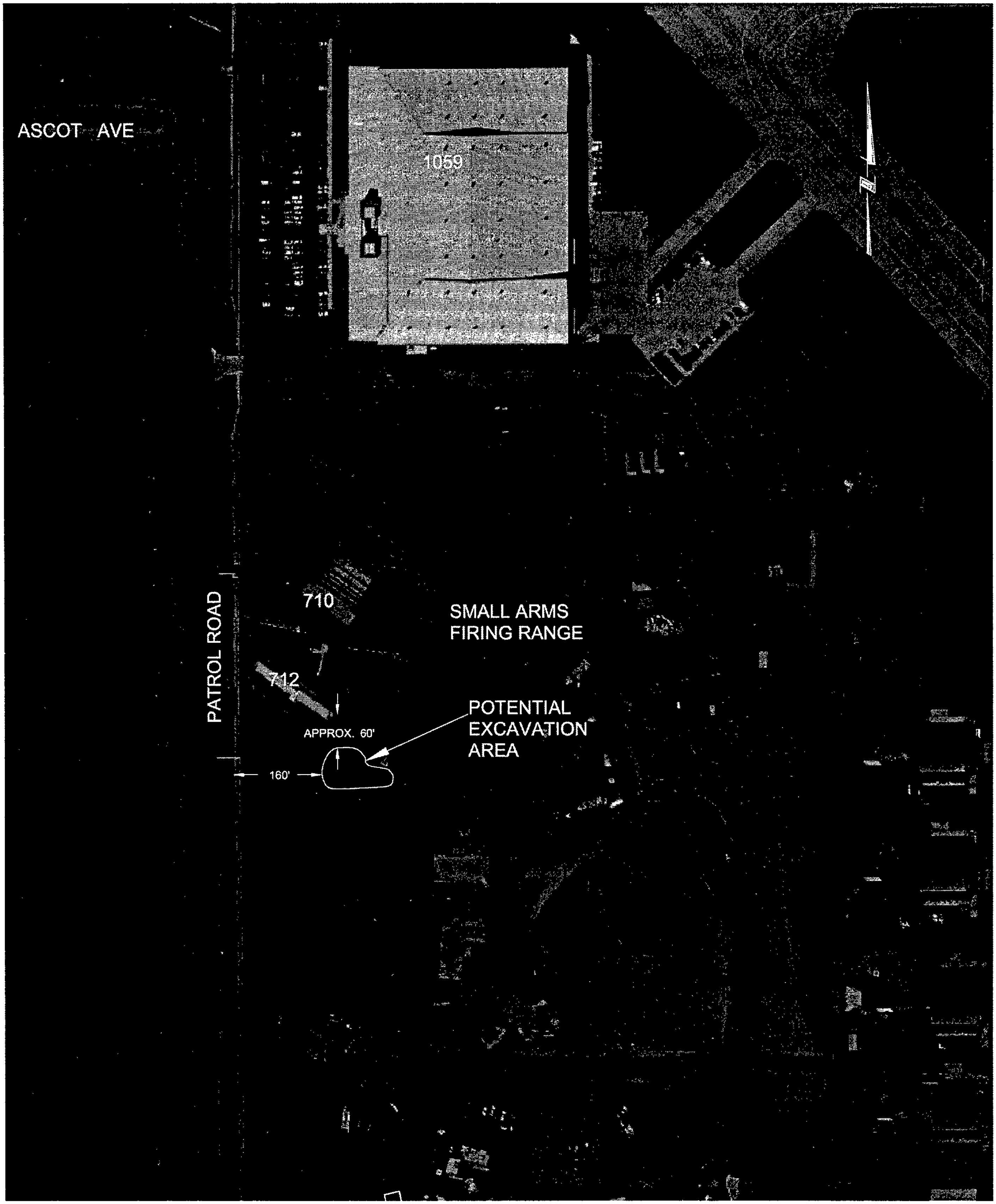
0 120' 240'

APPROX. SCALE
SCALE IN FEET

URS Greiner, Inc–Laidlaw

FIGURE E-3
PRL S-004
POTENTIAL EXCAVATION AREA
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

T:\ENVIRONMENTAL\MCAFBSOILWASHING\TAMARA\PRLS-006.DWG (ETB)



URS Greiner, Inc–Laidlaw

0 120' 240'
APPROX. SCALE
SCALE IN FEET

FIGURE E-4
IC 21 SMALL ARMS FIRING RANGE
POTENTIAL EXCAVATION AREA
Soil Washing and Solidification/
Stabilization Work Implementation Plan
McCLELLAN AFB, Sacramento, CA

T:\ENVIRONMENTAL\MCAFBSOILWASHING\TAMARA\PRLS-006.DWG (ETB)

APPENDIX F

Soil Washing and Solidification/Stabilization Study
McClellan Air Force Base

Field Treatability Procedures

STANDARD OPERATING PROCEDURE

PROCESS WATER SYSTEM SURVEY

A thorough system survey is required before jar testing. Some of the things that should be looked at are:

Flow Rates: Is the flow continuous, or are there peak flow rates? When does peak flow occur? Is there an equalization tank? How large is the equalization tank?

Feed Points: How far away are the feed points from clarifiers? Are there multiple feed points, or are all the chemicals fed to the same place? Is there any mixing between the feed points and the clarifier?

Feed Equipment: Does the plant have tanks and mixers in place to make down dry or emulsion polymers? Is dilution water available to set up a polymer feeder?

Clarifiers: In the case of a gravity settler how long is the residence time? The rise rate? What is the sludge removal frequency?

Influent Water: Are the water contaminant concentrations constant? If the levels vary, is the cycle predictable? What is the "worst case" to treat? Does the pH or temperature vary?

STANDARD OPERATING PROCEDURE

JAR TESTING FOR PROCESS WATER

1.0 JAR TEST

Jar testing[1] will be performed on the samples from the hydrocyclone overflow. Polymers are used to coagulate fines, increase mass, and aid setting in the clarifier. Optimizing the polymer addition allows the clarifier to perform efficiently. The following are general jar testing caveats:

- The jar testing sample must be representative of the treatment system influent. If the influent changes, start with the "worst case" sample, but jar test under ALL of the different influent conditions.
- Always try to duplicate as close as possible the dynamics of the system, *i.e.*, the mixing turbulence, the mixing time, time between chemical additions, retention time, etc.
- When comparing polymers, make sure all of the test conditions are the same.
- Always jar test the current process treatment program for comparison. The results from the system do not always compare directly with the jars. This will also determine if the dosage is what is really being fed to the system.
- After you find a successful jar test program, test variations of it to determine how flexible the program is. Try over and under dosages, different pH ranges, etc. Sample dosage chart and polymer makeup tables follow. This will give an indication how well the program will work in a system-upset condition.
- Make sure that successful results can be replicated. Document each test in the field logbook.
- Visual results, such as clarity and settling rate, are indicators of product performance, but specific wastewater parameters may need to be tested. The clarifier effluent needs to be analyzed for contaminants of concern.

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[1] Reference: Freeman, Harry M. 1989. Standard Handbook, Hazardous Waste Treatment and Disposal, McGraw-Hill, Inc., 1989.

FLOCCULENT SOLUTION DOSAGE CHART

	Milliliters (ml) to be added to 500 ml sample Solution Concentrations		
ppm	0.1%	0.5%	1.0%
0.50	0.25	0.05	0.025
1	0.50	0.10	0.050
2	1.00	0.2	0.100
5	2.50	0.5	0.250
10	5	1	0.50
20	10	2	1.0
30	15	3	1.5
50	25	5	2.5
75	37.5	7.5	3.75
100	50	10	5.0
200	100	20	10.0
250	125	25	12.5
350	175	35	17.5
400	200	40	20.0
450	225	45	22.5
500	250	50	25.0
1,000	500	100	50.0

Double the milliliters to be added for a given ppm dosage when using 1000 ml samples

POLYMER DILUTION

1 ml of neat polymer added to 99 ml of dilution water = 1% solution

10 ml of neat polymer added to 90 ml of water = 10.0% solution

10 ml of 1% polymer solution added to 90 ml of water = 0.1% solution

50 ml of 1% polymer solution added to 50 ml of water = 0.5%

1 ml of neat polymer solution added to 999 mls of dilution water = 1,000 ppm or 0.1%

1 ml of 0.1% polymer solution added to 1,000 mls of sample = 1 ppm

PRECIPITATING AGENTS (example)

DOSAGES IN PPM OF PRODUCT PER PPM METAL				
METAL	DT-9721	DT-9722	DT-9728	DT-9724
Cd	16.0	6.3	8.2	10.8
Co	22.4	11.8	15.4	21.2
Cr	39.6	6.3	8.2	35.6
Cu	21.6	11.0	14.3	19.6
Fe	36.8	18.5	24.0	33.2
Hg	6.8	3.5	4.5	6.0
Ni	23.2	12.0	15.6	20.8
Pb	6.8	3.3	4.3	6.0
Zn	10.8	10.8	14.0	18.8

1.1 Powdered Polymer Preparation

To prepare a dry polymer for use in jar testing.

Equipment Needed: Gang stirrer, graduated cylinder, 500 ml or 1,000 ml beakers, measuring device

PROCEDURE:

1. Weigh out 1 gram of dry polymer with a balance, or use a 0.1 gram scoop into a weighing dish. This will make a 0.1 percent polymer solution.
2. Add 1,000 mls of water to your beakers and place in gang stirrer. Make sure stir bars are clean.
3. Turn on gang stirrer at 100 percent speed.
4. Add polymer very slowly in a sprinkling fashion. Try to make sure each polymer particle is wetted in the water without touching other particles. When several particles that are not wetted come in contact, "fish eyes" may form.
5. Let gang stirrer run at 100 percent speed for 20 to 45 minutes, or until the polymer solution is clear and free of "fish eyes."
6. If you know which polymers you plan to test you should consider making up your diluted samples the night before.
7. Diluted polymer has a very short shelf life. Samples should be made up no more than 2 days prior to jar testing.

1.2 Liquid Polymer Preparation

Liquid polymers can be used without dilution, but for ease of measurement and highest polymer activity they should be diluted before jar testing. Viscous polymer should be diluted to aid in mixing in the jar tests.

Equipment Needed: Disposable syringes, graduated cylinder, plastic cups or 500 ml beakers, beverage whip or mixer.

PROCEDURE:

1. Estimate the dosage of polymer required (past experience on similar system, where available). For dosages of 10 —100 ppm, make 1.0 percent dilutions. If the jar tests will require dosages of 100 – 1000 ppm, use 10.0 percent dilutions.
2. Measure the appropriate amount of water, and add the liquid polymer with a syringe. Mix with a beverage whip or shake it in a bottle. Liquid polymers are soluble in any concentration.

3. Dilute liquid polymers have a 1-5 day shelf life, depending on the polymer. For best results, make fresh dilutions just prior to jar testing.

1.3 Emulsion Polymer Preparation

This procedure allows us to put an emulsion polymer into water at the highest activity level possible.

Equipment Needed: Mixer, 500-ml beakers or disposable plastic cups, disposable syringes, graduated cylinder.

PROCEDURE:

1. For best activity of the polymer, anionic and nonionic emulsions should be made initially at a 1 percent concentration. Cationic emulsion polymers should be made at 2 percent concentration. After the polymer is made, it can be diluted further for jar testing.

2. All emulsions will separate slightly over time. Always shake sample (neat) bottles thoroughly before use.

3. Place 198 ml of water (196 ml for cationic polymers) in a disposable cup or 500 ml beaker. Put the mixer in the cup. The water should cover the end of the mixer. Start the mixer and add 2 ml (4 ml for cationics) of emulsion polymer with a syringe wiped clean of excess and then inserted into the shoulder of the vortex. Mix at high speed for 15-20 seconds.

4. Allow aging for 30 minutes.

5. Dilute the polymer solution to 0.1 percent or 0.5 percent and use for jar testing.

6. Dilute emulsions have approximately a 24-hour shelf life. For best results, dilutions should be made on the day of jar testing.

2.0 EVALUATING JAR TEST RESULTS

Settling Rate: The speed at which the solids settle (or float) in the jar test. The ideal time will be determined by the system, but faster is typically better.

Compaction: A measure of the volume of solids versus the volume of water in a jar test. A good indication of whether a program will reduce the amount of sludge generated.

Clarity: How much of the suspended material has been settled out. This can be a visual comparison, or turbidity (a measurement of clarity) can be measured with a specialized instrument.

Floc Size: A larger floc tends to be less likely to carry over from a clarifier.

Floc Stability: An observation of whether the floc will be broken up and redispersed by mechanical action in the system.

Floc Formation: How fast a floc forms after chemical addition. This often requires a "slow mix" or "floc forming" step in the jar tests. The system will determine the requirements, but generally faster is better.

Dissolved Metals: Dissolved metal concentrations can be measured by both lab and field methods, although for very low levels lab methods may be necessary. Dissolved metals often do not affect the clarity of a wastewater sample.

STANDARD OPERATION PROCEDURE

FIELD TEST - SLUDGE DEWATERING

Gravity dewatering test that approximately duplicates the gravity section on a twin belt filter press.

Equipment Needed: Büchner funnel, 250 ml and 100 ml graduated cylinders, stopwatch, screen similar to screen on filter press, assorted syringes, 2-500 ml beakers.

PROCEDURE:

1. Prepare polymers (see jar test, polymer preparation).
2. Place screen (cut to fit) into the Büchner funnel.
3. Add 200 mL of untreated influent sludge to 500-ml beaker.
4. In the 100-ml graduate, add the initial dosage of polymer plus dilution water. For instance, if you are adding 20 mL of one polymer and 5 mL of another, both products should be diluted more so you always add the same amount of water to the sample.
5. Add polymer to beaker and pour into the other beaker until floc forms. From then on always pour into the beakers the same number of times.
6. Add the sludge to the Büchner funnel and simultaneously turn on the stopwatch.
7. Observe and record the volume of filtrate every 5 or 10 seconds until it stops draining. Plot out the results to determine which polymer helps the water to drain quickest.

PRELIMINARY TREATABILITY STUDY WORKPLAN

The focus of the soil washing and solidification/stabilization study to successfully treat site soils requires careful selection of feed material and process components. As currently planned, the study is based on a basic, flexible soil washing process. Concerns have been raised based on the recent bench-scale results obtained as part of other project (CH2M Hill, 2000). The characteristics of site soils, specifically cementation and agglomeration, have been extensively discussed. Soil conditions that can adversely affect soil washing operations (or soils which are not amenable to soil washing, as used in the bench-scale test) appear to be present at some non-VOC sites.

A bench-scale treatment test using representative site soils is imperative to determine appropriate treatment methods, as well as to predict actual scale-up and field performance of the selected approach for the full-scale treatment study. Our experience has shown that soils vary significantly from site to site, and even at different locations within a given site. Variations in soil that affect treatment procedures include grain size distribution, clay content and physical characteristics, mineralogy, aggregate hardness, organic content, soil pH, and the form and distribution of contaminants.

Obtaining accurate, site-specific information before mobilizing the soil washing equipment to McClellan AFB, has been suggested. In order to best determine the most appropriate equipment required for a successful soil washing demonstration, representative samples must be collected from the designated sites at the base. As was noted from the CH2M Hill bench-scale testing, representative samples are required for a study to be fully useful. To implement the findings and recommendations of the previous study, the following tasks have been proposed to be undertaken concurrently with the Work Implementation Plan (WIP) preparation and review:

- Site-Specific Sampling
- Preliminary Bench-scale Treatment Testing
- Technical Coordination Meeting

This section presents a workplan for the sampling and preliminary bench-scale treatment test.

In order to perform a bench-scale treatment test of contaminated soil from McClellan AFB, California, 5-gallon buckets of composite soil will be collected from six of the proposed sites) and forwarded to Surbec-ART Environmental's Norman OK facility. The bench-scale treatment testing will be performed at the Surbec-ART treatment study laboratory. The facility is equipped with analytical and mineral processing equipment. The main targets of this preliminary bench-scale treatment testing are, determination of physical soil characteristics including deagglomeration and treatment testing using soil washing to determine which sites will be selected for the full-scale treatment study.

INTRODUCTION

There are ten sites at McClellan AFB that have been identified as candidate sites for field treatment testing of physical treatment using soil washing technology. These sites have been prioritized as discussed in Section 2.0 of the WIP.

In 1999, under a separate contract with CH2M Hill, Hazen Research, Inc. (Hazen) evaluated soil samples from three sites. Only one of those sites, CS 013, is common to both studies. The soil samples were primarily grab samples taken from either the subsurface or from containers. Hazen found the soil to consist primarily of silica/carbonate agglomerates that were extremely resilient. The agglomerates were,

for the most part, reduced but not completely broken down into their soil constituents of gravel, sand, silt and clay prior to subsequent tests and post-treatment analytical (CH2M Hill, 2000).
Hazen's post-treatment analytical results indicated that only one of the soils (from CS 022) was a potential candidate for physical treatment. However, the failure to completely deagglomerate the soil or collect representative soil samples may have biased those results (CH2M Hill, 2000).

A bench-scale treatment test using representative soil samples will be performed using the key contaminants of concern as identified in Table 1 as an indicator of treatment success It is imperative that representative soil samples be used to determine appropriate treatment methods, as well as to predict actual scale-up and field performance of the selected approach. Our experience has shown that soils vary significantly from site to site, and even at different locations within a given site. Variations in soil that affect treatment procedures include grain size distribution, clay content and physical characteristics, mineralogy, aggregate hardness, soil pH, and the form and distribution of contaminants.

Results of the bench-scale treatment test will reveal the appropriate treatment approach for implementing the full-scale treatment study, or confirm that site soils are not good candidates for physical treatment. Treatment effectiveness and implementability will be presented in the treatment study report.

ANALYTICAL METHODS AND CONTROLS

Gravimetric Analysis

The representative sampling and accurate analysis of soil containing particulate metal contamination is imperative to prevent erroneous results and bias. Pre-treatment soil particulate metal concentrations will be determined gravimetrically. Once particulate metal has been removed and accounted for in the soil fractions amenable to density separation, AA analyses will be performed on the soil samples for total lead.

Off-Site Analysis

Due to the availability of soil and contaminated constituents, all samples will be submitted for off-site analysis by a independent laboratory using accepted EPA standard methods.

QUALITY CONTROL / QUALITY ASSURANCE

Quality control (QC) objectives of this bench-scale treatment test are to provide accurate, precise, and complete data sufficient to identify conditions under which selected indicator compounds are removed from contaminated soil. This information will be used to select sites amenable to soil washing and to determine equipment needs for the full-scale study. Chemical testing will be performed at an off-site USEPA approved lab and will follow standard QC procedures. Since the results of the chemical analysis will only be used for equipment and site selection for this study. Standard lab QC measures have been determined to be adequate for the extended purpose. Comparability and representativeness for quality control are discussed below.

The primary comparison made during the bench-scale test is between the contaminant levels in the feed soil and the contaminant levels in treated soil following successive levels of treatment. This comparison will be made to determine the effectiveness of each step of the treatment process. Comparability will be assured by preparing and analyzing feed and treated soils under identical conditions. All in-house laboratory procedures will be recorded in a bound laboratory notebook.

BENCH-SCALE TREATMENT TEST APPROACH AND METHODS

Bench-scale testing will be performed on composite 5-gallon soil samples from McClellan AFB, California. The bench-scale testing will be conducted in a manner simulating field-scale process steps. Total cleanup levels for the key COCs attainable using physical treatment will be determined and will be used as an indicator of the potential treatment success.

A bench-scale treatment test using a mining-based sampling approach is proposed to collect representative soils for study. A step-wise bench-scale treatment test is comprised of three major determinations in which each determination will be performed pending the success of the preceding determination. This approach will eliminate the potential for performing unnecessary lab tests, should one of the first two tests not succeed for a specific site soil. This approach will resolve: (1) the concern regarding site soils as candidates for physical treatment; (2) the concern regarding actual treatment technology requirements; and, (3) the concern regarding treatment costs meeting the life cycle cost goal. The three determinations are:

- Deagglomeration
- Soil grain size distribution
- Distribution of contaminants in various soil fractions

The soils studied by Hazen were found be unique, consisting of silica/carbonate agglomerates that under simulated "generic" physical treatment conditions were very resistant to reduction. Since deagglomeration is a mandatory precursor to effective physical treatment, the information from Hazen raises the concern that the proposed approach of using a standard wet-grizzly to deagglomerate the soil may not be effective. The first step of the bench-scale test will be to determine the deagglomeration requirements for soils at the various sites. The results may indicate that the cost to deagglomerate the soil will significantly impact project costs. This may result in a treatment system whose cost exceeds the goal of the program, which is to demonstrate a soil treatment approach that will reduce life cycle costs of remediating non-VOC soils by 25 percent.

SOIL SAMPLING

Ten non-VOC sites have been identified as possible remediation candidates for these bench-scale tests. In the WIP, these sites have been prioritized, and at least one site from each general category will be subjected to testing. Six of the highest-priority sites, CS 011, CS 013 (landfills), PRL S-006 (SVOC spill), PRL S-004, wastepile (metals only) and small arms firing range will be sampled. This test will use 5-gallon composite soil samples collected from each site.

Collection of representative samples is accomplished by excavating a test pit at each of the six sites. With the exception of the landfill sites (CS 011 and CS 013), impacted soils are reportedly shallow, and test pits would also be quite shallow (approximately 2 feet or less). At the landfills, the trench would be advanced to approximately 6 to 8 feet depth, in order to observe and sample stratified layers, if present.

A process engineer from one of the treatment subcontractors will be in attendance during the trenching in order to direct the sampling. At all sites, the engineer will record visual observations and take photos. Staff will collect a 5-gallon composite sample from each trench for bench-scale treatment testing. Visual observations are extremely important in initial selection of soils to be treated by this technology. Visually inappropriate soils would not be considered further. Site selection is discussed in further detail in Section 2.4 and Appendix E of the draft WIP (URSG, 2000).

Good composite samples of a site can be difficult to collect because it is hard to provide equal probability of reaching any part of the volume. This can be overcome by using an excavator at multiple locations within each site to dig pits and remove "cores" taken to depth. The soil taken from each pit can be combined into one stockpile and mixed with the excavator. From the small stockpile, a several hundred pound sample can then be placed on a tarp and roll-mixed. After the soil has been mixed a 5-gallon (approximately 40–60 pound) sample can be collected from random points of the pile. The remaining soil can then be placed back in the pits and compacted by the excavator to restore the site back to its original condition.

Although the uncertainty will not be reduced to zero regarding the actual soil characteristics, this approach provides the most cost effective means of collecting a representative sample.

NEED FOR REPRESENTATIVE SOIL SAMPLES

The functional requirements for physical treatment are to remove oversize debris (if any) and reduce the soil mass into its constituent granules of rock, gravel, sand, silt and clay to allow recovery of particulate metal and efficient subsequent treatment of specific soil fractions.

A key component of physical treatment thus is the reduction, or deagglomeration step for the soil mass. When Hazen (CH2M Hill, 2000) evaluated soil samples from three candidate sites for physical treatment, they found the soil to be extremely resistant to deagglomeration. Hazen's post-treatment analytical results also indicated that, with the possible exception of CS 022, the sites were not good candidates for physical treatment.

The interpretation that the sites are not good candidates for physical treatment was based on two findings: (1) the resiliency of the soil to deagglomeration and (2) residual soil contamination in all of the soil fractions.

It is important to recognize that the samples tested by CH2M Hill/Hazen were not random composite soil samples and may not be fully representative of the soils from each site. The findings by CH2M Hill/Hazen and the issue regarding the representativeness of the samples raise concerns about the "true" nature of the soils at each of the sites with regard to physical characteristics, contaminant types, and concentrations.

With regard to the deagglomeration findings, the characteristics of the soil evaluated may not match the characteristics of the soil mass slated for potential physical treatment. It is our opinion with regard to the analytical results that the results attained for the specific fractions may not have reflected the true contamination of the specific soil granules in a given fraction, but rather the contamination of agglomerates consisting of various sizes retained on the various sieves. Since soil contamination typically increases as a function of decreasing soil particle size, the presence of soil agglomerates in each soil fraction tested could have biased the fractional soil contaminant findings.

Based on the findings of the CH2M Hill study, there is insufficient information to fully design the physical treatment process for the full-scale treatment study. Therefore, to ensure that the project is not delayed due to mobilization of inappropriate treatment equipment, the pre-treatment testing described in the draft WIP has been expanded and accelerated.

SOIL CHARACTERIZATION

Deagglomeration

Deagglomeration is a mandatory precursor to effective physical treatment. The CH2M Hill/Hazen results indicate that deagglomeration technology other than the wet-grizzly originally proposed may be required. Their results also indicate that the cost to deagglomerate the soil may significantly impact project costs. This may result in a treatment system whose cost exceeds the goal of the program, which is to demonstrate a soil treatment approach that will reduce life cycle costs of remediating non-VOC soils by 25 percent. As such, this bench-scale testing will focus on the deagglomeration requirements for the soil samples collected from the site.

Physical testing will begin with a visual inspection of the sample followed by deagglomeration of a representative subsample. A minor amount of water will be added to a subsample and the material tumbled for a selected period of time. Coarse gravel will be added to provide an abraised surface to promote the deagglomeration of the material

These tests will reveal if standard water-based soil deagglomeration technology will prove effective for soils from the various sites. If the results are not favorable then the option is to examine much more expensive technology that imparts direct mechanical force to physically break the soil down. Various vendors offering these types of technology (hammer mills, impact mills, crushers, etc.) will be contacted. Samples may be provided for examination to determine if the soils are suitable for deagglomeration by these vendors' equipment.

Deagglomeration technologies deemed feasible will be evaluated from the standpoints of practicality and cost. Should the costs of implementing the technology be found to drive project costs above the program goal (based on conversations with McClellan AFB staff), then the bench-scale tests will be terminated at this point.

Should the Deagglomeration step prove favorable, the soil will be advanced to the next set of tests.

Gradation Analysis

Once the material is broken down into its constituent particles of gravel, sand, silt and clay, wet sieving will be performed. Individual soil fractions obtained from sieving will be oven dried and weighed in order to determine the distribution of particle sizes in the bulk soil. The following sieves will be used: 3/8"; 10 mesh; 50 mesh; and 200 mesh.

Other sieve sizes may be used during later stages of this study to simulate the generation of soil fractions appropriate to specific density-treatment processing equipment.

Soil Washing/Separation

Based on the results of deagglomeration and gradation analysis, four sites will be selected for treatment evaluation. A bulk sample of several kilograms of soil material will be processed through wet screening and hydrocyclone separation in the treatment study to best simulate full scale processing. The following fractions will be generated for analysis.

Fraction	Description

Feed (<3/8")	Feed material dry screened at 3/8" to remove coarse debris
Coarse gravel (>38")	Coarse gravel after wet screening
Fine gravel (2mm-3/8")	Fine gravel after wet screening
Sand (0.075-2.0mm)	Sand after hydrocycloning
Fines (<0.075mm)	Fines after hydrocycloning and flocculation

Each fraction will be analyzed for the selected indicator compounds. If required to meet treatment goals, additional treatment (spiral separation or other) may be performed as appropriate to further reduce contaminant levels.

WASH WATER TREATMENT EVALUATION

The used wash water will be archived for analyses, if required.

SOIL SAMPLE DISPOSAL

After the completion of the bench-scale treatment test, the physically treated soil will be returned to original containers and returned to McClellan AFB for disposition.

REPORT

Following completion of the bench-scale treatment test, a letter report will be prepared. The letter report will contain the following sections:

- Summary
- Methods
- Bench-scale Treatment Test Results
- Findings and Conclusions
- Recommendations regarding processes for the field-scale remediation and associated parameters.

REFERENCES

CH2M Hill. 2000. Non-VOC Bench-scale Soil Treatment Technical Memorandum (DRAFT). March. Report prepared for McClellan AFB, California.

Radian International (Radian). 1999. Basewide Remedial Investigation/Feasibility Study Quality Assurance Project Plan, Revision 4. June. Report prepared for McClellan AFB, California.

URSG-Laidlaw Joint Venture (URSG-JV). 2000. Soil Washing and Solidification/Stabilization Work Implementation Plan (DRAFT). February. Report prepared for McClellan AFB, California.

TABLE 1

Selected Indicator Compounds

Site	Pb	Cr	PCB	PAH	TPH-Diesel Range
SAFR	6				
PRL-S006				6	
CS-013	6		6		6
PRL-S004	6				
Waste Pile	6	6			
CS-011	-	-	-	-	-
Total Samples	24	6	6	6	6

APPENDIX G

Response to Comments Table

Soil Washing and Solidification/Stabilization Work Implementation Plan, Draft

Reviewer: Mr. David Rennie; Comments Dated May 15, 1999; Comments Received by URS May 17, 2000

Page	Section/ Line(s)	Comment	Response
General		Need to add contingency plans, such as roll-off bins, for process residuals (i.e., concentrated fines) that are anticipated to require disposal to the STSP in the event that facility is not available by the end of the fieldwork. This contingency needs to be incorporated throughout the document.	The use of roll-off bins for Process Residuals has been incorporated in the document.
Section 4.4		Portions of this section and Section 5 need to be edited to more clearly define the objectives (i.e., site and equipment selection) of the Preliminary Treatability Testing and what decision will be made based on those results. As currently written, it is still difficult differentiate this testing from the on-site lab testing that will be performed to optimize process operations.	Sections 4 and 5 have been edited to reflect the revised Preliminary Treatment Test included in Appendix E, and to clearly define the purpose of the treatment study.
2-4	Table 2-1	This table does not provide any value to the WIP.	This table has been deleted.
2-10	11-12	In addition to RPRGs, the "treated soils" will be evaluated against other potential (more and less stringent) cleanup goals to assess the technical and economic feasibility of several different standards.	To address the inert classification, the treated soils will also be compared to the "background" concentrations for inorganics and the detection limits for organics. Figure 2-3 has been developed to show how materials will be classified to address various clean levels.
3-4	36	Field sieving data obtained from on-site lab? Reference ASTM method as appropriate.	The text has been revised to reference the use of ASTM Standard Method 422D.
3-8	Sec. 3.3	Advantages and disadvantages of baseline remedy should be deleted from this section.	Text has been deleted.
3-9	19	Since the base will soon be open to the general public, transportation safety and traffic issues will be relevant (i.e., not "essentially eliminated"), but minimal compared to long-distance	The text has been changed to reflect the minimal transportation and safety issues associated with on-base treatment as compared

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Page	Section/ Line(s)	Comment	Response
		transportation to a hazardous waste landfill.	to off-site treatment.
4-2	20-27	This paragraph needs to be revised to incorporate general comment on Section 4.4 (see above). In addition, this paragraph should reference procedures in Appendix F.	The text has been revised to reflect the general comments on Section 4.4 and the procedures in Appendix F.
4-6	25-27	Discussion of estimated life-cycle costs and Table 4-1 should be deleted. The WIP should only discuss the parameters that will be measured. This section should state that the technical and economic analyses will be documented in the TAAR.	Table 4-1 has been deleted.
5-2	Sec. 5.1.3	This section should be updated to reflect contractor's performance of these tasks. This section should also include detail on how feed piles will be segregated/managed from the excavation pit to the treatment pad.	This section has been revised to reflect the contractor's performance of these tasks. Details on how feed piles will be managed is in the excavation plan in Appendix E.
5-2	Sec. 5.2.1	Discussion of the STSP and haul road should reference the 35% Staging Pile Design.	The text has been revised to reflect this issue.
5-5	31	It should be stated that the on-site lab data will be used for system optimization and <u>not</u> for any quantitative evaluation of system performance.	The text has been revised to reflect this issue.
5-7	Fig. 5-3	There should be at least three different utility meters such that the draw from the soil washing equipment, the solidification/stabilization equipment, and the lab/office	After discussions with McClellan AFB staff, only two additional meters would be required for the soil washing/ solidification and thermal unit. Figure 5-3 has been revised to reflect this. Methods for logging meter readings and determining power costs have

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Page	Section/ Line(s)	Comment	Response
		trailers/lighting/etc. can be measured separately.	been added to the text.
5-28	Sec. 5.6.3 and 5.6.4	These sections discuss the same facility and should be combined into one discussion.	Section 5.6.4 title was removed and the section was combined.
7-10	Sec. 7.2	This section does not state the frequency of sampling.	The seven composite samples specified in the first sentence of Section 7.2 will be collected at approximately 50 cubic yard intervals. This text has been added to Section 7.2.2.
7-11	Fig. 7-1	All final Product/Residuals piles that may be reused/recycled or require disposal should be bolded or otherwise highlighted.	Figure 7-1 has been changed to incorporate this comment.
7-12	Sec. 7-3	This section does not state the frequency of sampling.	The number of samples is identified in Subsection 7.3.2 (those numbers were initially incorrect and did not correspond to Table 7-2). Each solid composite will be collected approximately every 50 cubic yards of residual soil. One process water sample will be collected for every 4,000 gallons. The text in this subsection has been revised to include this information.
8-2	Sec. 8.4.1	This section does not clearly state the critical and non-critical DQOs.	All fixed laboratory analytical data and operational cost data are considered critical, since this information will determine the applicability of soil washing for treating non-VOC contaminated soil at McClellan AFB. Per Air Force direction operational costs are considered non-critical. The text has been added t Subsection 8.4.1.

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Page	Section/ Line(s)	Comment	Response
11-2		Regulatory review of Draft Final WIP should show 30 calendar days. 5 weeks for site preparation is not reasonable.	The schedule has been revised to reflect these comments.
12-1	Sec. 12.1	This section including Figure 12-1 should be updated to reflect personnel changes. Chris Goodrich should be shown as both the Site Safety Coordinator and Field Services Manager in Figure 12-1.	The text has been changed to incorporate all personnel changes.

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Page	Section/ Line(s)	Comment	Response
Appendix E		The excavation plans need to provide more detailed information for the selected sites. Specifically, the plans must demonstrate that the excavated soils are representative of known contamination (based on RI data). In addition, the figures (E-1 through E-6) are not sufficient to field-locate the target area or otherwise identify the expected contamination. The corners of each excavation need to be referenced to a known point of origin (i.e., direction and distance from building corner or other monument, northing and easting coordinates, etc.). These figures should show current surface features (i.e., Figure E-2 shows tanks, ponds, etc. from the wastewater treatment plant that have been demolished for several years) at the sites. Additionally, building numbers should be labeled and known utility lines shown. The scale on the figures should be adequate such that one can identify surface features in the vicinity of the excavation area.	The excavation work plan has been revised to reflect these issues.

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Page	Section/ Line(s)	Comment	Response
Global		Need to revisit to use of "clean" to describe soils treated by the process. The RWQCB definition of "clean" is synonymous to their legal definition of "inert". Therefore, in instances where "clean soil" is not meant to be inert, it should be replaced with "treated soil", otherwise use "inert".	The text has been changed to reflect this issue. A flow chart that provides "Materials Classification" has been added to Section 2, Figure 2-3 of the WIP.
Appendix F		Previous government comments on the Preliminary Treatability Testing provided during contract modification should be incorporated into Draft Final WIP.	The "Preliminary Treatment Study" has been revised to reflect the contract modifications.

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Page	Section/ Line(s)	Comment	Response
1-2	19-31	The information in Section 1.4 should reflect the approval procedure for amendments and modifications. In that, how a change will be initiated and how approval will be documented.	The text has been revised to include approval procedures for modifications and documentation of those changes in a memo to the Air Force.
2-3	32	The soil volumes cited should be updated to reflect current estimates.	New volume estimates are currently in the process of being revised by McClellan AFB. Current Air Force estimates show approximately 800,000 cubic yards of soil that exceeds the IPRGS and cubic yards 900,000 exceeding the RPRGS.
3-7	23-24	The statement that the asphaltic material has substantial recycling value is subjective and should be changed to a more suitable statement such as the material has potential commercial uses. (previous comment)	This statement has been revised as suggested.
		Per the NETTS format, Section 3.2 should discuss applicable waste media, classes and examples of organic and inorganic chemicals potentially treated with the technology, origin of waste, nature of treated residuals, and possible disposal method(s) of residuals. Alternatively, this section may reference the appropriate sections of the document where this information may be found. (previous comment)	References have been added to the document to address the NETTS format.
3-8/9	13 to 7	The advantages and disadvantages for the baseline technology should be removed from this section. The purpose of this section is to discuss the proposed technology only. The discussion of the disadvantages should be expanded and	The advantages and disadvantages of the baseline technology have been removed from this section. Additional discussion on disadvantages has been added.

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Page	Section/ Line(s)	Comment	Response
		clarified to add at a minimum some qualitative discussion on the "nature," "concentrations," etc.	
General		This document does not follow NETTS format for content. For example, Section 3.4 "Development Status" is missing from this document.	Section 3.4, Development Status has been added to the document.
General		When discussing the disposition of treated residuals, this document should note the Central Valley Regional Water Quality Control Board's requirement that wastes be inert prior to unrestricted reuse (*i.e.*, be considered "clean").	This issue has been addressed throughout the document.
General		This document should be revised to reflect that the soil treatment pad, excavation, soil hauling, and site restoration will be conducted under this work plan. This will require revisions to several sections of the document.	The document has been changed to reflect the construction of the treatment pad. The Excavation Plan has been revised to include excavation of selected sites, soil hauling, and site restoration. These changes have been made throughout the document.
4-6/7	25- Tab 1	The text and Table 4-1 should be deleted from this document. This information is inaccurate in as much as the baseline costs will need to be developed and fully documented in the TAAR.	The text and table have been deleted. This issue will be addressed in the TAAR.
4-7		Per NETTS requirements, Section 4.6 should describe the types of statistical analyses used to analyze and interpret all data collected.	Section 4.6 has been changed to address the NETTS requirements.
General		Discussions of the potential for expansion of soil treatment pad by others concurrently with field operations should be included within	Discussion on the treatment pad expansion as shown in the CH2M Hill 35% design has been added to the document.

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Page	Section/ Line(s)	Comment	Response
		appropriate sections of this document.	
5-6	32-33	Please quantify the estimated amounts of wastewater that will be collected and treated.	Approximately 25,000 gallons of waste water may be collected and treated. The text has been revised to reflect this issue.
5-7		To facilitate the development of the cost data for the demonstration as well as that projected for full-scale, at a minimum the utilities for the soil washing, solidification/stabilization, and office/lab equipment will need to be metered separately.	Two meters have been added to Figure 5-3. See previous Response to Comment by Mr. David Rennie, 5-7, Figure 5-3.
5-15	28-32	The determination of acceptable contaminant loading in wastewater used between sites should be clarified to prevent cross-contamination of soils with dissimilar contamination profiles (*e.g.*, adding PCB-contamination to soils not previously contaminated with PCBs).	COCs are not expected to be soluble enough to be of concern in the waste water. The water will be sampled before each run. Contaminant loading will be evaluated prior to the next load. To avoid cross contamination or contaminant loading from a different site, soil from the least contaminated site will be washed first.
5-16	23-25	Neither this section nor the referenced subsection describe the management of the residual stabilized product.	If the product is stable enough it can be used as backfill. If not it can be staged in bins. The change has been made in Subsection 5.3.6.5, Stabilized Product Management, and throughout the document.
5-17	12-17	Either this section, or Section 1.3, should discuss when McClellan AFB concurrence is required for process changes.	Section 1.3 has been changed.
5-18	12-17	While there is merit to your statement that exterior decontamination will not be required if trucks do not enter the EZ,	This section has been changed to allow an inspection of the

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Page	Section/ Line(s)	Comment	Response
		this work plan should implement a common sense approach requiring that an evaluation be made following dumping to see if the hauling or dumping process has resulted in minor exterior contamination to the vehicles.	exterior of the truck to determine if decontamination is required.
5-19/20		For the efforts in Section 5.4.8, please clarify what actions will require logging and the appropriate form or logbook.	The forms shown on Figures 5-4 through 5-8 show the elements to be tracked and will be the appropriate forms for logging information.. Other activities not included on the forms will be logged in a bound Field Log Book.
5-26	8-9	Please clarify that wastewater will be generated at the end of the demonstration.	The text has been modified to address this issue.
7-1	text after 4	This text does not correlate to the descriptions presented in Section 7.2.	The description in Section 7.0 for process streams has been changed.
		Sections 7 and 8 should be updated to reflect that Performance Evaluation Samples and PE samples submitted "double blind" will be used for QA/QC instead of using a second laboratory.	The addition of the term "double-blind" has been added to Subsection 8.8. The type of P.E. samples, the frequency, and the method of assessing the P.E. sample results are presented in Subsection 8.8.
		The basis for determining that 3 samples per site is sufficient for the inlet and outlet to the Solidification/Stabilization process should be presented. Cosmetically, this number of samples appears to be insufficient to meet the project requirement of determining the mean concentration at the 95% confidence level. Additionally, the basic input parameters to the DEFT software	The number of samples is estimated and is based upon collecting approximately one composite sample per every 50 cubic yards of solid. The input parameters to the DEFT software are presented in Subsection 8.4.1, Step 6, with the exception of variability which

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Page	Section/ Line(s)	Comment	Response
		should be listed in Section 7 or 8.	has been added to Step 7.
		Sections 7 and 8 respectively should be revisited to ensure that they will satisfy the requirements for meeting the "inert" classification.	Subsection 7.3 refers to Figure 2-3, which illustrates how the methods to be performed will meet these requirements. Site-specific background or non-detectable concentrations are considered secondary action levels for determining inert classification. The same methods and QLs are used for this project as were used to determine the action levels. Residential PRGs are the primary action levels.
General	Sect 8	While the discussion of the development of the DQOs is extensive, Section 8 should list the specific DQOs developed from this process. (previous comment)	The specific DQOs are specified in Step 7 of Subsection 8.4.1. The project objectives are stated in Step 1 of Subsection 8.4.1. The decision criteria, action levels, and data quantity and quality are described in Steps 5 and 7.
8-4	1	All DLs must be below the RPRGs. Also, this discussion should quantify the minimum percentage below the RPRGs that DLs will be set at.	Detection limits will be below the RPRGs for all identified COCs. The second bullet of Step 7 of the DQO process (Subsection 8.4.1) now includes a stipulation that the DL for COCs will be at least half of the RPRGs.
8-5	27-32	Please clarify the value of using a field screening procedure for PAHs with a DL of 1 mg/kg.	The high detection limit for this screening procedure would only provide data for real-time monitoring at sites where PAHs exceed this concentration but may not be used.
		Section 9 will need to be revised to discuss hazards associated with excavation and restoration of the sites. Additionally, specific	The H&S Plan has been revised to address these issues.

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Page	Section/ Line(s)	Comment	Response
		discussions of perimeter air monitoring must be added.	
		Section 9 should be updated to include current and future Security and Emergency Response telephone numbers and upcoming protocol changes (*e.g.*, open gates beginning October 1st, 911 is not a proper phone number until then, etc.).	Emergency phone numbers in Table 9-8 have been revised to reflect the need to use a base phone line to call 911 prior to October 1. Generally good housekeeping procedures will be followed after October 1, 2000. This includes locking gates and securing equipment at the end of the day. Additional security measures requested by the Air Force will be implemented.
		Section 9 must address the health and safety concerns associated with the potential for radioactive material contamination in landfills.	The H&S Plan has been revised to address this issue.
		Section 9 should include a signature and date of the preparer.	The final plan will be signed.
		Section 11 should be updated to the current schedule.	Major schedule changes can result from design changes for the soil treatment pad (STP). Once the design parameters of the STP have been established, the schedule will be completely revised. The current schedule is included in Section 12.
		Section 12 should be updated based on current project tasks and staffing.	Section 12 has been updated.
App B	Spill Plan	Several incorrect UEC and organizational references should be corrected. (previous comment)	This section has been revised per Air Force direction.

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Page	Section/ Line(s)	Comment	Response
App C	HWMP	The Hazardous Waste Management Plan remains below the minimal expected standards. Relying on the Soils Management Plan does not appear to be completely adequate for management of untreated soils during this treatability study. The management of treated soils needs to address the varying levels of contamination including Inert, RCRA-hazardous, CERCLA-regulated, etc. The discussion of wastewater needs to address the disposition of the process water at the completion of the demonstration. There is insufficient detail on how decontamination water will be characterized and segregated.	The HWMP and SAP have been revised to address these issues.
App C	DCP	All soil piles must be covered at the end of the work day. (previous comment)	The text has been revised to address this issue.
C-3	21	This does not appear to be a feasible measure for this study.	Line 21 has been deleted.
C-3	23-26	This discussion will need to be expanded to cover excavation and restoration of sites.	The section on disturbed surface area was revised to reflect this issue. A new section on site restoration was added.
C-4	8	Loads of contaminated soils must be covered if transferred on open roadways (*i.e.,* those accessible to base tenants or the public).	This section has been modified to address this issue.
C-4	26-30	Please clarify this section to address that every 1-2 days trucks will be delivering/replenishing the contaminated soils staging area. This may require truck entry into the EZ.	This comment was addressed with the previous comment. EZ decontamination procedures have also been revised.

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Page	Section/ Line(s)	Comment	Response
C-5	15-16	The BMPs to be used during construction should be included or specifically referenced.	This section has been revised to address this issue.
C-6		The Noise and Debris Control Plan does not seem to be needed. It appears to be redundant with other requirements in the WIP.	This plan has been deleted.
C-7		The SSP should be revised to address the stand down of base entry control beginning on October 1st. This plan should also address security of areas to be excavated.	The text has been revised to reflect this issue.
App D		This plan should be revised to address excavation, hauling, and restoration activities.	The equipment decontamination plan has been revised to address these issues.
App E		The procedure for Restoration provided in this document does not meet the requirements of the base. All areas should be restored to original grade following excavation. This restoration needs to be addressed in this plan. (previous comment) The plan needs to be revised to address the change in responsibilities for excavation and restoration of sites.	The excavation plan has been revised to address these issues.
E-4	4-16	Please ensure that this is still needed based upon the addition of the bench-scale testing.	This section has been revised to reflect the bench-scale testing.
E-5	4-7	More specific guidance should be given for contamination control during excavation, hauling, and restoration activities.	The text has been changed to address this issue.

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Page	Section/ Line(s)	Comment	Response
E-7		The scale of the drawings is insufficient to address the detail needed to properly excavate the contaminated areas. Additionally, the detail information is insufficient for implementation. For example, a coordinate system has not been used to locate the excavation area and there is no detail on proper sloping of the excavation area. Also, the shapes of the contaminated area do not match those specified in the RICS.	The drawings have been revised to provide sufficient detail to field locate the excavation areas. The excavation areas were plotted on aerial photographs of the site and are provided in the Excavation Plan in Appendix E.
E-8 to E-12		See comment to page E-7.	The excavation plan has been revised.
F-1	5	Please update this information on the planned equalization tankage or remove if no equalization tank will be used.	The equalization tank may not be used.

Reviewer: Mark Malinowski; Comments Dated May 15, 2000; Comments Received by URS May 17, 2000

Page	Section/ Line(s)	Comment	Response
Page 5-6	Lines 1-6	It is unclear if any samples will be submitted to a California certified laboratory to verify the field laboratory results. DTSC recommends that a percentage of samples be submitted to a fixed laboratory for confirmation.	The following text has been added to this section, "Field lab results will be confirmed using the results from definitive analyses described in Section 7.0."
Page 5-6	Lines 1-6	DTSC also recommends that, due to base activities and lack of disposal records, samples collected from landfills be screened for gamma radiation, prior to and after sorting.	Excavated soils will be screened for radioactive contaminants during the demonstration as stated in Section 7.1.
Page 5-18	Section 5.4.5	A paragraph should be added regarding the control of fugitive dust emissions as the material is collected by the loader and while being dumped into the grizzly/feeder.	A statement has been added referring to the dust control plan in Appendix C.
Page 6-2	Section 6.1.3	Even though a permit is not required by the local Air Quality Control District, DTSC recommends that atmospheric discharge be monitored by setting up PM-10 air sampling equipment down-wind of the treatment facility.	Air monitoring for the project will be conducted and is described in Section 9.7. A reference to Section 9.7 has been added to the text.

Reviewer: Mark Malinowski; Comments Dated May 15, 2000; Comments Received by URS May 17, 2000

Page	Section/ Line(s)	Comment	Response
Page 7-3,	Table 7-1	Specify why gas chromatography will be needed for sampling Streams 1-8, 10 and 11. As indicated in DTSC's first comment, we recommend that landfill samples be screened for gamma radiation.	Gas chromatography for selected PAHs will be performed to optimize and assess system performance on a real-time basis. This information has been added to Subsection 8.5.1. Gamma radiation screening has been added to Table 7-1 and Section 9.
Page 8-5,	Lines 20-26	XRF should not be performed on saturated soils due to potential interferences. DTSC recommends that soil moisture be no more than 20% before XRF readings are taken on samples.	Text has been added to Subsection 8.5.1 to include the limitation of 20% moisture for XRF analysis. However, due to the limited amount of soil being processed, XRF may not be used.

Soil Washing and Solidification/Stabilization Work Implementation Plan, Draft

Reviewer: Jeff Raines (RLI/EPA); Comments Dated May 15, 2000; Comments Received by URS May 17, 2000

Page	Section/ Line(s)	Comment	Response
1.		The main objective of the study, as described in Section 4.5 of the Draft Work Implementation Plan (WIP), is to assess whether soil washing, in conjunction with solidification/stabilization can substantially reduce the life cycle costs to clean up certain non-VOC soil contamination sites at McClellan AFB. The life cycle cost baseline assumes that 100,000 cubic yards of soil will be considered hazardous and require off-site disposal. However, the WIP proposes (Section 2.4) that approximately 1,923 cubic yards of non-VOC contaminated soils are to be treated during the study. Section 4.6 of the WIP indicates that the price (capital and operating costs) of full-scale application at McClellan AFB, which was determined from the process and cost data obtained during the field testing, will be compared to the costs associated with conventional technologies (i.e., off-site disposal). How these costs will be compared is not clearly stated in the WIP. The overall volume of soil for all non-VOC sites potentially requiring treatment (Section 2.4) is approximately 1,290,930 cubic yards, to meet residential Preliminary Remediation Goals (RPRGs), and 833,860 cubic yards to meet industrial PRGs (IPRGs). However, the WIP does not explain how the cost data obtained during the field testing to determine equipment sizing for different treatment feed rates and cost for full-scale application will be compared to the life cycle cost baseline presented in Table 4-1. Revise the WIP to discuss how the life cycle cost baseline will be compared to the costs of the treatability study (i.e., treatment of 1,923 cubic yards) and the full-scale treatment (i.e., 1,290,930 cubic yards to meet RPRGs and 833,860 cubic yards to meet IPRGs). Alternatively, provide this information in the Technology Application Analysis	Table 4.1 and supporting text has been removed from the document. The Baseline life cycle costs will be addressed in the Technology Application Analysis Report (TAAR).

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		Report (TAAR).	

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2.		The prioritization of the selected sites (Section 2) appears to have ignored existing data regarding some of the sites selected as top priority sites in their category. For example, Site CS 013 is selected as a top priority site in the category of landfills. The WIP appears not to have taken the following information into consideration during the selection process: - VOCs may be present at this site and similar sites at high concentrations that may not make this site suitable for soil washing. During the bench-scale study (CH2M Hill, 1999), PID measurement for organic vapor registered over 300 ppm immediately after opening up the buckets that were used to ship a sample from this site, and the soil emitted an obvious organic odor. - The soil particles (as determined by the bench-scale study) were clay-cemented agglomerates, and even though attrition scrubbing was used and additional attritioning was suggested to be helpful in de-agglomerating the sample from this site, they were generally deemed insufficient to meet the PRGs. - The depth of contamination at this site is approximately 32 feet, however, samples for the treatability study will be obtained from shallower depths of 6 to 8 feet below ground surface. The depth of the test pit proposed may not provide representative samples and may not provide adequate information regarding treatability of the site soil by soil washing and solidification/stabilization. The site soil contains high fraction of fines (> 40 % passing through a 200 mesh sieve) and may [illegible] be amenable to physical separation technologies.	Additional Remedial Investigation (RI) data gap information is being reviewed to obtain a better understanding of the contaminant distribution at the sites. In addition, the Preliminary Treatment Test described in this plan will be conducted to better determine the physical and chemical properties of the soil and their amenability to treatment by soil washing. VOCs will be considered during this technology test. Based on a review of RI data, the sampling and analysis plan includes the analysis of TPH-D. The agglomerating will be analyzed during the bench-scale study to determine the appropriate equipment for the treatment study. New data gap information that includes trenching shows that an eight-foot trench in CS 13 will provide an adequate profile of the waste material. Representative samples will be selected from the trench profile. Soil fractions will be analyzed in the Preliminary Treatment Test to determine the site's amenability to soil washing. Appendix F has been revised to address these issues during the bench-scale study.

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3.		According to Appendix E of the WIP, "soil quantities proposed to be treated were based both on providing an adequate amount of material to reach the anticipated treatment output, while allowing for" full "cleanup of several of the smaller candidate sites, should those sites be ultimately selected for the treatability study." As soils having all constituents of concern below the PRGs (after the technology application) may be used as fill at any location, or stored in a McClellan AFB-designated "clean soil" pile, the soil washing and solidification/stabilization may not be the desired final remedy because no record of decision (ROD) has been established for the remediation of the site. The remediation would, thus, be considered final only if the clean-up levels to the PRGs meet the requirements of the ROD. The WIP does not provide assurances that the ROD (when issued) will be considered in order to determine whether the remediation under the treatability study could be considered final for some of these smaller candidate sites. Revise the WIP to provide a statement as such in the text of the WIP.	Appendix E of the WIP Section 2.4.2 and Subsection 3.2, Waste and Media Applicability, have been changed to reflect the ROD requirement to determine the ultimate cleanup standard. Additional global changes have been made to the WIP to classify the treated material to determine if it is inert, designated, or hazardous. This will address concentrations starting at the background and non-detect levels. To avoid threats to surface water quality, only inert material will have unrestricted use as backfill material. This approach should address concerns regarding lower cleanup levels that may be established in the ROD, but no cleanup will be considered final until it has been documented in a ROD.
4.		The WIP indicates that the product residuals may be recycled as some form of asphalt-based construction material. Please revise the WIP to include additional details (regulatory requirements, local acceptance of the product, local demand for the product, value of the product) that will allow for the determination if this reuse is feasible in the Sacramento area, and if it is feasible, what the cost/benefit of the product is.	The full-scale treatment study will determine the quality of this product if produced and the cost, but the viability of this treatment option will be addressed in the TAAR.

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Specific Comments			
1.		Section 3, Technology Description: Treatment steps described in this section (i.e., attrition scrubbers, froth flotation, and surfactant addition) are not shown on Figure 3.1. Show these unit operations on the Process Flow Diagram indicating tie-in points and flow directions.	These treatment steps may not be necessary, therefore, they were not shown on the diagram. If they are determined to be necessary, they will be added at process Step 7, "Vibrating Wet Screen". A revised figure has been prepared.

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2.		Section 4.3, Statement of Treatability Study Objectives: The first objective of the study is to determine if a 25% savings in life-cycle costs over a baseline disposal alternative can be achieved. Table 4-1 lists the costs of excavation and off-site disposal as being between $110 and $225 per cubic yard. The cost estimate presented by McClellan in the Multi-Sites Non-VOC EE/CA for soil washing is $270 per cubic yard. Therefore, it appears that this study is pre-ordained to fail. As EPA has been charged by Congress to evaluate the cost-effectiveness of the remedial actions conducted at McClellan, please provide an estimate of the cost to the government of conducting this study, including the costs of preparation of the work plans, mobilization and demobilization of the equipment to and from the base, construction of the soil stockpiling area, and off-site disposal of residuals, so that EPA can determine if the cost of the study is justified given the small chance that the results of the study will indicate that soil washing is economical.	Table 4-1 has been deleted from the WIP and will be addressed in the TAAR. The $270 per cubic yard unit cost in the EE/CA is loaded with 57.5% to account for indirect costs. The loaded cost for off-site treatment and disposal from the same EE/CA is $ 380. This shows an obvious cost saving for on-site treatment. The EE/CA shows a direct unit cost for transport of $43 per cubic yard together with $176 per cubic yard for treatment and disposal for a total off-site treatment and disposal cost of $218 per cubic yard. This number should be compared to the direct unit cost for soil washing of $149 per cubic yard. This gives a direct unit cost saving of $70 per cubic yard. When applied over a large amount of soil, cost savings could be substantial. The full-scale treatment study will verify the treatment costs, which will be compared to the base line in the TAAR.
3.		Section 4.4.1, Field Tasks: This section indicates that only soils which a mini-treatability study (Appendix F) has shown to be amenable to soil washing will be tested. This imposes a limitation not described in Section 4.3, Statement of Treatability Study Objectives. Revise the first objective to include the caveat that the results apply only to the certain soils which have been shown to be amenable to this type of treatment using a mini-treatability test (i.e., Preliminary Treatability Study).	The first objective in Section 4.3 stated that soil washing would be assessed at certain non-VOC-contaminated site4s at McClellan AFB this statement has been clarified to state sites "that exhibit soil characteristics that are amendable to physical separation."

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4.		Section 5.1, Pre-operation Characterization: The second paragraph of this section states that "if soil tested exhibits characteristics beyond the operation parameters of the treatment process, it will be set aside, and soil from a different area will be selected." A table containing these parameters would be helpful for easy reference during review and field treatability procedures. Revise the WIP to present the operation parameters of the treatment process in a table.	Operational parameters will be determined during the preliminary treatment study. A table will be developed after the preliminary treatment study, but generally materials selection will be based upon particle size distribution. For example, if the clay fraction in the soil exceeds 50%, the soil may not be appropriate for soil washing because it would produce too much sludge cake. These parameters can be more clearly defined after the soil is tested during the preliminary treatment study.
5.		Section 7.3.2, Rationale for Sampling Locations, Numbers of Samples, and Analytical Parameters: This section states that one composite sample from each soil stockpile shall be collected and is typically considered representative of the soil product. The WIP does not describe what criteria were used or to be used in the field to determine that only one composite sample from each soil pile is considered representative of the stockpiled soil. The representativeness of the one composite sample may depend on the volume of the pile and the source of the soil prior to treatment and other factors. Revise the WIP to discuss how one sample for each soil stockpile was determined to be representative of the soil product.	The text was incorrect and did not match the sample quantities in Table 7-2. It has been corrected and the quantity of residual/product for each sample is presented.
6.		Appendix F, Preliminary Treatability Study Workplan: This workplan states that de-agglomeration of the samples will be done by tumbling with steel shot for four hours, and pending the	The preliminary treatment test will be conducted prior to mobilization of the treatment equipment. These data will be used to determine the appropriate type of

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		outcome, the material may be tumbled for additional hours until the material is broken down. The plant process described in Section 5 of the WIP uses a much less severe de-agglomeration procedure. Explain how and where in the field plant this rigorous de-agglomeration is replicated. In addition, since the preliminary treatability study describes the testing to be done on the sample prior to treatment and not to the treatment residues, explain how these data will be used. It would appear that this method of sample preparation should be used for at least some of the process residues to indicate whether further de-agglomeration efforts would improve the efficiency of the process.	equipment needed to address the agglomeration issue. If the results of the treatment testing indicate additional equipment is needed to process agglomerated soil, it will be added into the initial phase of the soil washing system and the WIP will be revised 1AW Section 1.3. Deagglomeraiton treatment would be added to the initial phases of the process, prior to the <3/8 screen. Coarse gravel could be added to deaglomerate the soil, then screened out and reused. The WIP has not been revised because the preliminary treatment study has not been completed.

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COMMENT #		Comment	Response
1.		[General] A number of Agency (EPA QA/R-5) required elements have not been included in the WIP as follows: 1A A title and approval sheet; 1B Special training requirements; 1C Instrument inspection details; 1D Inspection and acceptance criteria for consumables; and 1E Preventive maintenance.	Elements 1B and 1E have been added to the QAPP section, as appropriate. McClellan AFB has previously determined that the QAPP section of these documents are subtier to the Basewide QAPP and do not require signature approval unless major deviations from the primary QAPP exist.
2.		[Section 7.1, Preoperation Sampling and Analysis] Section 7.1 states that representative samples will be collected at a minimum of six priority sites, but, sampling depths for each site are only discussed in general. It is recommended the section indicate all depths at which the six proposed preoperation samples are to be collected. (Note this should correspond with the information provided in Appendix E, Excavation Plan.)	***The section has been changed. Preoperation samples will be collected based on the data produced from the RI. Specific depths are listed in Appendix E.***
3.		[Section 7.1.3, Field Methods and Procedures; 7.1.3.1, Sample Collection; Figure 8-1, Quantitation Limits and Regulatory Limits for Metals] Section 7.1.3 references the McClellan Basewide QAPP (Radian 1996) for field methods and procedures while other sections cite a 1999 Radian Basewide QAPP. Please provide	The correct terminology is McClellan Basewide QAPP (Radian 1999b). All other references to this document have been corrected.

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		clarification why two QAPPs are cited.	
4.		3B. An SOP for X Ray fluorescence (XRF) has not been referenced. This should be included in the WIP.	***An SOP for XRF analysis will not be provided because it may not be used during the project. Text in Subsection 7.1 and footnote to Table 7-1 have been changed to indicate XRF and GC may not be used.***
5.		[Sections 7.1.4, 7.2.4, 7.3.4, Quality Control (QC) Sampling] Section 7.1.4 indicates that duplicate samples will be collected at a frequency of ten percent for system startup, operation and post-operation samples. It is unclear if this implies that a total of ten percent duplicates, or ten percent per sampling process (startup, operation and post operation) duplicate samples, will be collected. It is recommended ten percent from each process be collected. It is further recommended that the associated table, Table 7-2, also include the proposed QC samples to be collected. In addition, if possible, the tables should indicate where duplicate samples will be collected. Note, also duplicate samples must be "blind" to the laboratory.	QC samples have been added to Table 7-2. The text in the specified subsections has been clarified to state that duplicates will be collected at a frequency of 10% for each process phase. Table 7-2 has been revised as recommended.
6.		5A. [Table 7-3, Analytical Methodology Requirements; Section 8.2, Measurements] Table 7-3 identifies a six months holding time for metals analysis. In addition, a 28-day holding time for mercury should be included as mercury is identified as an analyte to be measured in Section 8.2.	The holding time for mercury has been added to Table 7-3.

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7.		5B. Section 8.2 includes dioxin as a constituent to be analyzed by XRF; presumably this should read chromium (Section 8.5.1, X-Ray Fluorescence Field Screening).	This has been corrected as noted.
		5C. It is recommended that the elements chromium, copper, manganese, and nickel be added to Section 8.2, as they are identified as contaminants of concern for one of the six sites in Table 2-2 (Background Information).	The metals mentioned in this comment are included in the analyte list for Method 6010B. The bullet in Section 8.2 indicates that only arsenic, antimony, cadmium, lead, selenium, and thallium are analyzed by 7000 series methods.
		5D. In addition, it is unclear if samples are to be analyzed for hexavalent chromium. This is not included in Section 8.2, yet the analytical method is included in Section 8.5.1 (page 8-17).	Samples will not be analyzed for hexavalent chromium, because hexavalent chromium is not identified as a COC for any of these sites. The analytical method has been removed from Subsection 8.5.1.
8.		[Section 7.3.2, Rationale for Sampling Locations, Number of Samples, and Analytical Parameters; 7.3.3, Field Methods and Procedures; Table 7-2, Sample Analysis Summary] Section 7.3.2 indicates that for residual sampling, one composite sample from each stockpile and two composites from each solid residual type will be collected. Presumably that sums up to the three samples	This section has been corrected to correspond with Table 7-2.

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		identified in Table 7-2 (oversize debris [2], cobbles/gravel [3], coarse sand [4], sludge cake [13] and stabilized product [14]). However, Section 7.3.2 also states that two discrete samples of the clarifier effluent (identified as No. 12 on Figure 7-1) will be collected. These are not included in Table 7-2. In addition, Table 7-2 identifies six process water [15] samples. These are not discussed in Section 7.3.2, though their collection is discussed in Section 7.3.3. It is recommended that the table and sections be consistent.	
9.		[Section 8.4.2, Quantitative QA Objectives] Section 8.4.2 states that the precision and accuracy objectives are included in the Basewide QAPP (Radian 1999). It is recommended that all project-specific QC criteria be included in the WIP. (Or indicate where it is in the Basewide QAPP.)	The location of QAOs in the McClellan AFB Basewide QAPP has been added to the text.
10.		8A. [Section 8.6, Data Reduction, Validation, and Reporting] Section 8.6.2 indicates that 90 percent of the data will have a cursory review and 10 percent will be fully validated. It is recommended the section provide more detail on what a cursory review will entail based on the recent Region 9 tiered validation approach (EPA Region 9, January 14, 2000). 8B. In addition, it is suggested the QAPP include a provision for obtaining gas chromatography/mass spectrometry (GC/MS) data on magnetic tape from the laboratory. This could be made	The detail is provided in the referenced SOP and in lines 13, 14, and 15, page 8-20 of the draft WIP. The Region IX tiers have been added to each section. The requirement for maintenance of electronic data has been added to Subsection 8.6.1. The delivery of the tapes to the base has been added to this section also.

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		available to Region 9 upon request.	
11.		9A. [Section 8.8, Performance and System Audits] Section 8.8 indicates that a performance evaluation (PE) sample will be run for each matrix. Note, Region 9 requires that the results of the PE samples be provided to the Region for review. 9B. Section 8.8 also indicates that one field audit will be performed. It is recommended the WIP also discuss if any on-site laboratory audits are planned in addition to the PE samples. All laboratory audit reports should be provided to Region 9 for review.	This information has been added to Section 8.8. The discussion and rationale for not conducting laboratory audits has been added to Section 8.8.
12.		10A. [Sections 12.0, Management and Staffing; 12.1, Demonstration Management Personnel; Figure 12-1, Project Organization Chart; Table 12-1, Soil Washing and Solidification/Stabilization Study Management Points of Contact] Figure 12-1 indicates the government employees and their associations with the contractors performing the work. Regional guidance requires that a QAO who is a government employee be identified. Therefore, a McClellan AFB Quality Assurance Officer (QAO) must be identified. In addition, the WIP must indicate that this QAO is responsible for implementation, maintenance, auditing and general oversight of the QA system and has the necessary seniority and experience to perform the task. 10B. Section 12.0 indicates that CalTest will perform the laboratory analyses, and Table 12-1 identifies D. Anderson as the CalTest representative. However, CalTest should also be depicted	The text has been revised to incorporate all concerns addressed in this comment.

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		on the organization chart. 10C. Section 12.1 identifies C. Goodrich as the Field Services Manager (FSM) and responsibilities are included. However, C. Goodrich is identified as the Site Safety Coordinator in Figure 12-1, no discussion of safety responsibilities is included in Section 12.1 for this individual. The text and organization chart should be consistent. Similarly, K. Siebenmann is identified as the contractor QAO in the organization chart and as the senior chemist in Section 12.1. Even though the senior chemist responsibilities identified in Section 12.1 include review and oversight, it is suggested, the text and chart be consistent in their personnel title descriptions. 10D. A Project Chemist (K. Anthony) is identified in Figure 12-1, but this URSG member is not discussed in Section 12.1. The section should discuss this chemists' role and how she will interact with the analytical laboratory CalTest, or is she to be a field laboratory member? 10E. In general Sections 12.0 and 12.1 discuss the project personnel and provide responsibilities and case histories of individuals involved. Note, that only case histories are provided for some individuals. It is recommended that the WIP discuss the project-specific responsibilities of all personnel identified in the	

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		section.	
Comment			
1.		[Figures 3-1, Process Flow Diagram; 5-1, Site Plan; 5.2, Process Pad Layout; 5.3, Electrical One-Line Diagram; 7-1, Sample Locations] The engineering drawing depicted in Figures 3-1, 5-1, 5-2, 5-3 and 7-1 are not signed to indicate they have been reviewed and approved by supervisory and quality assurance (QA) personnel. It is recommended these be reviewed and approved by pertinent personnel.	These drawings are not design drawings, therefore, the certification of this WIP will be by the PE in responsible charge. In that, the PE certification indicates the drawings are sufficient for their stated purpose.

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General Comment		The sections of the Plan (e.g., Sections 2.4, 2.4.2, 4.3, and Table 2-3) that discuss objectives and target cleanup goals do not address protection of surface water and groundwater quality. Protection of water quality objectives for surface water and groundwater should be a stated goal, and the Plan should be revised to address water quality protectiveness in the treatability study evaluations. Table 2-3 should be modified to include cleanup goals that are protective of water quality objectives for each contaminant of concern. The results of the treatability study should be evaluated with respect to cleanup goals that are protective of water quality objectives.	These sections and Table 2-3 have been revised to address protection of water quality. Groundwater quality will be addressed by comparing concentrations to designated levels for protection of groundwater as shown in the PRL S-33 EE/CA (CH2M Hill). Surface water will be addressed by comparing concentrations to interim standards presented in the forthcoming Non-VOC FS.
page 3-1,	Section 3.1, first sentence	This sentence describes the term "clean" as defined by the applicable treatment standards defined in the Basewide Non-VOC and Landfill Sites Feasibility Study. The referenced Feasibility Study has not yet been submitted for review and approval by the agencies. Therefore, we cannot concur with the definition of "clean" soil as referenced in the Plan until we have had an opportunity to review and comment on the Feasibility Study.	The reference to the Basewide Non-VOC and Landfill Sites Feasibility Study has been deleted, because it has not been submitted for review and approved by the agencies.
page 3-4, page 4-3, and page 5-16	Section 3.1.1.2, last paragraph, Section 4.4.1, bullet at bottom of page, Section 5.3.6.1,	The statement on page 3-4 includes several concepts that are presented throughout the Plan. We have several concerns related to this statement that apply to the entire Plan. The paragraph on page 3-4 states the following: *"The effectiveness of stabilization will be determined by the resultant leachability of the stabilized product, as measured by the Toxicity Characteristic Leaching Procedure (TCLP) and by the California Soluble Threshold Limit Concentration (STLC). Products meeting required standards would be available for use as a construction-grade product such as backfill or roadway subbase."*	The plan has been revised to reflect use of the DI WET, eliminate the reference to STLC as an analytical procedure, and to incorporate a materials classification process as shown on Figure 2-3.

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		First, the Plan should be revised to clearly state that STLCs are regulatory threshold values, and not analytical procedures. The California Waste Extraction Test (WET) results are compared with STLC values to determine appropriate classification of tested soils. Furthermore, while TCLP and WET are appropriate for determining if soils are hazardous or not, these procedures may be overly aggressive for determining if soils meet designated or inert criteria. The WET uses a high pH citrate buffer in the extraction process, which may produce results that do not reflect the conditions that the soil would be normally exposed to, unless they are in a high pH environment. A WET utilizing de-ionized water (i.e., D.I. WET), rather than a citrate buffer is a less aggressive and more realistic method for determining if treated soils meet designated or inert criteria. The Air Force should consider including D.I. WET analysis in the Plan to address this issue. Finally, as stated above, TCLP and WET methods are used to determine if soils are classified as hazardous. The Plan does not address that soils must also be evaluated to determine if they are designated (i.e., pose a threat to surface or groundwater quality), or inert (i.e., at non-detect or within the range of background concentrations). Requirements for the classification of soils to determine if they are designated or inert are addressed in Division 2, Title 27, Solid Waste Requirements. Designated waste classification is in Title 27, Division 2, Section 20210, and inert waste classification is in Title 27, Division 2, Section 20230. The Plan must be revised to address the classification and disposition	

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		of soils that may be classified as designated or inert waste. Only inert soil may be placed or used without restrictions. These comments also apply to the referenced paragraphs on pages 4-3, and 5-16, and perhaps other applicable sections of the Plan.	
page 5-27	Section 5.6.2, Table 5-4	The referenced table includes, "Stabilize and Dispose at On-site Landfill" in the Disposition column. The Plan should clearly state that the disposition of soils into an onsite landfill has not been determined at this time. The upcoming Basewide Non-VOC Feasibility Study will evaluate landfill capping as an alternative, and perhaps other potential alternatives (e.g., off-site disposal). Section 5.6.2 should be revised to discuss other alternatives or contingencies for the disposition of treated soils. Table 5-4 should be revised to include all viable alternatives.	The reference to the onsite landfill has been deleted and replaced by containment requirements. The containment requirements for the treated soils will be evaluated in the TARR. Alternatives will be addressed in the Non VOC FS. Subsection 5.6.2 has been revised to address interim containment for the soils that do not pass the treatment standards.
page 6-3	Section 6.2	This section should include references to Title 27, Division 2, Solid Waste Requirements, and Title 23, Division 3, Chapter 15, Discharges of Hazardous Waste to Land (See Comment 3).	These references have been added.
General Comment,	Section 7.0	See Comment 3. The Air Force should consider including D.I. WET analysis in the Plan to address the classification of designated and inert waste. Section 7.0 should be revised accordingly.	DI WETs have been added to testing on the stabilized materials. See response to Comment 3.

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